(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 843 121 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
17.01.2018 Bulletin 2018/03

(21) Application number: **13181958.3**

(22) Date of filing: **28.08.2013**

(51) Int Cl.:
D06F 58/22 *(2006.01)*

(54) **Laundry dryer apparatus**

Wäschetrocknervorrichtung

Appareil de séchage de linge

(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

(43) Date of publication of application:
04.03.2015 Bulletin 2015/10

(73) Proprietor: **Electrolux Appliances Aktiebolag**
105 45 Stockholm (SE)

(72) Inventors:
- **Giovannetti, Andrea**
  33080 Porcia (PN) (IT)
- **Santarossa, Marco**
  33080 Porcia (PN) (IT)

(74) Representative: **Electrolux Group Patents**
AB Electrolux
Group Patents
105 45 Stockholm (SE)

(56) References cited:
WO-A1-2008/100065
DE-C1- 19 613 298
DE-U1- 29 618 169
JP-A- 2008 079 858

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

EP 2 843 121 B1

Printed by Jouve, 75001 PARIS (FR)

Description

[0001] The present invention relates to a laundry dryer, in particular to a heat pump laundry dryer or a heat pump washing machine having drying function.

[0002] As it is known, a laundry dryer generally comprises a cabinet enclosing a rotatable drum whose inner region defines a laundry treating chamber where a drying process is carried out, the drum being accessible by a user through a opening and a corresponding door. The machine cabinet is closed at the bottom thereof by a basement having a lower surface facing the floor where the machine is to be placed and an upper surface provided with seats for receiving operational components provided for carrying out a drying process on laundry. One or more electric motors, at least a fan, a drying air circuit (process air circuit), a process air moisture removing device, and other devices provided for operating the laundry apparatus are operational components of the machine.

[0003] Today's laundry dryers are notable for their high drying capability and effective energy saving. Typically, when drying laundry, while the drum is rotated by a drive unit, the process drying air is re-circulated through the drum by means of a process air circuit and a fan installed in such circuit. Thus, the process air exhausted from the drum is cooled and dehumidified by an air moisture removing device and, subsequently, after being heated, it is supplied again into the drum for performing a laundry drying process. As a result, dry warm air is repeatedly supplied into the drum, whereby laundry is dried.

[0004] Typically, in order to allow the process air moisture removing device to receive clean process air, an air filter is positioned between the rotatable laundry drum and the process air moisture removing device, in such a way lint removed from laundry and dispersed in the process air exiting the drum is filtered out by the air filter before the process air enters the process air moisture removing device. In this way the process air moisture removing device is kept clean for many subsequent drying cycles. Such an air filter is typically housed in a proper filter seat which is formed at a section of the process air circuit where process air leaves the drum. Such air outlet section is normally provided at the laundry loading/unloading opening, so as to allow a user to easily reach and remove the filter for cleaning purposes by simply opening the door that gives access to the laundry loading/unloading opening.

[0005] Typically, in order to allow a good sealing of the air filter to its seat, a gasket is positioned between the air filter seat and the air filter. Gaskets of know type have a transverse sectional shape whose outer edge forms a closed polygonal line defining a convex polygon, i.e. a polygon wherein whatever line joining two points of the polygon lies entirely within the polygon. A typical shape of the outer edge of a gasket of known type has a substantially flat surface on the gasket contact area with the gasket seat and a rounded or semi-circular surface on the gasket side provided for entering in contact with the air filter portions designed for abutting against the filter seat.

[0006] Sealing arrangements of the above described type are disclosed in WO 2008/100065 A1 and JP 2008 079858 A.

[0007] Gaskets of the above described known type generally have a hollow cavity comprised within the closed polygonal line allowing the gasket to be compressed when the filter is placed on its seat. Such compression air-tightens the filter onto its seat.

[0008] However, since gaskets of known type work only along a vertical plane because of the compression induced thereon by the filter, the shape of the gasket progressively wears out with the consequence that an amount of fluff containing air leaving the drum by-passes the air filter without being depurated by the fluff. This causes the process air moisture removing device to be progressively soiled.

[0009] In addition, gaskets of the above known type are quite inefficient to avoid fluff accumulated thereon during a drying process to fall into the process air circuit and reaching the process air moisture removing device when the filter is removed. It is in fact quite common to have fluff filaments or blocks accumulating on the gasket during a laundry drying process and such fluff may still remain on the gasket after the filter is removed thereby forcing the user to clean not only the filter but also the gasket with the risk of damaging it.

[0010] Thus, there is the need to have a laundry dryer apparatus having a filter gasket with a reliable configuration allowing an improved sealing and avoiding the above cited drawbacks of the known filter gaskets.

SUMMARY OF THE INVENTION

[0011] In compliance with the above aims, according to the present invention there is provided a laundry dryer comprising a cabinet, a drum for treating laundry which is arranged in a rotating manner inside the cabinet, the drum being accessible by a user through a laundry loading/unloading opening closable by a door, and a process air circulating conduit extending through the drum having a process air outlet section.

[0012] The laundry dryer of the present invention further comprises an air filter which is removably received in a seat formed on said process air outlet section so as to be accessed by opening said door, and a gasket positioned between said air filter and said seat for sealing the air filter to the seat.

[0013] The laundry dryer of the present invention is characterized in that said gasket has a transverse sectional shape comprising an outer edge which is in sealing contact with at least two distinct areas of the filter when the latter rests on the seat.

[0014] By the present invention said filter gasket configuration allows an improved sealing between the filter and the gasket. In particular, the fact that the outer edge

of the transverse sectional shape of the gasket is in sealing contact with said two distinct areas of the filter, when said filter rests on the seat, allows to avoid the fluff accumulation on the gasket during a drying process and the consequent fluff fall into the process air circuit when the filter is removed. It is thus avoided the fluff to reach the process air moisture removing device.

[0015] In the present invention, the term "transverse sectional shape" of the gasket refers to the shape of said gasket that is obtained by cutting the gasket along a plane intersecting the longitudinal developing line of the outer edge of the gasket, preferably said plane being orthogonal to said developing line of the gasket.

[0016] A first sealing contact area is formed on a filter surface designed for abutting against the seat and a second sealing
contact area is formed on a filter surface portion that protrudes into said process air circulating conduit.

[0017] By this way, said first sealing contact area and said second sealing contact area, being formed on different portions of the filter surface, allows an improvement in sealing contacts between the filter and the gasket.

[0018] Furthermore and preferably, though not necessarily, said first and second sealing contact areas are separated by a gap formed between the gasket outer edge and the filter.

[0019] By this way, said first sealing contact area and said second sealing contact area, being separated by said gap, are formed on different portions of the filter surface, allowing a still better improvement in sealing contacts between the filter and the gasket.

[0020] Furthermore and preferably, though not necessarily, said gasket outer edge is further in sealing contact with a third area formed on a perimeter border of the process air outlet section which defines said seat.

[0021] Furthermore and preferably, though not necessarily, said gasket is anchored to the perimeter border of said seat.

[0022] Furthermore and preferably, though not necessarily, said gasket outer edge is further in sealing contact with a fourth area formed on a wall connecting said seat with said laundry loading/unloading opening.

[0023] By the presence of at least one of said further third and fourth sealing contact, preferably of both of them, the gasket and the seat are fixed in a better way one each other.

[0024] Furthermore and preferably, though not necessarily, said filter is movable between a working position, in which said filter abuts against said seat, and an extracted position in which said filter is removed from said process air circulating conduit, said fourth sealing contact area increasing its dimensions while moving said filter from the extracted position towards the working position.

[0025] By this way, during the filter insertion phase, i.e. when the filter is moved from the extracted position to the working position, said fourth sealing contact area pass from being defined by a minimum sealing contact point between the gasket and said wall connecting the seat with said laundry loading/unloading opening, when the filter is in the extracted position, to a large consistent sealing contact area between said gasket and said wall, when the filter is in the working position. This is due to the fact that, during the filter insertion phase, the filter compresses downwards the gasket causing the letter to be laterally deformed so as to occupy the maximum space at its disposal in the region of said fourth sealing contact area.

[0026] Furthermore and preferably, though not necessarily, said filter is movable between a working position, in which said filter abuts against said seat, and an extracted position in which said filter is removed from said process air circulating conduit, said fourth sealing contact area decreases its dimensions while moving said filter from the working position towards the extracted position.

[0027] By this way, during the filter removal phase, i.e. when the filter is moved from the working position to the extracted position, the said fourth sealing contact area pass from occupying, respectively, a large consistent sealing contact area between said gasket and said wall connecting the seat with said laundry loading/unloading opening, occupied when the filter is in the working position, to a minimum sealing contact point between said gasket and said wall, when the filter is in the extracted position. This is due to the fact that, during the filter removal phase, the filter releases the compression downwards against the gasket allowing the gasket itself to be free to relax and modify its shape thereby allowing the outer edge of the gasket to reduce to a minimum the sealing contact point between said gasket and said wall, in the filter extracted position.

[0028] In one embodiment, when the filter is in the extracted position, the gasket may be completely detached from said wall.

[0029] In another embodiment, when the filter is in the extracted position, at least a minimum sealing contact exists between the gasket and said wall; for example observing a transversal sectional shape of the gasket, there may be at least one sealing contact point between said gasket and said wall, preferably in correspondence of the tangent line between them.

[0030] Furthermore and preferably, though not necessarily, said filter is movable between a working position, in which said filter abuts against said seat, and an extracted position in which said filter is removed from said process air circulating conduit, the pressure exerted by said gasket outer edge on said wall increasing while moving said filter from the extracted position towards the working position.

[0031] By this way, when the filter is in the extracted position, the gasket may be completely detached from said wall or there exists at least a minimum sealing contact between the gasket and said wall, while moving said filter from the extracted position towards the working position the pressure exerted by the gasket outer edge against said wall increases, because the lateral defor-

mation of the gasket is greater than the space available to accommodate the deformed gasket.

[0032] Furthermore and preferably, though not necessarily, said gasket outer edge has an open arched profile that defines a hollow cavity between an upper end region and a lower end region of the arched profile.

[0033] Furthermore and preferably, though not necessarily, said filter is movable between a working position, in which said filter abuts against said seat, and an extracted position in which said filter is removed from said process air circulating conduit, said gasket outer edge defining a concave polygon in at least one position comprised between the working position and the extracted position.

[0034] By this way, said gasket outer edge has a transverse sectional shape whose outer edge forms an open polygonal line defining a concave polygon, i.e. a polygon wherein at least one line joining two points of the polygon lies partially outside the polygon itself. Preferably, such transverse sectional shape has a C-like shape.

[0035] Furthermore and preferably, though not necessarily, when, during the filter insertion phase, the filter is approaching its working position in which said filter abuts against said seat, said gasket may change its configuration in such a way that the outer edge of the gasket passes from forming a concave polygon to a convex one.

[0036] By this way, during the filter insertion phase, the two end-points of the gasket outer edge, as viewed in a transverse sectional shape, may be in so close contact on each other such that the gasket outer edge defines a substantially closed convex polygon.

[0037] Furthermore and preferably, though not necessarily, said filter consists in a solid frame comprising vertically extending walls and substantially horizontal air permeable surfaces placed in there between said vertical walls. The filter frame is provided with air permeable filtering surfaces arranged mainly on the vertical extending walls. Preferably, said frame is made of plastic, i.e. a polymeric material.

[0038] By this way, the filter has a solid structure supporting the filter itself.

[0039] Furthermore and preferably, though not necessarily, said filtering surfaces are realized by covering air apertures formed by the filter frame with a thin mesh net, said thin mesh net determining said filtering surfaces.

[0040] Furthermore and preferably, though not necessarily, said filter is movable between a working position, in which said filter abuts against said seat, and an extracted position in which said filter is removed from said process air circulating conduit, a plurality of intermediate positions existing between said working position and said extracted position in which at least a portion of said gasket wipes against a wall of said filter while the latter is inserted and/or removed into/from said process air circulating conduit. Furthermore and preferably, though not necessarily, said at least a portion of said gasket which wipes against a wall of said filter is the portion including one of the end-point of said gasket outer edge.

[0041] By this way, during the filter insertion/removal phase, the sealing contact between the filter and the gasket is assured at least by the continuous wiping of the gasket against the wall of the filter.

[0042] Furthermore and preferably, though not necessarily, said filter is movable between a working position, in which said filter abuts against said seat, and an extracted position in which said filter is removed from said process air circulating conduit, said gasket outer edge moving away from said process air outlet section while moving said filter from the working position to the extracted position so as to keep laundry fluff resting on said gasket after a laundry drying process away from said process air outlet section.

[0043] By this way, during the filter removal phase, the gasket outer edge is allowed to free moving away from said process air outlet section. Such gasket outer edge movement pushes the laundry fluff accumulated on the gasket during a laundry drying process away from the process air outlet section where the filter rests, thereby avoiding that said fluff falls down into said process air outlet section when the filter is in its extracted position.

[0044] Furthermore and preferably, though not necessarily, said gasket extends all around said seat of said process air outlet section, and its transverse sectional shape is the same wherever the gasket section is taken.

[0045] By this way, said transverse sectional shape of the gasket remains constant all around said seat.

[0046] Furthermore and preferably, though not necessarily, said first, second, third and/or fourth sealing contact areas are realized in the gasket portion which faces said laundry loading/unloading opening.

[0047] Furthermore and preferably, though not necessarily, a process air moisture removing device is provided within said process air circulating conduit, the process air moisture removing device being an air-air type heat exchanger or being part of a heat pump assembly having members comprising a first heat exchanger acting as evaporator and a second heat exchanger acting as condenser arranged in said process air circulating conduit, a compressing device, a refrigerant expansion device and a refrigerant loop for circulating a refrigerant fluid through said members.

[0048] In the laundry dryer of the invention, a flow rate of hot air passes through the drum, removing water from wet clothes. Inside the drum, the hot air is cooled down and the heat released by the air allows the evaporation of the water from the clothes.

[0049] In a first embodiment, the laundry dryer of the present invention is a vented dryer wherein the processed air runs through an open path; in fact, the processed air is sucked from ambient air, heated up by means of an electrical heater and, after flowing in the drum, said process air with moisture extracted from wet clothes is conveyed through a vent duct to the environment outside the laundry dryer.

[0050] In a second embodiment, the laundry dryer of the present invention is a so-called "condense dryer";

typically condense dryers are dryers utilizing an air-to-air heat exchanger or a heat pump assembly. In such condense-type dryers, the process air, i.e. the laundry drying air, flows in a closed circuit wherein the heated airflow is passed cyclically through a drying chamber and through a moisture removing unit that removes moisture from the air flow exiting the drying chamber. In fact, the process air is heated up by an electric heater or by a refrigerant condenser of the heat pump assembly before entering the drum and then the air is cooled and dehumidified by an air-to-air heat exchanger or by a refrigerant evaporator of the heat pump assembly at drum outlet. Moisture removed from the airflow, which operates in a closed circuit, is stored in a tank that must be periodically emptied by a user.

[0051] A non-limiting embodiment of the present invention will be described hereinafter by way of an example with reference to the accompanying drawings, in which:

Figure 1 shows in a perspective view a laundry dryer made in accordance with the teachings of the present invention;

Figure 2 shows in a sectional view a portion of the laundry dryer of Figure 1, wherein a portion of the filter in the working position and the gasket are visible;

Figure 3 shows an enlargement of Figure 2, better showing the filter and the gasket;

Figure 4 shows in an enlarged sectional view a portion of the laundry dryer of Figure 1, wherein a portion of the filter in the extracted position and the gasket are visible;

Figure 5 shows in a sectional view the entire filter in the working position and the gasket;

Figure 6 shows a schematic view of a heat pump type laundry dryer made in accordance with an embodiment of the present invention.

[0052] With reference to Figure 1, number 1 indicates as a whole a, preferably household, laundry dryer apparatus which comprises a boxlike cabinet 2 structured for resting on the floor. The cabinet 2 houses a substantially cylindrical, revolving drum 3 for treating laundry using process air, and which is mounted in axially rotating manner inside the boxlike cabinet 2. The revolving drum 3 directly faces a laundry loading/unloading through opening 10 formed in the front wall 13 of the cabinet 2; the user is thus allowed to access laundry in the drum 3 through a porthole door 4 of the laundry dryer 1 which is provided for closing the laundry loading/unloading through opening 10. The porthole door 4 hinged to the front wall 13 of the cabinet 2 rotates about a preferably, though not necessarily, vertically-oriented reference axis, to and from a closing position in which the porthole door 4 rests completely against the front wall 13 to close the laundry loading/unloading opening 10 and substantially airtight seal the revolving drum 3.

[0053] The laundry dryer 1 additionally comprises, inside the boxlike cabinet 2, an electric motor (not shown in the figures), which is mechanically connected to the revolving drum 3 for driving into rotation the drum 3 about its longitudinal axis; a closed-circuit, hot-air generator (not shown in the figures) which is structured to circulate through the revolving drum 3 a stream of hot air having a low moisture level, and which flows over and dries the laundry located inside drum 3; and finally an electronic central control unit (not shown) which controls both the electric motor and the hot-air generator to perform one of the user-selectable drying cycles.

[0054] Furthermore, the boxlike cabinet 2 preferably comprises a substantially parallelepiped-shaped lower supporting basement 35 which is structured for resting on the floor and for housing at least part of the hot-air generator; and a substantially parallelepiped-shaped upper boxlike cabinet 36 which is rigidly fixed to the top of the lower supporting basement 35 and it is structured so as to house the revolving drum 3.

[0055] The laundry loading/unloading opening 10 of cabinet 2 is therefore made in the front wall 13 of the upper boxlike cabinet 36, and the porthole door 4 is hinged to the front wall 13 of the aforesaid upper boxlike cabinet 36.

[0056] With reference to Figures 2-5, the laundry dryer 1 further comprises a process air circulating conduit 12 extending through the drum 3 and having a process air outlet section 25. In addition, the laundry dryer 1 further comprises an air filter 5, which is removably received in a seat 6 formed on the process air outlet section 25 so as to be accessed by opening the door 4, and a gasket 7 positioned between the air filter 5 and the seat 6 for sealing the air filter 5 to the seat 6.

[0057] The air filter 5 comprises a frame having vertically extending walls 9 and substantially horizontal air permeable surfaces placed between the walls 9, air filtering surfaces being realized by covering apertures formed by the frame on the walls 9 with a thin mesh net, the thin mesh net determining the filtering surfaces. The frame of the air filter 5 is made of plastic.

[0058] The gasket 7 has a transverse sectional shape which comprises the outer edge 20; such a transverse sectional shape of the gasket 7 is obtained by cutting the gasket along a plane intersecting the longitudinal developing line of the outer edge 20 of the gasket 7. The transverse sectional shape of the gasket 7 is substantially the same wherever the gasket section is taken.

[0059] As it is better shown in Figure 3, the gasket 7 extends all around the seat 6 of the process air outlet section 25 and is anchored to the perimeter border 27 of the seat 6 through a vertically oriented protuberance 28 having one or more couple of lateral projections 37 for each side of the protuberance 28. Furthermore, the gas-

ket outer edge 20 has an open arched profile that defines a hollow cavity 29 between an upper end region 30 and a lower end region 31 of the arched profile.

[0060] As it is clearly shown in Figures 2 and 3, when the air filter 5 rests on the seat 6, the outer edge 20 of the gasket 7 is in sealing contact with at least two distinct areas 22, 23 of the air filter 5. The first sealing contact area 22 is formed on a filter surface 8 designed for abutting against the seat 6 and the second sealing contact area 23 is formed on a filter surface portion 26 that protrudes into the process air circulating conduit 12. The first and second sealing contact areas 22, 23 are separated by a gap 32 formed between the gasket outer edge 20 and the air filter 5. A better sealing between the air filter 5 and the gasket 7 is thus obtained.

[0061] As it is also shown in Figures 2 and 3, the gasket outer edge 20 is further in sealing contact with a third area 33 formed on a perimeter border 27 of the process air outlet section 25 which defines the seat 6 and with a fourth area 21 formed on a wall 19 connecting the seat 6 with the laundry loading/unloading opening 10.

[0062] The air filter 5 is movable between a working position, in which the air filter 5 abuts against the seat 6 (Figures 2, 3 and 5), and an extracted position in which the air filter 5 is removed from the process air circulating conduit 12 (Figure 4).

[0063] During the air filter 5 insertion phase, i.e., when the air filter 5 is moved from the extracted position (Fig. 4) towards the working position (Fig. 3), the fourth sealing contact area 21 increases its dimensions. In fact, the fourth sealing contact area 21 passes from being defined by a minimum sealing contact region between the gasket 7 and the wall 19 connecting the seat 6 with the laundry loading/unloading opening 10, when the air filter 5 is in the extracted position (Fig. 4), to a large consistent sealing contact area between the gasket 7 and such a wall 19, when the filter is in the working position (Fig. 3). This is due to the fact that, during the air filter 5 insertion phase, the air filter 5 compresses downwards the gasket 7 allowing the upper end region 30 of the gasket outer edge 20 to move downwardly and, as a consequence of that, allowing the rest of the outer edge 20 of the gasket 7 to occupy the maximum width at its disposal in the region of such a fourth sealing contact area 21.

[0064] On the contrary, during the air filter 5 removal phase, i.e., when the air filter 5 is moved from the working position towards the extracted position, the fourth sealing contact area 21 decreases its dimensions.

[0065] In addition, while moving the air filter 5 from the extracted position (Fig. 4) towards the working position (Fig. 3), the pressure exerted by the gasket outer edge 20 on the wall 19 connecting the seat 6 with the laundry loading/unloading opening 10 increases. On the contrary, during the air filter 5 removal phase, i.e., when the air filter 5 is moved from the working position towards the extracted position, the pressure exerted by the gasket outer edge 20 on the wall 19 connecting the seat 6 with the laundry loading/unloading opening 10 decreases, allowing the gasket outer edge 20 to relax and to have a minimum contact against the wall 19.

[0066] Furthermore, the gasket outer edge 20 defines a concave polygon 34 in at least one position comprised between the working position and the extracted position. By this way, in a position comprised between the working position and the extracted position, at least one line joining two points of the concave polygon 34 lies partially outside the polygon 34 itself, and the gasket outer edge 20 assumes a C-like shape.

[0067] In a particular embodiment (not shown in the figures) when, during the air filter 5 insertion phase, the air filter 5 is approaching its working position in which the air filter 5 abuts against the seat 6, the gasket 7 may change its configuration in such a way that the outer edge 20 of the gasket 7 passes from forming a concave polygon 34 to a convex one. By this way, during the air filter 5 insertion phase, the upper end region 30 and the lower end region 31 of the gasket outer edge 20 may come in so close contact one each other that the gasket outer edge 20 defines a convex polygon.

[0068] Between the working position (Fig. 3) and the extracted position (Fig. 4) there exists a plurality of intermediate positions in which at least a portion of the upper end region 30 of the outer edge 20 of the gasket 7 wipes against a wall 9 of the air filter 5 while the air filter 5 is inserted and/or removed into/from the process air circulating conduit 12. Such a continuous wiping of the outer edge 20 of the gasket 7 against the wall 9 of the air filter 5 during the insertion/removal of the air filter 5 assures an improved sealing between the air filter 5 and the gasket 7.

[0069] In particular, while moving the air filter 5 from the working position (Fig. 3) to the extracted position (Fig. 4), the gasket outer edge 20 is released and moved farther and farther away from the process air outlet section 25, so as to keep away from the process air outlet section 25 the laundry fluff accumulated on the gasket 7 during a laundry drying process. Thus, it is avoided the risk that, when the air filter 5 is in the extracted position, the laundry fluff falls down into the process air outlet section 25, with the unpleasant consequence for the user to have to remove the laundry fluff from the process air outlet section 25, and the undesired consequence to have the inner parts of the process air circulating conduit 12 covered by fluff.

[0070] In an embodiment of the laundry dryer according to the present invention, the laundry dryer is a heat pump type condense dryer, as schematically shown in Fig. 6, wherein a process air circulating conduit 12 for conveying the process air through the drum 3 and a heat pump assembly 14 are indicated. The process air circulating conduit 12 is usually a closed-circuit air recirculating conduit having its two ends fluidly connected to the revolving drum 3, on opposite sides of the latter; a fan 24 located along the process air circulating conduit 12 produces, inside the latter, an airflow which flows through the revolving drum 3. The arrows in Fig. 6 show the di-

rection of the air in the process air circulating conduit 12.

[0071] With particular reference to Figure 6, the heat pump assembly 14 schematically comprises:

- a first air/refrigerant heat exchanger 15 which is located along the process air circulating conduit 12 and is structured for cooling down the airflow arriving from revolving drum 3 to condense and restrain the moisture in the airflow;

- a second air/refrigerant heat exchanger 16 which is located along the process air circulating conduit 12, downstream of the first heat exchanger 15, and which is structured for heating the airflow arriving from the first heat exchanger 15 and directed back to revolving drum 3, so that the airflow re-entering into revolving drum 3 is heated to a temperature higher than or equal to that of the air flowing out of revolving drum 3;

- an electrically-powered refrigerant compressing device 17 which is interposed between the refrigerant-outlet of the first heat exchanger 15 and the refrigerant-inlet of the second heat exchanger 16, and which is structured for compressing the gaseous-state refrigerant directed towards the second heat exchanger 16 so that refrigerant pressure and temperature are much higher at the refrigerant-inlet of the second heat exchanger 16 than at the refrigerant-outlet of the first heat exchanger 15; and

- an expansion valve or similar passive/operated refrigerant expansion device 18 (for example a capillary tube, a thermostatic valve or an electrically-controlled expansion valve) which is interposed between the refrigerant-outlet of the second heat exchanger 16 and the refrigerant-inlet of the first heat exchanger 15, and it is structured so as to cause an expansion of the refrigerant directed towards the first air/refrigerant heat exchanger 15, so that refrigerant pressure and temperature are much higher at the refrigerant-outlet of the second heat exchanger 16 than at the refrigerant-inlet of the first heat exchanger 15;

- a refrigerant loop 11 for circulating a refrigerant fluid through the members 15, 16, 17, 18 of the heat pump assembly 14.

[0072] The air/refrigerant first heat exchanger 15 is conventionally referred to as the "evaporator" or "gas-heater" of the heat-pump assembly 14, and it is structured so that the airflow arriving from revolving drum 3 and the low-pressure and low temperature refrigerant directed to the suction of the refrigerant compressing device 17 can flow through it simultaneously, allowing the refrigerant having a temperature lower than that of the airflow, to absorb heat from the airflow, thus causing condensation of the surplus moisture in the airflow arriving from revolving drum 3.

[0073] The air/refrigerant second heat exchanger 16, in turn, is conventionally referred to as the "condenser" or "gas-cooler" of the heat-pump assembly 14, and it is structured so that the airflow directed back into revolving drum 3 and the high-pressure and high-temperature refrigerant arriving from the delivery of the refrigerant compressing device 17 can flow through it simultaneously, allowing the refrigerant having a temperature greater than that of the airflow to release heat to the airflow, thus heating the airflow directed back into the revolving drum 3.

[0074] Clearly, changes may be made to the laundry dryer 1 as described herein without, however, departing from the scope of the present invention.

[0075] For example, in other particular embodiment of the present invention (not shown in the figures), the laundry dryer may be a vented dryer, wherein the processed air runs through an open path and the process air with moisture extracted from wet clothes is conveyed through a vent duct to the environment outside the dryer, or another "condense dryer" type which utilizes an air-to-air heat exchanger instead of the heat pump evaporator described above for removing moisture from the laundry drying air.

Claims

1. A laundry dryer (1) comprising
a cabinet (2),
a drum (3) for treating laundry which is arranged in a rotating manner inside the cabinet (2), the drum (3) being accessible by a user through a laundry loading/unloading opening (10) closable by a door (4),
a process air circulating conduit (12) extending through the drum (3) having a process air outlet section (25),
wherein the laundry dryer (1) further comprises an air filter (5) which is removably received in a seat (6) formed on the process air outlet section (25) so as to be accessed by opening the door (4), and
wherein the dryer (1) further comprises a gasket (7) positioned between said air filter (5) and said seat (6) for sealing the air filter (5) to the seat (6), the gasket (7) having a transverse sectional shape comprising an outer edge (20) which is in sealing contact with at least two distinct areas (22, 23) of the air filter (5) when the latter rests on the seat (6),
characterized in that,
when the air filter (5) rests on the seat (6), the outer edge (20) of the gasket (7) is in sealing contact with a first sealing contact area (22), which is formed on a filter surface (8) designed for abutting against the seat (6), and a second sealing contact area (23), which is formed on a filter surface portion (26) that protrudes into said process air circulating conduit

(12).

2. Laundry dryer according to claim 1, wherein the first and the second sealing contact areas (22, 23) are separated by a gap (32) formed between the gasket outer edge (20) and the air filter (5).

3. Laundry dryer according to any preceding claim, wherein said gasket outer edge (20) is further in sealing contact with a third area (33) formed on a perimeter border (27) of the process air outlet section (25) which defines said seat (6).

4. Laundry dryer according to claim 3, wherein the gasket (7) is anchored to the perimeter border (27) of the seat (6).

5. Laundry dryer according to one or more of the previous claims, wherein said gasket outer edge (20) is further in sealing contact with a fourth area (21) formed on a wall (19) connecting the seat (6) with the laundry loading/unloading opening (10).

6. Laundry dryer according to claim 5, wherein said air filter (5) is movable between a working position, in which said air filter (5) abuts against said seat (6), and an extracted position in which the air filter (5) is removed from the process air circulating conduit (12), the gasket outer edge (20) being arranged such that the fourth sealing contact area (21) increases its dimensions while moving the air filter (5) from the extracted position towards the working position.

7. Laundry dryer according to claim 5 or 6 wherein said air filter (5) is movable between a working position, in which said air filter (5) abuts against said seat (6), and an extracted position in which the air filter (5) is removed from the process air circulating conduit (12), the gasket outer edge (20) being arranged such that the pressure exerted by the gasket outer edge (20) on the wall (19) increases while moving the air filter (5) from the extracted position towards the working position.

8. Laundry dryer according to any claim 5 to 7, wherein said air filter (5) is movable between a working position, in which said air filter (5) abuts against said seat (6), and an extracted position in which the air filter (5) is removed from the process air circulating conduit (12), the gasket outer edge (20) being arranged such that the fourth sealing contact area (21) decreases its dimensions while moving the air filter (5) from the working position towards the extracted position.

9. Laundry dryer according to any preceding claim, wherein said air filter (5) is movable between a working position, in which said air filter (5) abuts against said seat (6), and an extracted position in which the air filter (5) is removed from the process air circulating conduit (12), said gasket outer edge (20) defining a concave polygon (34) in at least one position comprised between the working position and the extracted position.

10. Laundry dryer according to one or more of the previous claims, wherein said gasket outer edge (20) has an open arched profile that defines a hollow cavity (29) between an upper end region (30) and a lower end region (31) of the arched profile.

11. Laundry dryer according to one or more of the previous claims, wherein said air filter (5) is movable between a working position, in which said air filter (5) abuts against said seat (6), and an extracted position in which the air filter (5) is removed from the process air circulating conduit (12), at least a portion of the upper end region (30) of the gasket (7) being arranged such that, in a plurality of intermediate positions existing between said working position and said extracted position, said portion of the upper end region (30) of the gasket (7) wipes against a wall (9) of the air filter (5) while the latter is inserted and/or removed into/from the process air circulating conduit (12).

12. Laundry dryer according to any preceding claim, wherein said air filter (5) is movable between a working position, in which said filter (5) abuts against said seat (6), and an extracted position in which the air filter (5) is removed from the process air circulating conduit (12), said gasket outer edge (20) being arranged so as to move away from the process air outlet section (25) while moving the air filter (5) from the working position to the extracted position thereby keeping laundry fluff resting on the gasket (7) after a laundry drying process away from the process air outlet section (25).

13. Laundry dryer according to any preceding claim, wherein the gasket (7) extends all around the seat (6) of the process air outlet section (25), and its transverse sectional shape is the same wherever the gasket section is taken.

14. Laundry dryer according to one or more of the previous claims, wherein a process air moisture removing device is provided within said process air circulating conduit (12), the process air moisture removing device being an air-air type heat exchanger or being part of a heat pump assembly (14) having members (15, 16, 17, 18) comprising a first heat exchanger acting as evaporator (15) and a second heat exchanger acting as condenser (16) arranged in the process air circulating conduit (12), a compressing device (17), a refrigerant expansion device (18) and

a refrigerant loop (11) for circulating a refrigerant fluid through the members (15, 16, 17, 18).

Patentansprüche

1. Wäschetrockner (1), umfassend:

ein Gehäuse (2),
eine Trommel (3), um Wäsche zu behandeln, die in dem Gehäuse (2) auf eine sich drehende Weise angeordnet ist, wobei die Trommel (3) über eine durch eine Tür (4) schließbare, zum Beladen und Entladen der Wäsche bestimmte Öffnung (10) für einen Benutzer zugänglich ist, ein Prozessluft umwälzendes Rohr (12), das sich durch die Trommel (3) erstreckt und einen Prozessluftauslassabschnitt (25) aufweist,
wobei der Wäschetrockner (1) ferner einen Luftfilter (5) umfasst, der auf herausnehmbare Weise in einem Sitz (6) aufgenommen ist, der an dem Prozessluftauslassabschnitt (25) ausgebildet ist, um durch Öffnen der Tür (4) zugänglich zu sein, und
wobei der Trockner (1) ferner einen Dichtungsring (7) umfasst, der zwischen dem Luftfilter (5) und dem Sitz (6) positioniert ist, um den Luftfilter (5) gegenüber dem Sitz (6) abzudichten, wobei der Dichtungsring (7) eine quer verlaufende Querschnittsform aufweist, die einen äußeren Rand (20) umfasst, der sich in dichtendem Kontakt mit wenigstens zwei unterschiedlichen Bereichen (22, 23) des Luftfilters (5) befindet, wenn Letzterer auf dem Sitz (6) ruht,
dadurch gekennzeichnet, dass
sich der äußere Rand (20) des Dichtungsrings (7), wenn der Luftfilter (5) auf dem Sitz (6) ruht, in dichtendem Kontakt mit einem ersten dichtenden Kontaktbereich (22), der auf einer Filterfläche (8) ausgebildet ist, die dazu ausgelegt ist, an dem Sitz (6) anzuliegen, und einem zweiten dichtenden Kontaktbereich (23) befindet, der auf einem Filterflächenabschnitt (26) ausgebildet ist, der in das Prozessluft umwälzende Rohr (12) ragt.

2. Wäschetrockner nach Anspruch 1, wobei der erste und der zweite dichtende Kontaktbereich (22, 23) durch einen Spalt (32) getrennt sind, der zwischen dem äußeren Rand (20) des Dichtungsrings und dem Luftfilter (5) ausgebildet ist.

3. Wäschetrockner nach einem der vorhergehenden Ansprüche, wobei sich der äußere Rand (20) des Dichtungsrings ferner in dichtendem Kontakt mit einem dritten Bereich (33) befindet, der an einer Umfangsumrandung (27) des Prozessluftauslassabschnitts (25) ausgebildet ist, der den Sitz (6) festlegt.

4. Wäschetrockner nach Anspruch 3, wobei der Dichtungsring (7) an der Umfangsumrandung (27) des Sitzes (6) verankert ist.

5. Wäschetrockner nach einem oder mehreren der vorhergehenden Ansprüche, wobei sich der äußere Rand (20) des Dichtungsrings ferner in dichtendem Kontakt mit einem vierten Bereich (21) befindet, der an einer Wand (19) ausgebildet ist, die den Sitz (6) mit der zum Beladen und Entladen der Wäsche bestimmten Öffnung (10) verbindet.

6. Wäschetrockner nach Anspruch 5, wobei der Luftfilter (5) zwischen einer Arbeitsstellung, in der der Luftfilter (5) an dem Sitz (6) anliegt, und einer ausgefahrenen Stellung, in der der Luftfilter (5) aus dem Prozessluft umwälzenden Rohr (12) herausgenommen ist, bewegbar ist, wobei der äußere Rand (20) des Dichtungsrings so angeordnet ist, dass sich die Abmessungen des vierten dichtenden Kontaktbereichs (21) vergrößern, während der Luftfilter (5) aus der ausgefahrenen Stellung in die Arbeitsstellung bewegt wird.

7. Wäschetrockner nach Anspruch 5 oder 6, wobei der Luftfilter (5) zwischen einer Arbeitsstellung, in der der Luftfilter (5) an dem Sitz (6) anliegt, und einer ausgefahrenen Stellung, in der der Luftfilter (5) aus dem Prozessluft umwälzenden Rohr (12) herausgenommen ist, bewegbar ist, wobei der äußere Rand (20) des Dichtungsrings so angeordnet ist, dass sich der Druck, den der äußere Rand (20) des Dichtungsrings auf die Wand (19) ausübt, erhöht, während der Luftfilter (5) aus der ausgefahrenen Stellung in die Arbeitsstellung bewegt wird.

8. Wäschetrockner nach einem der Ansprüche 5 bis 7, wobei der Luftfilter (5) zwischen einer Arbeitsstellung, in der der Luftfilter (5) an dem Sitz (6) anliegt, und einer ausgefahrenen Stellung, in der der Luftfilter (5) aus dem Prozessluft umwälzenden Rohr (12) herausgenommen ist, bewegbar ist, wobei der äußere Rand (20) des Dichtungsrings so angeordnet ist, dass sich die Abmessungen des vierten dichtenden Kontaktbereichs (21) verringern, während der Luftfilter (5) aus der ausgefahrenen Stellung in die Arbeitsstellung bewegt wird.

9. Wäschetrockner nach einem der vorhergehenden Ansprüche, wobei der Luftfilter (5) zwischen einer Arbeitsstellung, in der der Luftfilter (5) an dem Sitz (6) anliegt, und einer ausgefahrenen Stellung, in der der Luftfilter (5) aus dem Prozessluft umwälzenden Rohr (12) herausgenommen ist, bewegbar ist, wobei der äußere Rand (20) des Dichtungsrings ein konkaves Vieleck (34) in wenigstens einer zwischen der Arbeitsstellung und der ausgefahrenen Stellung eingenommenen Stellung festlegt.

10. Wäschetrockner nach einem oder mehreren der vorhergehenden Ansprüche, wobei der äußere Rand (20) des Dichtungsrings ein offenes bogenförmiges Profil aufweist, das einen Hohlraum (29) zwischen einem oberen Endbereich (30) und einem unteren Endbereich (31) des bogenförmigen Profils festlegt.

11. Wäschetrockner nach einem oder mehreren der vorhergehenden Ansprüche, wobei der Luftfilter (5) zwischen einer Arbeitsstellung, in der der Luftfilter (5) an dem Sitz (6) anliegt, und einer ausgefahrenen Stellung, in der der Luftfilter (5) aus dem Prozessluft umwälzenden Rohr (12) herausgenommen ist, bewegbar ist, wobei wenigstens ein Abschnitt des oberen Endbereichs (30) des Dichtungsrings (7) so angeordnet ist, dass in einer Vielzahl von zwischen der Arbeitsstellung und der ausgefahrenen Stellung befindlichen Zwischenstellungen der Abschnitt des oberen Endbereichs (30) des Dichtungsrings (7) an einer Wand (9) des Luftfilters (5) reibt, während Letzterer in das Prozessluft umwälzende Rohr (12) eingesetzt und/oder aus diesem herausgenommen wird.

12. Wäschetrockner nach einem der vorhergehenden Ansprüche, wobei der Luftfilter (5) zwischen einer Arbeitsstellung, in der der Luftfilter (5) an dem Sitz (6) anliegt, und einer ausgefahrenen Stellung, in der der Luftfilter (5) aus dem Prozessluft umwälzenden Rohr (12) herausgenommen ist, bewegbar ist, wobei der äußere Rand (20) des Dichtungsrings so angeordnet ist, dass er sich von dem Prozessluftauslassabschnitt (25) weg bewegt, während der Luftfilter (5) aus der Arbeitsstellung in die ausgefahrene Stellung bewegt wird, wodurch Wäscheflusen, die nach einem Wäschetrocknungsvorgang auf dem Dichtungsring (7) ruhen, von dem Prozessluftauslassabschnitt (25) entfernt gehalten werden.

13. Wäschetrockner nach einem der vorhergehenden Ansprüche, wobei sich der Dichtungsring (7) vollständig um den Sitz (6) des Prozessluftauslassabschnitts (25) herum erstreckt und die quer verlaufende Querschnittsform desselben immer gleich ist, unabhängig davon, wo sich der Dichtungsringabschnitt befindet.

14. Wäschetrockner nach einem oder mehreren der vorhergehenden Ansprüche, wobei eine Prozessluftfeuchtigkeit beseitigende Vorrichtung in dem Prozessluft umwälzenden Rohr (12) vorgesehen ist, wobei es sich bei der Prozessluftfeuchtigkeit beseitigenden Vorrichtung um einen Wärmetauscher vom Luft-/Luft-Typ handelt oder diese Teil einer Wärmepumpenanordnung (14) ist, die Elemente (15, 16, 17, 18) aufweist, die einen ersten als Verdampfer (15) wirkenden Wärmetauscher und einen zweiten als Verflüssiger (16) wirkenden Wärmetauscher, die in dem Prozessluft umwälzenden Rohr (12) angeordnet sind, eine Kompressionsvorrichtung, eine Kühlmittelausdehnungsvorrichtung (18) und eine Kühlmittelschleife (11) zum Umwälzen einer Kühlflüssigkeit durch die Elemente (15, 16, 17, 18) umfassen.

Revendications

1. Sèche-linge (1), comprenant:

une carrosserie (2),
un tambour (3) pour traiter du linge qui est disposé d'une manière rotative à l'intérieur de la carrosserie (2), le tambour (3) étant accessible pour un utilisateur à travers une ouverture de chargement/déchargement de linge (10) fermable par une porte (4),
un conduit de circulation d'air de traitement (12) qui s'étend à travers le tambour (3) et qui présente une section de sortie d'air de traitement (25),
dans lequel le sèche-linge (1) comprend en outre un filtre à air (5) qui est reçu de façon amovible dans un siège (6) formé sur la section de sortie d'air de traitement (25) de manière à être accessible en ouvrant la porte (4), et
dans lequel le séchoir (1) comprend en outre une garniture (7) positionnée entre ledit filtre à air (5) et ledit siège (6) pour sceller le filtre à air (5) sur le siège (6), la garniture (7) présentant une forme de section transversale qui comprend un bord extérieur (20) qui se trouve en contact d'étanchéité avec au moins deux surfaces distinctes (22, 23) du filtre à air (5) lorsque ce dernier repose sur le siège (6),
caractérisé en ce que, lorsque le filtre à air (5) repose sur le siège (6), le bord extérieur (20) de la garniture (7) est en contact d'étanchéité avec une première surface de contact d'étanchéité (22), qui est formée sur une surface de filtre (8) conçue de manière à buter contre le siège (6), et une deuxième surface de contact d'étanchéité (23), qui est formée sur une partie de surface de filtre (26) qui fait saillie dans ledit conduit de circulation d'air de traitement (12).

2. Sèche-linge selon la revendication 1, dans lequel les première et deuxième surfaces de contact d'étanchéité (22, 23) sont séparées par un espace (32) formé entre le bord extérieur de garniture (20) et le filtre à air (5).

3. Sèche-linge selon l'une quelconque des revendications précédentes, dans lequel ledit bord extérieur de garniture (20) est en outre en contact d'étanchéité avec une troisième surface (33) formée sur une bor-

dure périmétrique (27) de la section de sortie d'air de traitement (25) qui définit ledit siège (6).

4. Sèche-linge selon la revendication 3, dans lequel la garniture (7) est ancrée sur la bordure périmétrique (27) du siège (6).

5. Sèche-linge selon une ou plusieurs des revendications précédentes, dans lequel ledit bord extérieur de garniture (20) est en outre en contact d'étanchéité avec une quatrième surface (21) formée sur une paroi (19) qui connecte le siège (6) à l'ouverture de chargement/déchargement de linge (10).

6. Sèche-linge selon la revendication 5, dans lequel ledit filtre à air (5) est déplaçable entre une position de travail, dans laquelle ledit filtre à air (5) bute contre ledit siège (6), et une position extraite, dans laquelle le filtre à air (5) est enlevé du conduit de circulation d'air de traitement (12), le bord extérieur de garniture (20) étant agencé de telle sorte que les dimensions de la quatrième surface de contact d'étanchéité (21) augmentent pendant le déplacement du filtre à air (5) à partir de la position extraite en direction de la position de travail.

7. Sèche-linge selon la revendication 5 ou 6, dans lequel ledit filtre à air (5) est déplaçable entre une position de travail, dans laquelle ledit filtre à air (5) bute contre ledit siège (6), et une position extraite, dans laquelle le filtre à air (5) est enlevé du conduit de circulation d'air de traitement (12), le bord extérieur de garniture (20) étant agencé de telle sorte que la pression exercée par le bord extérieur de garniture (20) sur la paroi (19) augmente pendant le déplacement du filtre à air (5) à partir de la position extraite en direction de la position de travail.

8. Sèche-linge selon l'une quelconque des revendications 5 à 7, dans lequel ledit filtre à air (5) est déplaçable entre une position de travail, dans laquelle ledit filtre à air (5) bute contre ledit siège (6), et une position extraite, dans laquelle le filtre à air (5) est enlevé du conduit de circulation d'air de traitement (12), le bord extérieur de garniture (20) étant agencé de telle sorte que les dimensions de la quatrième surface de contact d'étanchéité (21) diminuent pendant le déplacement du filtre à air (5) à partir de la position de travail en direction de la position extraite.

9. Sèche-linge selon l'une quelconque des revendications précédentes, dans lequel ledit filtre à air (5) est déplaçable entre une position de travail, dans laquelle ledit filtre à air (5) bute contre ledit siège (6), et une position extraite, dans laquelle le filtre à air (5) est enlevé du conduit de circulation d'air de traitement (12), ledit bord extérieur de garniture (20) définissant un polygone concave (34) dans au moins une position comprise entre la position de travail et la position extraite.

10. Sèche-linge selon une ou plusieurs des revendications précédentes, dans lequel ledit bord extérieur de garniture (20) présente un profil arqué ouvert qui définit une cavité creuse (29) entre une région d'extrémité supérieure (30) et une région d'extrémité inférieure (31) du profil arqué.

11. Sèche-linge selon une ou plusieurs des revendications précédentes, dans lequel ledit filtre à air (5) est déplaçable entre une position de travail, dans laquelle ledit filtre à air (5) bute contre ledit siège (6), et une position extraite, dans laquelle le filtre à air (5) est enlevé du conduit de circulation d'air de traitement (12), au moins une partie de la région d'extrémité supérieure (30) de la garniture (7) étant agencée de telle sorte que, dans une pluralité de positions intermédiaires existant entre ladite position de travail et ladite position extraite, ladite partie de la région d'extrémité supérieure (30) de la garniture (7) frotte contre une paroi (9) du filtre à air (5) pendant que ce dernier est inséré dans le et/ou enlevé du conduit de circulation d'air de traitement (12).

12. Sèche-linge selon l'une quelconque des revendications précédentes, dans lequel ledit filtre à air (5) est déplaçable entre une position de travail, dans laquelle ledit filtre (5) bute contre ledit siège (6), et une position extraite, dans laquelle le filtre à air (5) est enlevé du conduit de circulation d'air de traitement (12), ledit bord extérieur de garniture (20) étant agencé de manière à s'écarter de la section de sortie d'air de traitement (25) pendant le déplacement du filtre à air (5) à partir de la position de travail vers la position extraite, maintenant de ce fait la peluche de linge accumulée sur la garniture (7) après un processus de séchage de linge à l'écart de la section de sortie d'air de traitement (25).

13. Sèche-linge selon l'une quelconque des revendications précédentes, dans lequel la garniture (7) s'étend autour de la totalité du siège (6) de la section de sortie d'air de traitement (25), et sa forme de section transversale est la même, quel que soit l'endroit où la section de la garniture est prise.

14. Sèche-linge selon une ou plusieurs des revendications précédentes, dans lequel un dispositif d'élimination de l'humidité de l'air de traitement est prévu à l'intérieur dudit conduit de circulation d'air de traitement (12), le dispositif d'élimination de l'humidité de l'air de traitement étant un échangeur de chaleur du type air-air ou faisant partie d'un ensemble de pompe à chaleur (14) présentant des éléments (15, 16, 17, 18) comprenant un premier échangeur de chaleur qui agit comme un évaporateur (15) et un

deuxième échangeur de chaleur qui agit comme un condenseur (16) disposé dans le conduit de circulation d'air de traitement (12), un dispositif de compression (17), un dispositif d'expansion de réfrigérant (18) et une boucle de réfrigérant (11) pour faire circuler un fluide réfrigérant travers les éléments (15, 16, 17, 18).

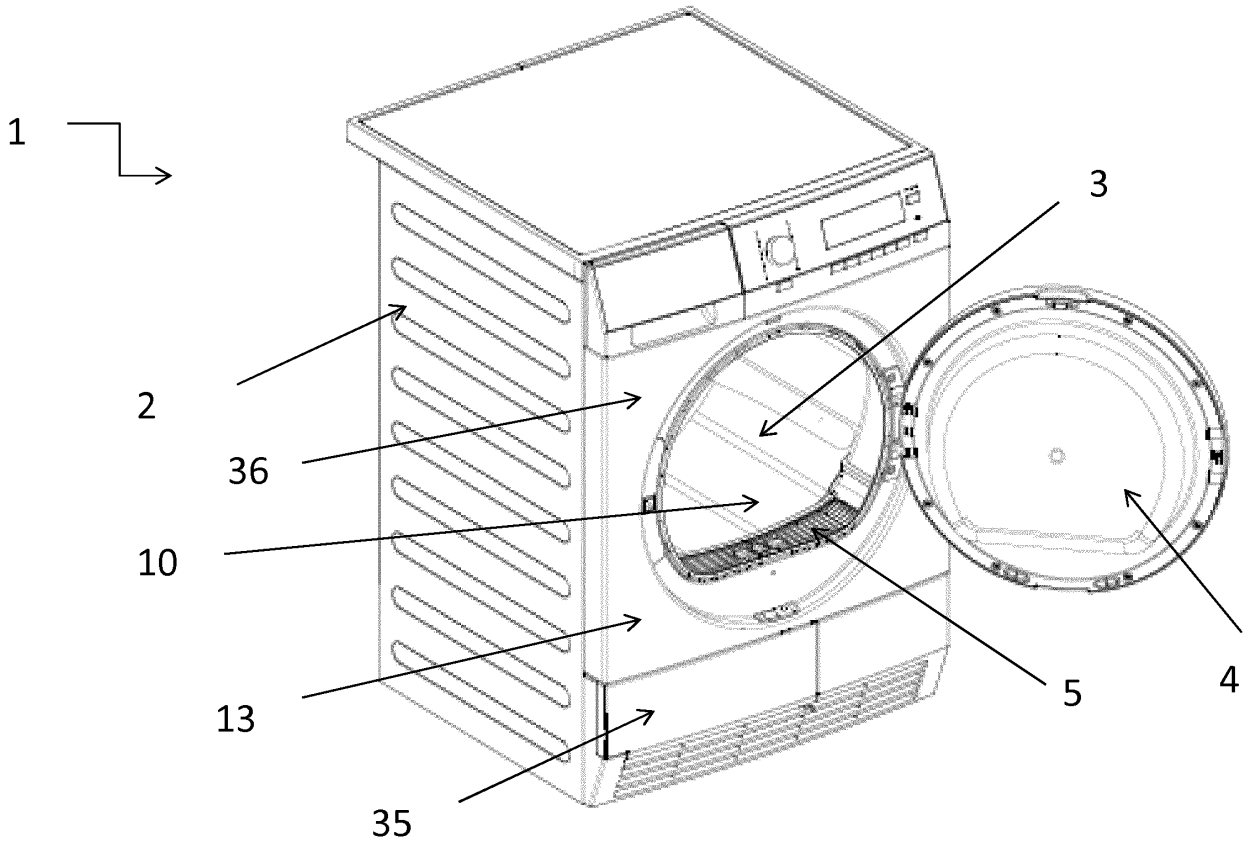


Figura 1

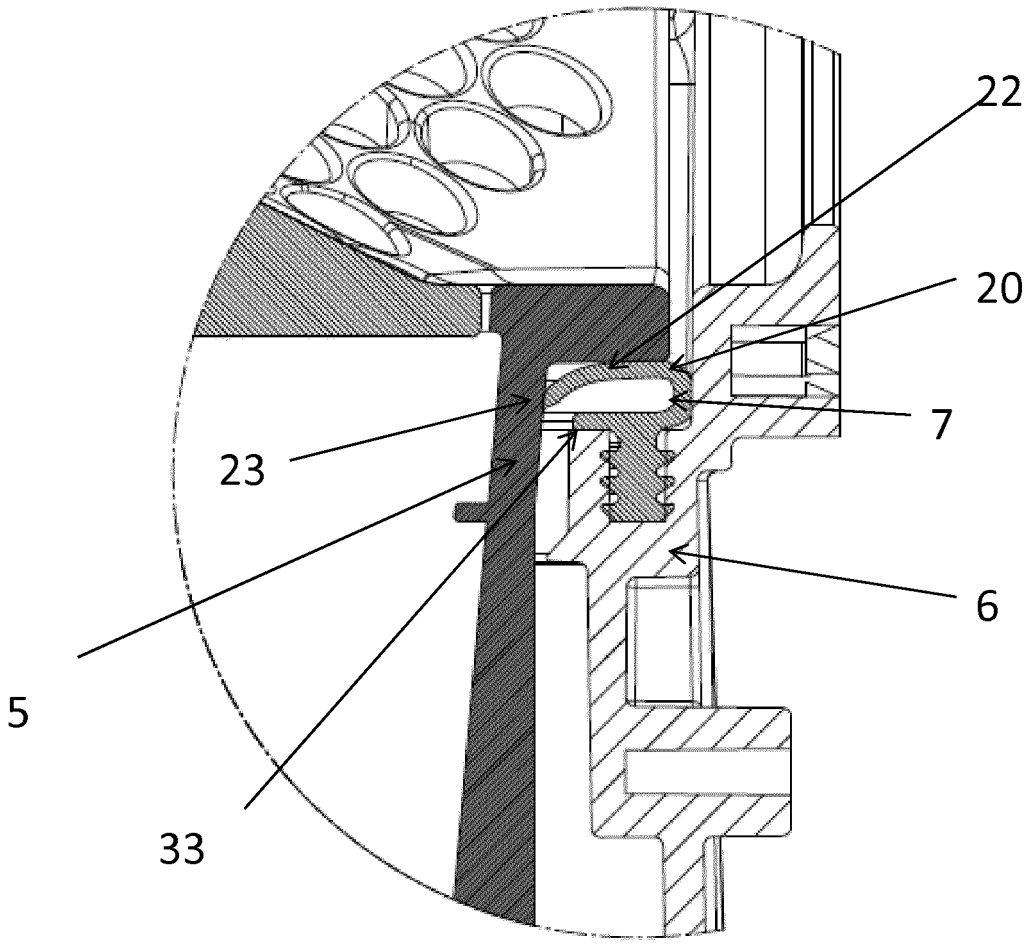


Figura 2

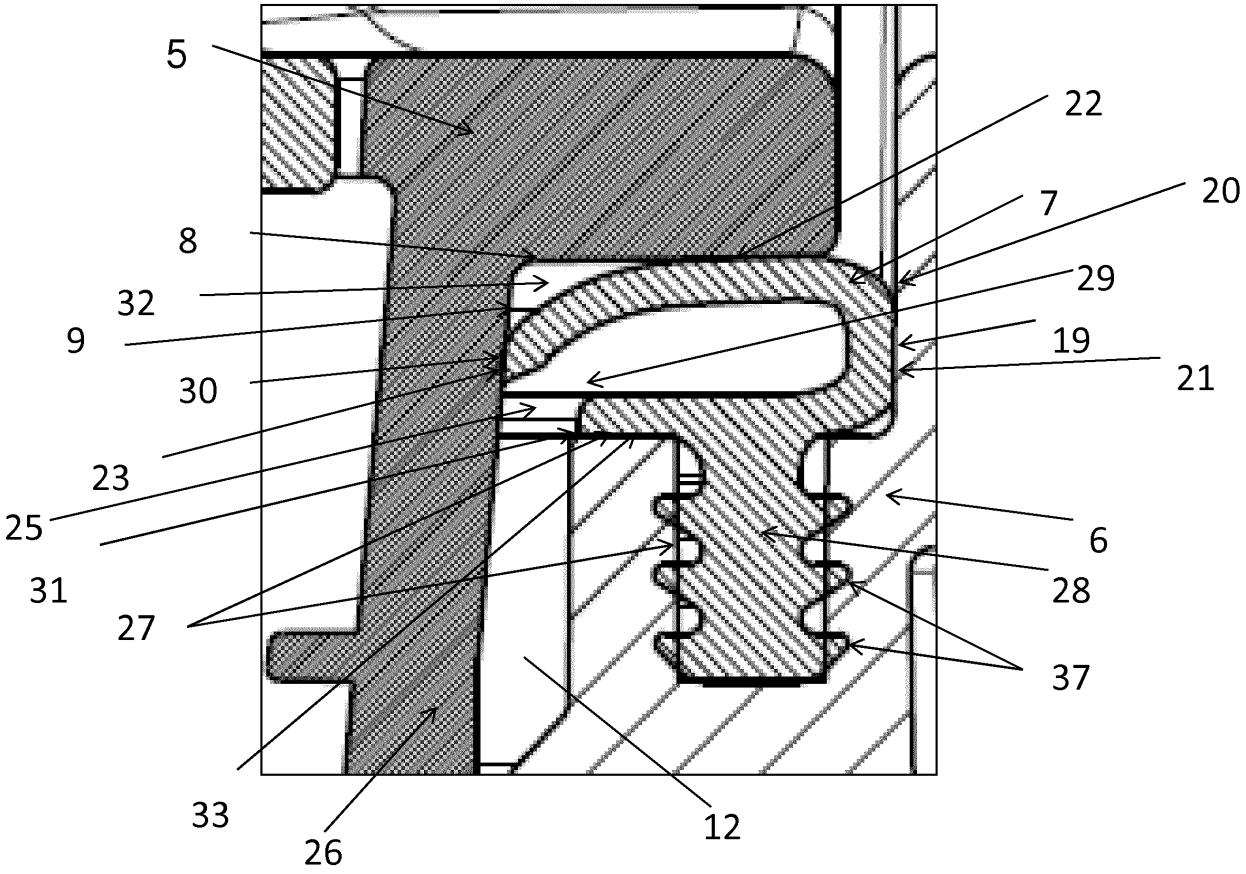


Figura 3

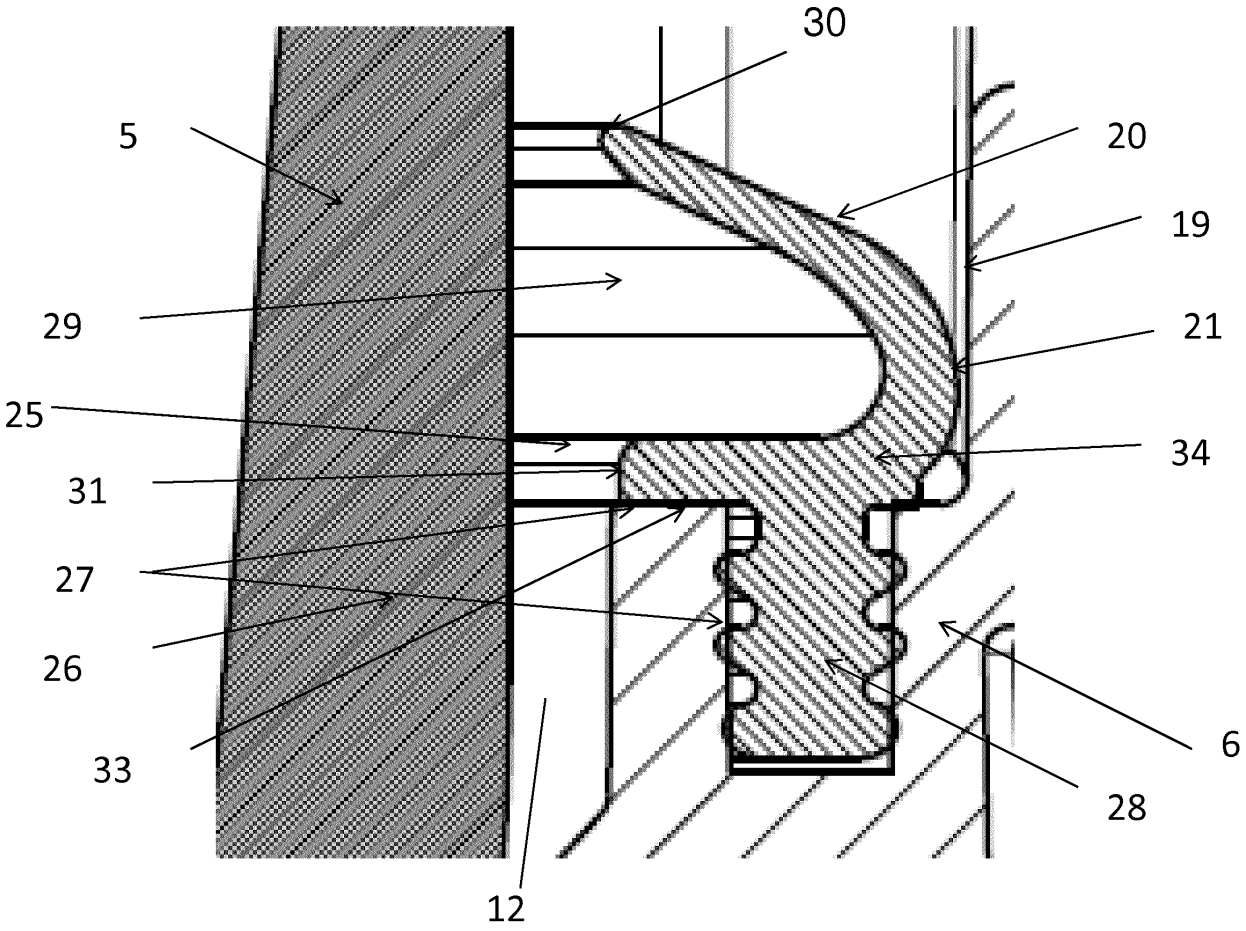


Figura 4

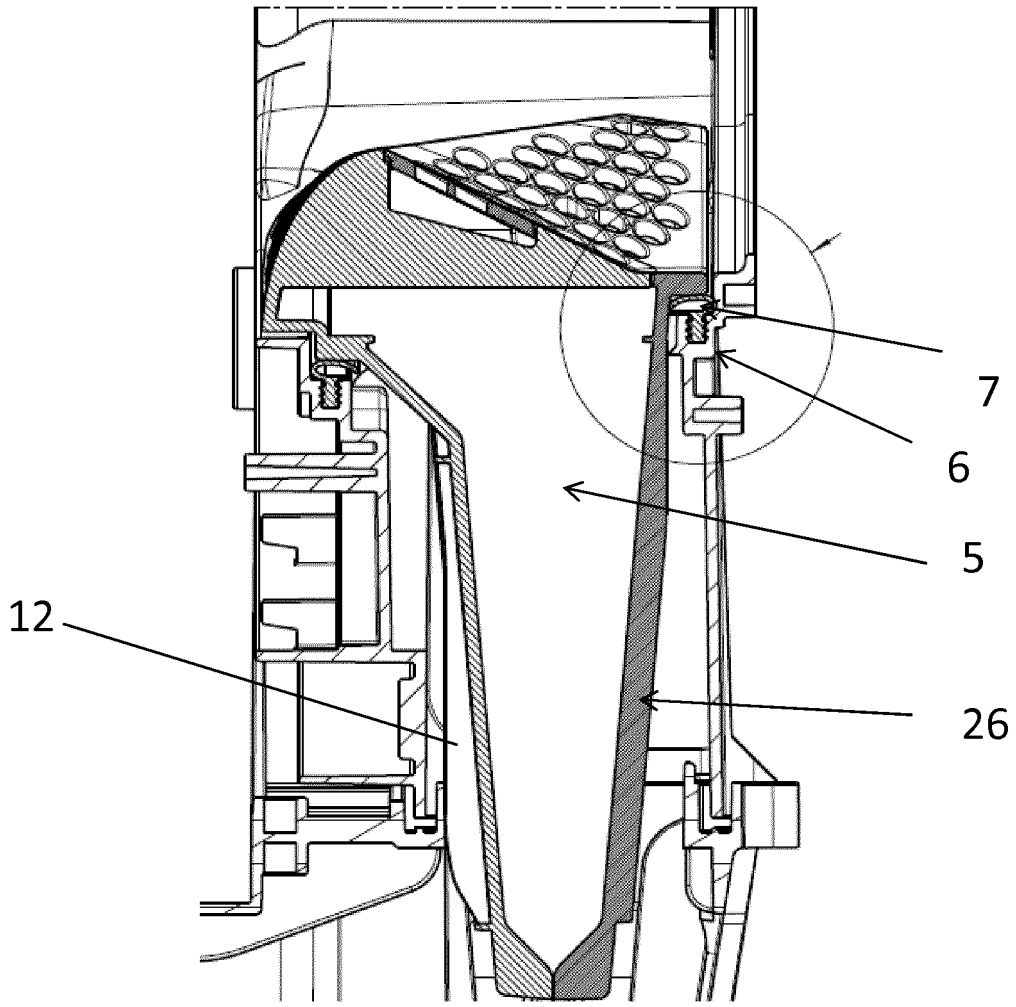


Figura 5

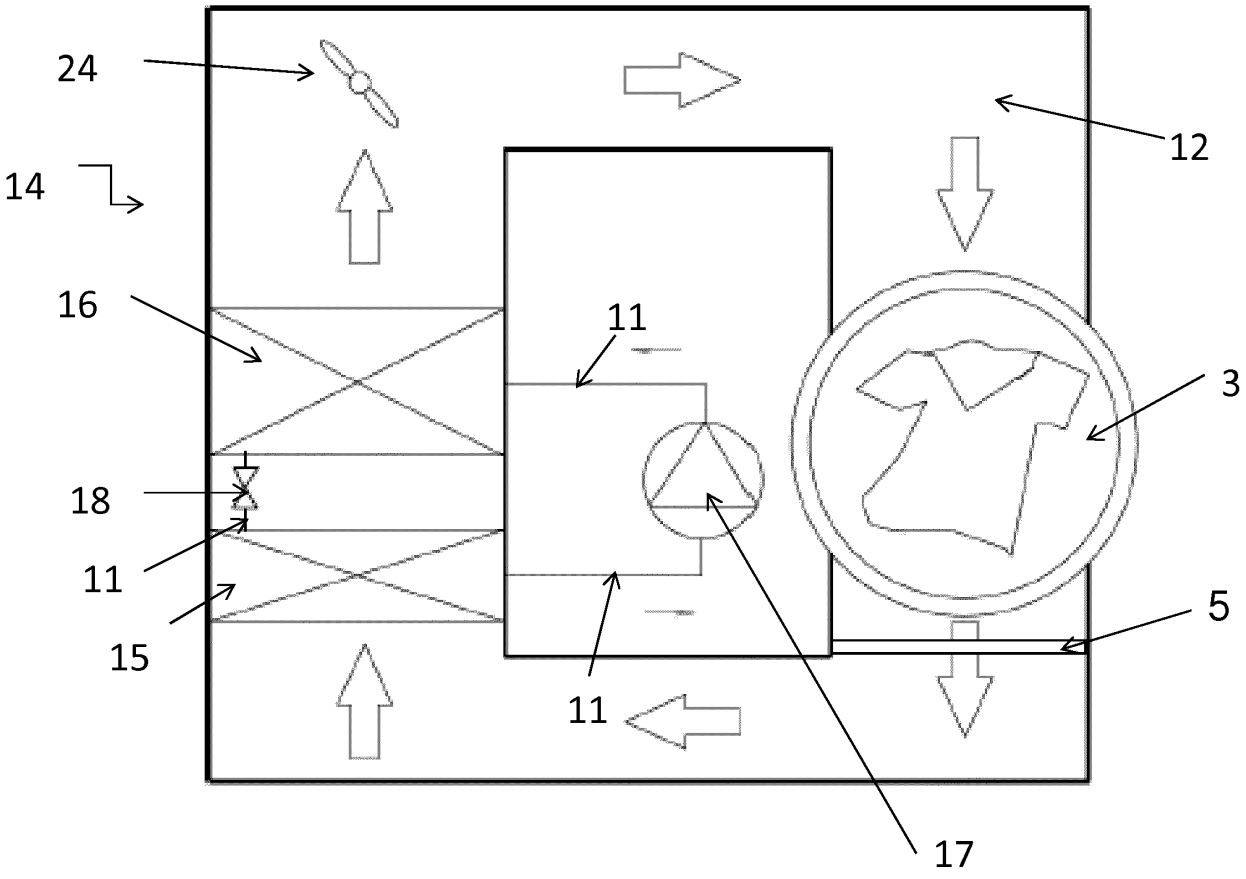


Figura 6

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

- WO 2008100065 A1 **[0006]**
- JP 2008079858 A **[0006]**