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

(11) EP 2 527 527 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
28.11.2012 Bulletin 2012/48

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

(21) Application number: **11167972.6**

(22) Date of filing: **27.05.2011**

(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
Designated Extension States:
BA ME

(71) Applicant: **Electrolux Home Products Corporation N.V.**
1130 Brussel (BE)

(72) Inventors:
- **Santarossa, Marco**
  33080 Porcia (PN) (IT)
- **Pillot, Sergio**
  33080 Porcia (PN) (IT)

(74) Representative: **Nardoni, Andrea et al**
Electrolux Italia S.p.A.
Corso Lino Zanussi, 30
33080 Porcia (PN) (IT)

(54) Rotary-drum laundry dryer

(57) A rotary-drum laundry dryer (1) comprises a revolving drum (3) adapted to receive laundry to be dried, a hot-air generator (6) structured to circulate an airflow (f) for drying laundry, and a lower supporting base or socle (9) which is structured for resting on the floor and for housing at least part of the hot-air generator (6); the hot-air generator (6) comprises: an air recirculating conduit (12) allowing the airflow (f) to flow through the revolving drum (3) and through at least one heat exchanger (15) located along the air recirculating conduit (12) for condensing moisture inside the airflow (f); and a air filtering unit (18) located along the air recirculating conduit (12), upstream of the at least one heat exchanger (15); the air filtering unit (18) comprising an air-filtering device (20, 20a) fitted into an inlet (12i) of the air recirculating conduit (12), to stop fluff and/or lint particles; a segment (12c) of the air recirculating conduit (12) extending across the lower supporting base or socle (9); the air-filtering device (20, 20a) extends at least partially in the segment (12c) of the air recirculating conduit (12) with a portion (20b).

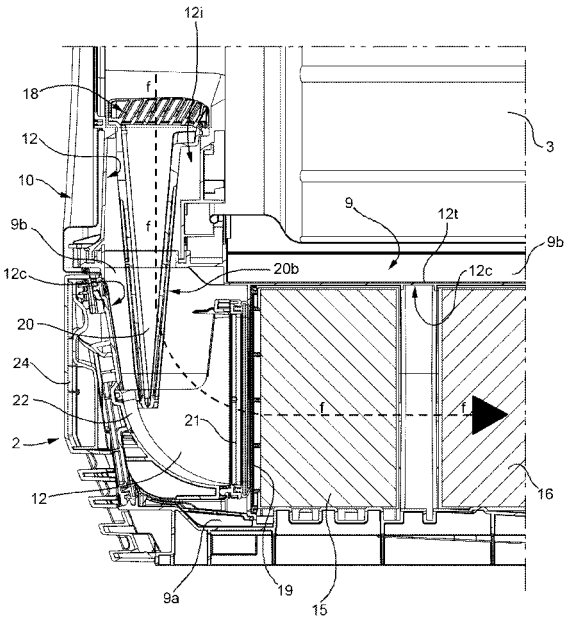

FIG. 2

EP 2 527 527 A1

Description

[0001] The present invention relates to a rotary-drum laundry dryer.

[0002] In particular, the present invention relates to a rotary-drum home laundry dryer, to which the following description refers purely by way of example without implying any loss of generality.

[0003] As is known, today's rotary-drum home laundry dryers comprise: a substantially parallelepiped-shaped outer boxlike casing structured for resting on the floor; a substantially cylindrical revolving drum structured for housing the laundry to be dried, and which is housed in axially rotating manner inside the casing to rotate about its horizontally-oriented longitudinal axis, directly facing a laundry loading/unloading opening formed in the front wall of the casing; a porthole door hinged to the front wall of the casing to rotate to and from a closing position in which the door rests completely against the front wall of the casing to close the laundry loading/ unloading opening and airtight seal the revolving drum; and an electric motor assembly structured for driving into rotation the revolving drum about its longitudinal axis inside the casing.

[0004] Home laundry dryers of the above type are also provided with an open-circuit or closed-circuit, hot-air generator which is structured to circulate inside the revolving drum a stream of hot air having a low moisture content, and which flows through the revolving drum and over the laundry inside the drum to rapidly dry the laundry; and with an electronic central control unit which controls both the motor assembly and the hot-air generator to perform one of the user-selectable drying cycles stored in the same central control unit.

[0005] In today's high-end rotary-drum home laundry dryers, the hot-air generator is usually a closed-circuit, heat-pump type, hot-air generator that comprises: an air recirculating conduit having its two ends fluidically connected to the revolving drum, on opposite sides of the latter; an electric centrifugal fan located along the air recirculating conduit to produce, inside the latter, an airflow which flows through the revolving drum; a heat-pump assembly having its two heat exchangers located one after the other, along the air recirculating conduit; and finally a manually-removable filtering element which is fitted into the inlet of the air recirculating conduit located on the peripheral frame of the porthole door, i.e. upstream of the two heat exchangers of the heat-pump assembly, and which is structured to stop fluff and/or lint particles upstream of the two heat exchangers of the heat-pump assembly and of the centrifugal fan.

[0006] EP-2034084 discloses a heat-pump type, rotary-drum home laundry dryer having a closed-circuit, heat-pump type, hot-air generator of the type referred above. In today's high-end rotary-drum home laundry dryers, the filter needs to be cleaned by the user at the end of every cycle because the fluff can occlude the air recirculating conduit, thereby causing malfunctioning of the appliance.

[0007] Aim of the present invention is therefore to provide a home laundry drier featuring a simple and more efficient air filtering system, capable of significantly reducing laundry-driers production costs and increasing use efficiency.

[0008] A further aim of the present invention is to simplify the structure of today's laundry dryers, so to simplify the assembly of the laundry dryer and/or the maintenance of the closed-circuit, hot-air generator.

[0009] Still another aim of the present invention is to provide a laundry drying machine allowing a user to perform two or more drying processes on laundry without the need to clean an air filtering unit provided for stopping fluff and/or lint particles from laundry drying airflow.

[0010] Another aim of the present invention is to reduce the number of maintenance operations that a user has to perform between two consecutive laundry drying processes carried out by the laundry dryer.

[0011] In compliance with the above aims, according to the present invention there is provided a rotary-drum laundry dryer comprising a revolving drum adapted to receive laundry to be dried, a hot-air generator structured to circulate an airflow (f) for drying laundry, and a lower supporting base or socle which is structured for resting on the floor and for housing at least part of the hot-air generator; the hot-air generator comprising: an air recirculating conduit allowing the airflow (f) to flow through the revolving drum and through at least one heat exchanger located along the air recirculating conduit for condensing moisture inside the airflow (f); and an air filtering unit located along the air recirculating conduit, upstream of said at least one heat exchanger; said air filtering unit comprising a manually-removable, air-filtering device fitted into an inlet of the air recirculating conduit, to stop fluff and/or lint particles;

a segment of the air recirculating conduit extending across the lower supporting base or socle;

the laundry dryer being characterized in that said air-filtering device extends at least partially in the segment of the air recirculating conduit with a portion.

[0012] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterized in that said air filtering unit comprises a manually-removable, air-permeable panel or septum which is arranged inside said segment of the air recirculating conduit, downstream said air filtering device so as to obstruct the local air-passage section of said segment of the air recirculating conduit, and is structured/dimensioned so as to stop fluff and/or lint particles upstream of said at least one heat exchanger.

[0013] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterized in that said air-filtering device extends at least partially in front of said manually-removable, air-permeable panel or septum.

[0014] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterised in that said air-filtering device comprises a supporting plate

which is made of plastic material and is structured for being insertable into said inlet, and a substantially bag-shaped hollow shell which overhangingly protrudes from a rear face of the supporting plate so as to extend inside a section of the air recirculating conduit of the laundry drier.

[0015] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterised in that said hollow shell is realized in one piece with the supporting plate by an injection molding process, and is divided into two complementary valve-like pieces pivotally arranged relative to one another; the air-filtering device being also provided with a first annular gasket over-injected on the whole peripheral edge of the supporting plate, and/or with at least one second annular gasket which is made of a thermoplastic elastomer and is over-injected along the whole coupling peripheral edge of at least one of the two valve-like pieces.

[0016] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterised by comprising two second annular gaskets, each of which is over-injected along the whole coupling peripheral edge of a respective valve-like piece. Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterised in that the two valve-like pieces of the hollow shell are laterally hinged to one another on the opposite side of the supporting plate.

[0017] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterised in that said supporting plate is provided with a throughout opening through which the airflow can enter into the hollow shell; and that the bottom wall of each valve-like piece of said hollow shell is provided with at least one throughout opening, which is completely covered with a grille or a close-mesh net or gauze patch properly dimensioned for restraining fluff and/or lint particles within the hollow shell.

[0018] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterised in that said grille or close-mesh net or gauze patch is made of a propylene material.

[0019] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterised in that said hot-air generator comprises an air circulating device consisting in a centrifugal fan which is located outside of the lower supporting base or socle, substantially at one of the two end-openings of said segment of the air recirculating conduit.

[0020] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterised by also comprising an electric motor assembly which is mechanically connected to the revolving drum for rotating said drum about its longitudinal axis; said electric motor assembly being fixed on said lower supporting base or socle and the centrifugal fan being mechanically connected to said electric motor assembly. Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterised by also comprising an upper boxlike cabinet which is rigidly fixed to the top of the lower supporting base or socle and is structured so to house the revolving drum.

[0021] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterised in that the hot-air generator additionally comprises a rigid, grid-like protective assembly which is fixed inside said segment of the air recirculating conduit, downstream of the filtering unit and upstream of the at least one heat exchanger, so to bar said segment of the air recirculating conduit for preventing a generic hard foreign body from reaching the heat exchanger.

[0022] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterised in that the heat exchanger is an air/refrigerant heat exchanger of a heat pump circuit or an air/air heat exchanger wherein the airflow (f) is cooled by ambient air.

[0023] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterized in that the air filtering device comprises a supporting plate insertable into an inlet of the air recirculating conduit and a bottom wall formed by a first and a second portion; the first portion extending substantially parallel to a floor resting surface on which the laundry dryer is placed, and the second portion extending from the first portion towards the supporting plate.

[0024] A non-limiting embodiment of the present invention will now be described by way of example with reference to the accompanying drawings, in which:

- Figure 1 shows in isometric view, and with parts removed for clarity, a rotary-drum home laundry dryer realized in accordance with the teachings of the present invention;
- Figure 2 is a sectioned side view of the lower front portion of the Figure 1 laundry-dryer, with parts removed for clarity;
- Figure 3 is a partly-exploded isometric view of the lower supporting base or socle of the Figure 1 laundry-dryer, with parts removed for clarity; whereas
- Figure 4 shows in isometric view, and with parts removed for clarity, the inside of the Figure 3 lower supporting base or socle of the laundry-dryer, with parts removed for clarity;
- Figures 5 and 6 are two perspective views of a first embodiment of a manually-removable filtering element according to the invention;
- Figure 7 shows an isometric view, with parts removed for clarity, of the Figure 1 laundry-dryer with the manually-removable filtering element in an operative position; and
- Figure 8 shows a front section view of the lower front portion of the Figure 1 laundry-dryer with the manually-removable filtering element in an operative position.

[0025] With reference to Figures 1 and 2, number 1 indicates as a whole a preferably household, rotary-drum

laundry dryer which comprises:

- a preferably, though not necessarily, parallelepiped-shaped outer boxlike casing 2 structured for resting on the floor;
- a substantially cylindrical, revolving drum 3 structured for housing the laundry to be dried, and which is fixed in axially rotating manner inside the boxlike casing 2, directly facing a laundry loading/ unloading through opening formed in the front wall of casing 2; and
- a porthole door 4 hinged to the front wall of casing 2 to rotate about a preferably, though not necessarily, vertically-oriented reference axis, to and from a closing position in which the door 4 rests completely against the front wall to close the laundry loading/ unloading opening and substantially airtight seal the revolving drum 3.

[0026] Inside the boxlike casing 2, the rotary-drum laundry dryer 1 additionally comprises an electric motor 5 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 6 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 rapidly dries the laundry located inside drum 3; and finally an electronic central control unit 7 which controls both the electric motor 5 and the hot-air generator 6 to perform one of the user-selectable drying cycles preferably, though not necessarily, stored in the same central control unit 7.

[0027] With reference to Figure 1, the boxlike casing 2 preferably comprises a substantially parallelepiped-shaped lower supporting base or socle 9 which is structured for resting on the floor and for housing at least part of the hot-air generator 6; and a substantially parallelepiped-shaped upper boxlike cabinet 10 which is rigidly fixed to the top of the lower supporting base or socle 9 and it is structured so as to house the revolving drum 3.

[0028] In the example shown, in particular, the revolving drum 3 preferably extends inside the boxlike cabinet 10 coaxial to a substantially horizontally-oriented longitudinal reference axis L, and rests on a number of substantially horizontally-oriented, front and rear idle supporting rollers 11 which are located in pairs substantially at the two axial ends of the revolving drum 3, and are fixed in free revolving manner to the casing 2 so as to allow the revolving drum 3 to freely rotate about its reference axis L inside the boxlike cabinet 10.

[0029] With reference to Figures 1 and 3, the front and rear idle supporting rollers 11 are preferably fixed in free revolving manner directly to the top of the lower supporting base or socle 9.

[0030] The laundry loading/unloading opening of casing 2 is therefore realized in the front wall of the upper boxlike cabinet 10, and the porthole door 4 is hinged to the front wall of the aforesaid upper boxlike cabinet 10.

[0031] In addition to the above, the lower supporting base or socle 9 is also preferably structured so to directly support the electric motor 5.

[0032] With reference to Figures 1, 2 and 3, the closed-circuit, hot-air generator 6 instead preferably consists in a heat-pump type, hot-air generator 6 which is structured for gradually drawing air from revolving drum 3; rapidly cooling down the air arriving from revolving drum 3 so to extract and retain the surplus moisture in the air drawn from revolving drum 3; rapidly heating the dehumidified air to a predetermined temperature, normally higher than the temperature of the air from revolving drum 3; and finally feeding the heated, dehumidified air back into the revolving drum 3, where it flows over the laundry inside the drum to rapidly dry said laundry.

[0033] In other words, with reference to Figures 2, 3 and 4, the hot-air generator 6 provides for continually dehumidifying and heating the air circulating inside revolving drum 3 to rapidly dry the laundry inside the drum, and basically comprises:

- an air recirculating conduit 12 having its two ends in communication with, i.e. flowingly connected to, the revolving drum 3 on opposite sides of the latter;
- a centrifugal fan 13 which is located along the air recirculating conduit 12 to produce, inside the air recirculating conduit 12, an airflow f which flows through the revolving drum 3, over the laundry located inside the drum 3; and
- a heat-pump assembly 14 which is able to rapidly cool the airflow f coming out from revolving drum 3 for condensing and retaining the surplus moisture in the airflow f, and then to rapidly heat the airflow f returning back into revolving drum 3, so that the airflow f re-entering into revolving drum 3 is rapidly heated to a temperature higher than or equal to that of the airflow f coming out of the drum.

[0034] With reference to Figures 1to 4, the heat-pump assembly 14 comprises:

- a first air/refrigerant heat exchanger 15 which is located along the air recirculating conduit 12 and is structured for rapidly cooling down the airflow f arriving from revolving drum 3 to condense and restrain the surplus moisture in the airflow f;
- a second air/refrigerant heat exchanger 16 which is located along the air recirculating conduit 12, downstream of heat exchanger 15, and which is structured for rapidly heating the airflow f arriving from heat exchanger 15 and directed back to revolving drum 3, so that the airflow f re-entering into revolving drum 3 is heated rapidly 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 heat exchanger 15 and the refrigerant-inlet of heat exchanger 16, and which is structured for

compressing the gaseous-state refrigerant directed towards heat exchanger 16 so that refrigerant pressure and temperature are much higher at the refrigerant-inlet of heat exchanger 16 than at the refrigerant-outlet of heat exchanger 15; and finally

- an expansion valve or similar passive/operated refrigerant expansion device (for example a capillary tube, a thermostatic valve or an electrically-controlled expansion valve) which is interposed between the refrigerant-outlet of heat exchanger 16 and the refrigerant-inlet of heat exchanger 15, and it is structured so as to cause a rapid 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 heat exchanger 16 than at the refrigerant-inlet of heat exchanger 15.

[0035] The air/refrigerant 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 f 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 f, to absorb heat from the airflow f, thus causing condensation of the surplus moisture in the airflow f arriving from revolving drum 3.

[0036] The air/refrigerant 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 f 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 f to release heat to the airflow f, thus rapidly heating the airflow f directed back into the revolving drum 3.

[0037] With reference to Figure 2, in the example shown, in particular, the first mouth or inlet 12i of the air recirculating conduit 12 is preferably integrated in the peripheral frame of the boxlike cabinet 10 that defines/ delimits the laundry loading/unloading opening, and the porthole door 4, when arranged in the closing position, abuts on this peripheral frame so as to substantially airtight seal the laundry loading/unloading opening and at the same time put/leave the mouth or inlet 12i of the air recirculating conduit 12 in direct communication with the inside of revolving drum 3. The second mouth or outlet (not shown) of the air recirculating conduit 12 is instead preferably realized/integrated in the rear wall of the upper boxlike cabinet 10, approximately at the center of the rear rim of revolving drum 3.

[0038] In addition to the above, with reference to Figures 2, 3 and 4, in the example shown a central/intermediate segment 12c of the air recirculating conduit 12 extends in pass-through manner across the lower supporting base or socle 9, and is shaped/dimensioned so as to house, one downstream the other along the flowing direction of the airflow f, both the evaporator 15 and the condenser 16 of the heat-pump assembly 14. In the example shown, in particular, the central segment 12c of air recirculating conduit 12 preferably extends inside the lower supporting base or socle 9 substantially horizontally. Central/intermediate segment 12c of the air recirculating conduit 12 is defined on top by an upper wall 12t of the supporting base or socle 9.

[0039] The centrifugal fan 13 in turn is preferably located outside of the lower supporting base or socle 9, preferably at one of the two end-openings of the central segment 12c of the air recirculating conduit 12, so to directly communicate with, i.e. be flowingly connected to, both the central segment 12c of the air recirculating conduit 12 and the inside of revolving drum 3.

[0040] In particular the centrifugal fan 13 is preferably located on the back of the lower supporting base or socle 9, at the exit end-opening or outlet of the central segment 12c of the air recirculating conduit 12, i.e. downstream of both the evaporator 15 and the condenser 16 of heat-pump assembly 14.

[0041] With reference to Figures 1, 2 and 4, the closed-circuit, hot-air generator 6 furthermore comprises a filtering assembly 18 which is located along the air recirculating conduit 12, upstream of evaporator 15, and is structured so as to stop fluff and/or lint particles upstream of both the evaporator 15 and the condenser 16; and a rigid, protective grid-like assembly 19 which is crosswise firmly and preferably also unmovably fixed inside the central segment 12c of the air recirculating conduit 12, downstream of the filtering assembly 18 and immediately upstream of the evaporator 15 of heat-pump assembly 14, so as to bar the central segment 12c of the air recirculating conduit 12 for preventing a generic hard foreign body to bump against the evaporator 15.

[0042] The protective grid-like assembly 19 is therefore completely separated and independent from the filtering assembly 18, and is properly shaped/dimensioned so to not significantly slow down the airflow f flowing along of the air recirculating conduit 12.

[0043] The protective grid-like assembly 19 is preferably shaped/dimensioned so as to have an air-passage free surface ratio greater than 60%, and preferably also 75%, of the local air-passage section of the air recirculating conduit 12. Furthermore the grid-like assembly 19 is preferably shaped/dimensioned so as to have an air-passage free surface ratio at least equal to twice the air-passage free surface ratio of the filtering assembly 18.

[0044] In the example shown, in particular, the protective grid-like assembly 19 preferably consists in substantially flat, rigid, large-meshed grille 19 which is preferably complementary in shape to that of the local air-passage section of the air recirculating conduit 12. The flat, large-meshed grille 19 is preferably realized in metal or plastic material.

[0045] With reference to Figures 2, 3 and 4, in the example shown, in particular, the lower supporting base or socle 9 of outer casing 2 is formed/composed by a lower half-shell 9a which is structured for resting on the floor, and by an upper half-shell 9b which is structured for being stacked up on top of, and rigidly coupled to, the lower half-shell 9a, so to preferably directly support the upper boxlike cabinet 10 and preferably also the front and rear idle rollers 11 that support in free revolving manner the revolving drum 3.

[0046] The lower half-shell 9a and the upper half-shell 9b are furthermore shaped so as to form, when coupled to one another, the substantially horizontally-oriented, whole central segment 12c of the air recirculating conduit 12 which houses, one downstream the other along the flowing direction of the airflow f, the protective grid-like assembly 19 and both the evaporator 15 and the condenser 16 of the heat-pump assembly 14.

[0047] In particular, the lower half-shell 9a and the upper half-shell 9b are preferably structured/shaped so as to firmly jam/block in between themselves the flat, large-meshed grille 19, i.e. the protective grid-like assembly 19, and preferably also the evaporator 15 and the condenser 16 of the heat-pump assembly 14.

[0048] In other words, the lower half-shell 9a and upper half-shell 9b are shaped so as to form the two halves of the central segment 12c of the air recirculating conduit 12. The top portion of the central/intermediate segment 12c is delimited by the wall 12t of the upper half shell 9b. Lower and upper half shells 9a, 9b are structured for being substantially airtight coupled to one another, so as to compose/form the whole central segment 12c of the air recirculating conduit 12, and contemporaneously directly ensnare in between themselves the large-meshed grille 19, the evaporator 15 and the condenser 16.

[0049] In the example shown, the lower half-shell 9a and the upper half-shell 9b are both preferably, though not necessarily, realized in plastic material by means of an injection molding process.

[0050] With reference to Figures 2 and 4, the filtering assembly 18 in turn preferably comprises two manually-removable, air-filtering devices which are located, one downstream the other along the air recirculating conduit 12, upstream of protective grid-like assembly 19, evaporator 15 and condenser 16.

[0051] The first air-filtering device preferably consists in a substantially plug-shaped, air-filtering device 20 which is inserted in easy extractable manner into the inlet 12i of the air recirculating conduit 12, and is structured to fit in the inlet 12i to stop fluff and/or lint particles at entrance of the air recirculating conduit 12.

[0052] With reference to Figures 5 and 6, the air-filtering device 20 has a symmetrical shape with respect to the insertion axis into inlet 12i and comprises a substantially flat supporting plate 40 made of rigid plastic material, which is structured for being insertable in easy extractable manner into inlet 12i; and a substantially bag-shaped hollow shell 41 made of rigid plastic material, which over-hangingly protrudes from the rear face of supporting plate 40 so as to extend inside the starting section of air recirculating conduit 12 and at least partially inside central/intermediate segment 12c of air recirculating conduit 12 with a respective portion 20b.

[0053] Hollow shell 41 is realized in one piece with supporting plate 40 via an injection molding process, and is divided into two complementary flat valve-like pieces 42a and 42b, which are hinged to one another through a bottom wall 46 preferably, though not necessarily, on the opposite side of supporting plate 40, so that hollow shell 41 is openable in a book-like manner (see Figure 5).

[0054] With reference to Figures 5 and 6, supporting plate 40 is centrally provided with a large throughout opening 40a through which the airflow f can enter into the hollow shell 41; whereas the bottom wall of each valve-like piece 42a, 42b of hollow shell 41 is provided with at least one large throughout opening 41 a, which is completely covered with a grille or a close-mesh net or gauze patch 43 properly dimensioned for restraining fluff and/or lint particles within hollow shell 41.

[0055] In fact, with reference to Figure 5, after having entered into the hollow shell 41 through opening 40a on supporting plate 40, the airflow f bifurcates and comes out form hollow shell 41 through openings 41a on the two valve-like pieces 42a and 42b of hollow shell 41, leaving fluff and/or lint particles within hollow shell 41.

[0056] With reference to Figures 5 and 6, in the example shown, in particular, supporting plate 40 is substantially rectangular in shape, and is properly bent to match the profile of the first mouth or inlet 12i of the air recirculating conduit 12 which is preferably integrated in the peripheral frame of the boxlike cabinet 10 that defines/ delimits the laundry loading/unloading opening; whereas opening 40a on supporting plate 40 is preferably, though not necessarily, completely covered by a grille made in one piece with the supporting plate 40 itself.

[0057] Hollow shell 41 instead has preferably, though not necessarily, a substantially V-shaped cross section, and the bottom wall of each valve-like piece 42a, 42b is provided with four adjoining throughout openings 41a, each of which is completely covered with a close-mesh net patch 43 properly dimensioned for restraining fluff and/or lint particles within the shell.

[0058] In addition to the above, with reference to Figures 5 and 6, air-filtering device 20 is provided with a main annular gasket 44 made of thermoplastic rubber or similar thermoplastic elastomer (TPE), which is over-injected on the whole peripheral edge of the supporting plate 40, and two additional annular gaskets 45 made of thermoplastic rubber or similar thermoplastic elastomer (TPE), each of which is over-injected along the whole coupling peripheral edge of a respective valve-like piece 42a, 42b.

[0059] In the example shown the main annular gasket 44 and/or the two additional annular gaskets 45 are made of Santoprene™, i.e. a mixture of EPDM rubber (ethylene propylene diene M-class rubber) and polypropylene,

having a hardness grade ranging preferably, though not necessarily, from 35 Shore A to 60 Shore D.

[0060] When the coupling peripheral edges of valve-like pieces 42a and 42b come in abutment one against the other, the two annular gaskets 45 reciprocally press themselves so to form a substantially air-tight seal which is able to stop all kinds of fluff and/or lint particles, even the smallest.

[0061] In the same way, when the supporting plate 40 is inserted in inlet 12i, annular gasket 44 comes in abutment against the lateral wall of the starting section of air recirculating conduit 12, and is compressed so as to form a second substantially air-tight seal which prevents airflow f from bypassing the air-filtering device 20.

[0062] In figures 7 and 8 there is shown a further embodiment of the air filtering device 20a that differs from the filtering device 20 described with reference to figures 5 and 6 in that the bottom wall 46 is formed by two portions 46a, 46b. The first and second portion 46a, 46b define a couple of surfaces intersecting one another along a common region, thereby conferring to the bottom wall 46 an asymmetrical configuration relative to the insertion axis of the filtering device 20a into inlet 12i. Preferably, the first portion 46a extends substantially parallel to a laundry dryer resting surface, i.e. a floor resting surface onto which the laundry drying machine is placed, while the second portion 46b extends from the first portion 46a towards the supporting plate 40. In other words, the second portion 46b extends at increasing distances from the floor resting surface proceeding in a direction from the common intersecting region between the first and the second portion 46a, 46b towards the supporting plate 40.

[0063] In this way, notwithstanding the increased size of the air-filtering device 20a compared to those known in the art, it is still possible to accommodate laundry dryer operational parts, like a compressor 17 or a cooling device thereof, without interfering with said filtering device 20a.

[0064] The second air-filtering device preferably consists in an air-permeable panel, narrow-meshed net or septum 21 which is located inside the central segment 12c of the air recirculating conduit 12, immediately upstream of the protecting grid-like assembly 19, so as to completely obstruct the local air-passage section of the central segment 12c of the air recirculating conduit 12, and is structured/dimensioned so as to stop fluff and/or lint particles upstream of evaporator 15.

[0065] The air-passage free surface ratio of the air-permeable panel, narrow-meshed net or septum 21 is preferably less than half the air-passage free surface ratio of the rigid, large-meshed grille 19.

[0066] Moreover, in the example shown the filtering panel or septum 21 is preferably rigidly fixed on a drawer-like supporting structure 22 which is inserted into a corresponding access opening 22a realized on front of the lower supporting base or socle 9, and directly communicating with the central segment 12c of the air recirculating conduit 12, upstream of protective grid-like assembly 19. The drawer-like supporting structure 22 is preferably structured so as to place, when completely inserted into the access opening 22a on front of the lower supporting base or socle 9, the filtering panel or septum 21 in abutment against the flat, large-meshed grille 19 forming the protecting grid-like assembly 19.

[0067] In use the substantially plug-shaped, air-filtering device portion 20b is placed in front of the panel 21.

[0068] To substantially airtight seal the access opening 22a on front of the lower supporting base or socle 9 and to hide the drawer-like supporting structure 22, the laundry dryer 1 is preferably also provided with a second porthole door 24 which is hinged to the front of the lower supporting base or socle 9 to rotate about a preferably, though not necessarily, vertically-oriented reference axis, to and from a closing position in which the door 24 rests completely against the front of the lower supporting base or socle 9 to completely close the access opening 22a and cover the drawer-like supporting structure 22 inserted therein.

[0069] With reference to Figures 3 and 4, the centrifugal fan 13 instead preferably comprises an outer housing 24 which is located on the back of the lower supporting base or socle 9, at the end-opening of the central segment 12c of the air recirculating conduit 12, so to directly communicate, i.e. be flowingly connected to, both the central segment 12c of the air recirculating conduit 12 and the inside of revolving drum 3; and an impeller 25 which is housed in axially rotating manner inside the outer housing 18 to generate the airflow f when rotating about its reference axis A.

[0070] In the example shown, in particular, the electric motor 5 is preferably fixed/recessed on the lower supporting base or socle 9 so that its drive shaft 5a sticks out from the back of the lower supporting base or socle 9, at the end-opening of the central segment 12c of the air recirculating conduit 12; and the centrifugal fan 13 is mechanically connected to the electric motor 5.

[0071] In the examples shown, the centrifugal fan 13 is preferably located on the back of the lower supporting base or socle 9, locally substantially aligned to the drive shaft 5a of electric motor 5, so that the outer housing or propeller housing 24 is locally substantially coaxial to the drive shaft 5a of electric motor 5, and the impeller 19 is rigidly fitted to the axial end of the drive shaft 5a of electric motor 5 so to be directly driven into rotation by the latter.

[0072] Furthermore, with reference to Figures 3 and 4, in the example shown the outer or impeller housing 24 of centrifugal fan 13 is preferably also at least partly integrated on the back of the lower supporting base or socle 9 formed by the two half-shells 9a and 9b.

[0073] In other words, the outer or impeller housing 24 of centrifugal fan 13 comprises a first portion 24a directly incorporated in the lower supporting base or socle 9, at the end-opening of the central segment 12c of the air recirculating conduit 12, and a second portion 24b which is structured/shaped for being coupled in a rigid and stable, though easily releasable, manner to the first portion

24a of the impeller housing so to close the first portion 24a of the impeller housing for covering up the impeller 25 that is at least partly recessed inside the first portion 24a of outer housing 24.

[0074] The first portion 24a of outer or impeller housing 24 is preferably realized in one piece with the lower supporting base or socle 9, whereas the second portion 24b of the impeller housing consists in a substantially basin-shaped, rigid cover 25b which is fixed in a rigid and stable, though easily releasable, manner to the area of the lower supporting base or socle 9 forming the first portion 24a of outer or impeller housing 24, so as to substantially airtight close said first portion 24a and completely cover the impeller 25.

[0075] In particular, the first portion 24a of the outer or impeller housing 15 of centrifugal fan 13 is preferably divided into two distinct and separated sections which are realized in one piece, respectively, with the lower half-shell 9a and with the upper half-shell 9b, so that the whole first portion 24a of the outer housing 24 is formed when the two half-shells 9a and 9b are coupled to one another.

[0076] In the example shown, in particular, the aforesaid two distinct and separated sections forming the first portion 24a of impeller housing 24 are preferably structured and shaped so as to form, when firmly coupled to one another, a first approximately half-volute of the outer housing 24; whereas the second portion 24b of impeller housing preferably consists in a substantially basin-shaped, rigid cover 24b which is shaped so as to form the remaining, complementary second half-volute of the impeller housing 24, and is structured for being substantially airtight coupled to the first half-volute 24a formed by the two half-shells 9a and 9b, to complete the outer housing 24 of centrifugal fan 13.

[0077] In other words, the impeller housing 24 of centrifugal fan 13 is spitted into three distinct and separated pieces which are structured for being substantially airtight coupled to one another to form the volute of the outer housing 24.

[0078] In addition to the above, with reference to Figures 3 and 4, in the example shown the lower half-shell 9a and upper half-shell 9b are also preferably, though not necessarily, structured so that the central segment 12c of the air recirculating conduit 12 is substantially L-shaped, and is oriented so that a first portion of the central segment of the air recirculating conduit 12 extends below the revolving drum 3 while remaining locally substantially parallel to the longitudinal axis L of revolving drum 3, and that a second transversal portion of the central segment of the air recirculating conduit 12 extends below the revolving drum 3 remaining locally substantially perpendicular to the longitudinal axis L of drum 3.

[0079] The protecting grid-like assembly 19, the evaporator 15 and the condenser 16 are located, one downstream the other, inside the first portion of the central segment 12c of the air recirculating conduit 12; whereas the refrigerant compressing device 17 and the electric motor 5 are preferably fixed/recessed on the lower supporting base or socle 9, aligned one after the other in a direction locally substantially parallel to the longitudinal axis L of revolving drum 3, beside the first portion of the central segment 12c of the air recirculating conduit 12, so that the drive shaft 5a of electric motor 5 sticks out from the back of the lower supporting base or socle 9, at the end of the second portion of the central segment 12c of the air recirculating conduit 12.

[0080] In the example shown, in particular, electric motor 5 and refrigerant compressing device 17 are preferably fixed/recessed directly onto the lower half-shell 9a, beside the first portion of the central segment 12c of the air recirculating conduit 12.

[0081] With reference to Figure 4, the centrifugal fan 13 is therefore located on the back of the lower supporting base or socle 9, at the end of the transversal second portion of the central segment 12c of the air recirculating conduit 12, locally aligned to the drive shaft 5a of the electric motor 5.

[0082] General operation of the rotary-drum home laundry drier 1 is clearly inferable from the above description, with no further explanation required.

[0083] Moreover a home laundry drier comprising air filtering unit according to the present invention allows to clean the filter after several cycles instead of after every cycle.

[0084] Moreover the position of the air filtering unit according to the present invention allows to obtain a larger filtering surface, to contain more fluff and to improve the filtering of the second air-filtering device.

[0085] Moreover, in a preferred embodiment the filtering device has an asymmetrical shape with respect to the insertion axis into inlet 12i.

[0086] This shape prevents the filtering device from interfering with the cooling fan of the compressor of the heat pump circuit or with other elements such as a motor for operating various fans.

[0087] Clearly, changes may be made to the rotary-drum laundry drier 1 as described herein without, however, departing from the scope of the present invention.

[0088] For example, in a less sophisticated embodiment the closed-circuit, hot-air generator 6 may consist of a forced-air, hot-air generator in which the cooling of the airflow f arriving from the revolving drum 3 is performed via a cold airflow arriving from the outside of casing 2.

[0089] In this less sophisticated embodiment, the hot-air generator 6 lacks the evaporator 15, the condenser 16, the refrigerant compressing device 17 and the refrigerant expansion device, i.e. the whole heat-pump assembly 14, and instead comprises: an air/air heat exchanger which is located along the central segment 12c of the air recirculating conduit 12, in place of the evaporator 15; and a resistor or similar air-heating device which is located along the air recirculating conduit 12, downstream of said air/air heat exchanger.

[0090] The air/air heat exchanger is structured for be-

ing crossed, at the same time, by the airflow f arriving from revolving drum 3 and by a stream of cold air arriving from outside the casing 2, thus allowing the stream of external cold air to absorb heat from the airflow f for causing the condensation of the surplus moisture in the airflow f arriving from revolving drum 3; whereas the resistor is structured for rapidly heating up the dehumidified air directed back into the revolving drum 3.

[0091] In this less sophisticated embodiment, the protecting grid-like assembly 19, i.e. the flat, large-meshed grille 19, is located along the central segment 12c of the air recirculating conduit 12, immediately upstream of the air/air heat exchanger and the portion 20b of the air filtering device 20 is placed in front of the septum 21 and the grille 19.

Claims

1. Rotary-drum laundry dryer (1) comprising a revolving drum (3) adapted to receive laundry to be dried, a hot-air generator (6) structured to circulate an airflow (f) for drying laundry, and a lower supporting base or socle (9) which is structured for resting on the floor and for housing at least part of the hot-air generator (6);
the hot-air generator (6) comprising: an air recirculating conduit (12) allowing the airflow (f) to flow through the revolving drum (3) and through at least one heat exchanger (15) located along the air recirculating conduit (12) for condensing moisture inside the airflow (f); and a air filtering unit (18) located along the air recirculating conduit (12), upstream of said at least one heat exchanger (15); said air filtering unit (18) comprising an air-filtering device (20, 20a) fitted into an inlet (12i) of the air recirculating conduit (12), to stop fluff and/or lint particles;
a segment (12c) of the air recirculating conduit (12) extending across the lower supporting base or socle (9);
the laundry dryer (1) **being characterized in that** said air-filtering device (20, 20a) extends at least partially in the segment (12c) of the air recirculating conduit (12) with a portion (20b).

2. Rotary-drum laundry dryer according to claim 1, **characterized in that** said air filtering unit (18) comprises an air-permeable panel or septum (21) which is arranged inside said segment (12c) of the air recirculating conduit (12), downstream said air-filtering device (20, 20a) so as to obstruct the local air-passage section of said segment (12c) of the air recirculating conduit (12), and is structured/dimensioned so as to stop fluff and/or lint particles upstream of said at least one heat exchanger (15).

3. Rotary-drum laundry dryer according to claim 1 or 2, **characterized in that** said air-filtering device (20, 20a) extends at least partially in front of said air-permeable panel or septum (21).

4. Rotary-drum laundry dryer according to any one of the foregoing claims, **characterised in that** said air-filtering device (20, 20a) comprises a supporting plate (40) which is made of plastic material and is structured for being insertable into said inlet (12i), and a substantially bag-shaped hollow shell (41) which overhangingly protrudes from a rear face of the supporting plate (40) so as to extend inside a section of the air recirculating conduit (12) of the laundry drier (1).

5. Rotary-drum laundry dryer according to claim 4, **characterised in that** said hollow shell (41) is realized in one piece with the supporting plate (40) by an injection molding process, and is divided into two complementary valve-like pieces (42a, 42b) pivotally arranged relative one another; the air-filtering device (20, 20a) being also provided with a first annular gasket (44) over-injected on the whole peripheral edge of the supporting plate (40), and/or with at least one second annular gasket (45) which is made of a thermoplastic elastomer and is over-injected along the whole coupling peripheral edge of at least one of the two valve-like pieces (42a, 42b).

6. Rotary-drum laundry dryer according to any one of the foregoing claims, **characterised by** comprising two second annular gaskets (45) each of which is over-injected along the whole coupling peripheral edge of a respective valve-like piece (42a, 42b).

7. Rotary-drum laundry dryer according to claims 5 or 6, **characterised in that** the two valve-like pieces (42a, 42b) of the hollow shell (41) are laterally hinged to one another on the opposite side of the supporting plate (40).

8. Rotary-drum laundry dryer according to any of claims 5 to 7, **characterised in that** said supporting plate (40) is provided with a throughout opening (40a) through which the airflow (f) can enter into the hollow shell (41); and that the bottom wall of each valve-like piece (42a, 42b) of said hollow shell (41) is provided with at least one throughout opening (41a), which is completely covered with a grille or a close-mesh net or gauze patch (43) dimensioned for restraining fluff and/or lint particles within the hollow shell (41).

9. Rotary-drum laundry dryer according to claim 8, **characterised in that** said grille or close-mesh net or gauze patch (43) is made of a polypropylene material.

10. Rotary-drum laundry dryer according to any one of the foregoing claims, **characterized in that** said hot-

air generator (6) comprises an air circulating device (13) consisting in a centrifugal fan (13) which is located outside of the lower supporting base or socle (9), substantially at one of the two end-openings of said segment (12c) of the air recirculating conduit (12).

11. Rotary-drum laundry dryer according to claim 10, **characterized by** also comprising an electric motor assembly (5) which is mechanically connected to the revolving drum (3) for rotating said drum (3) about its longitudinal axis (L); said electric motor assembly (5) being fixed on said lower supporting base or socle (9) and the centrifugal fan (13) being mechanically connected to said electric motor assembly (5).

12. Rotary-drum laundry dryer according to any one of the foregoing claims, **characterized by** also comprising an upper boxlike cabinet (10) which is rigidly fixed to the top of the lower supporting base or socle (9) and is structured so to house the revolving drum (3).

13. Rotary-drum laundry dryer according to any one of the foregoing claims, **characterized in that** the hot-air generator (6) additionally comprises a rigid, grid-like protective assembly (19) which is fixed inside said segment (12c) of the air recirculating conduit (12), downstream of the filtering unit (18) and upstream of the at least one heat exchanger (15), so to bar said segment (12c) of the air recirculating conduit (12) for preventing a generic hard foreign body from reaching the heat exchanger (15).

14. Rotary-drum laundry dryer according to any one of the foregoing claims, **characterized in that** the heat exchanger (15) is an air/refrigerant heat exchanger of a heat pump circuit or an air/air heat exchanger wherein the airflow (f) is cooled by ambient air.

15. Rotary-drum laundry dryer according to any one of the foregoing claims, wherein said air filtering device (20a) comprises a supporting plate (40) insertable into said inlet (12i), and a bottom wall (46) formed by a first and a second portion (46a, 46b); said first portion (46a) extending substantially parallel to said floor resting surface and said second portion 46b extending from the first portion (46a) towards the supporting plate 40.

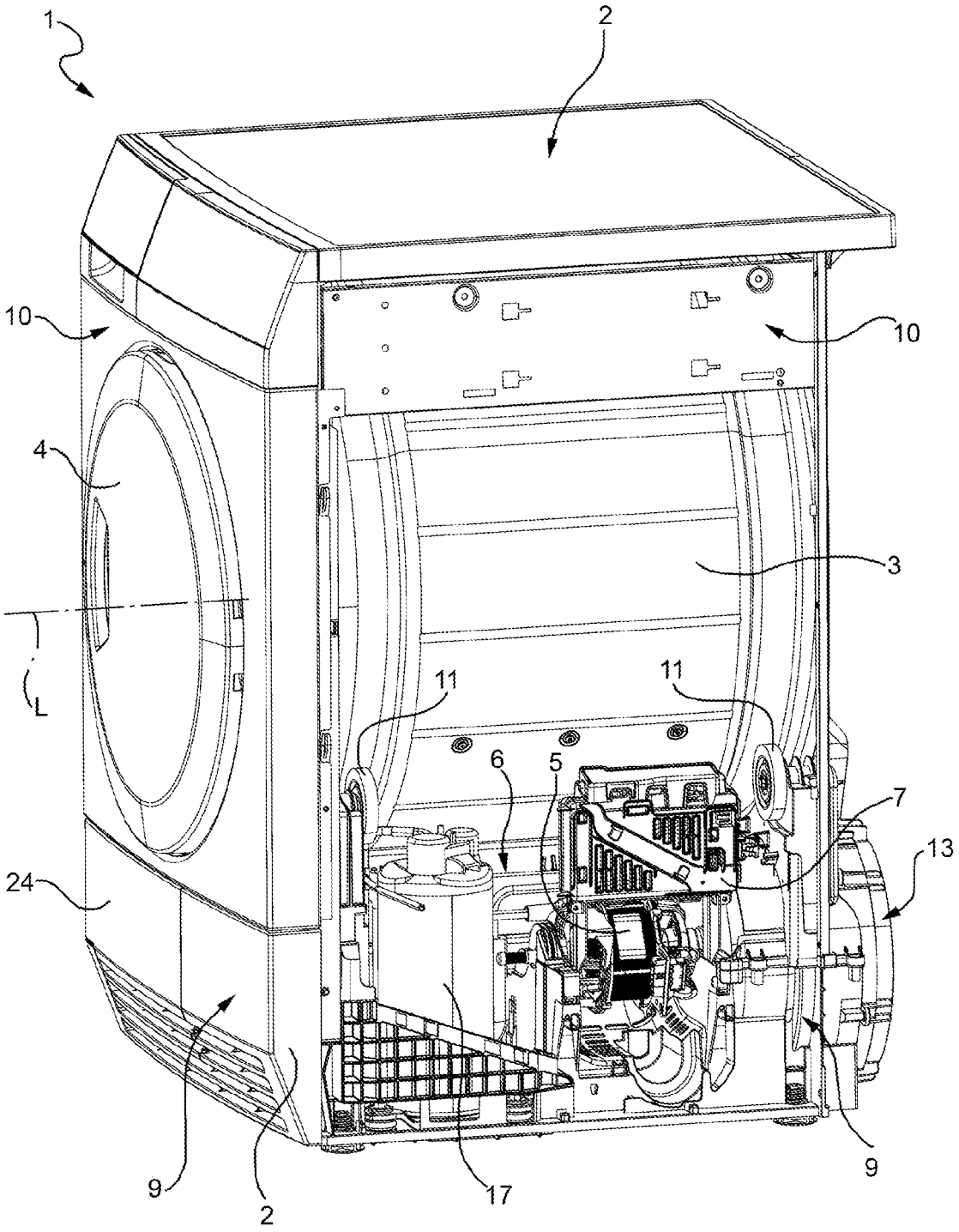

FIG. 1

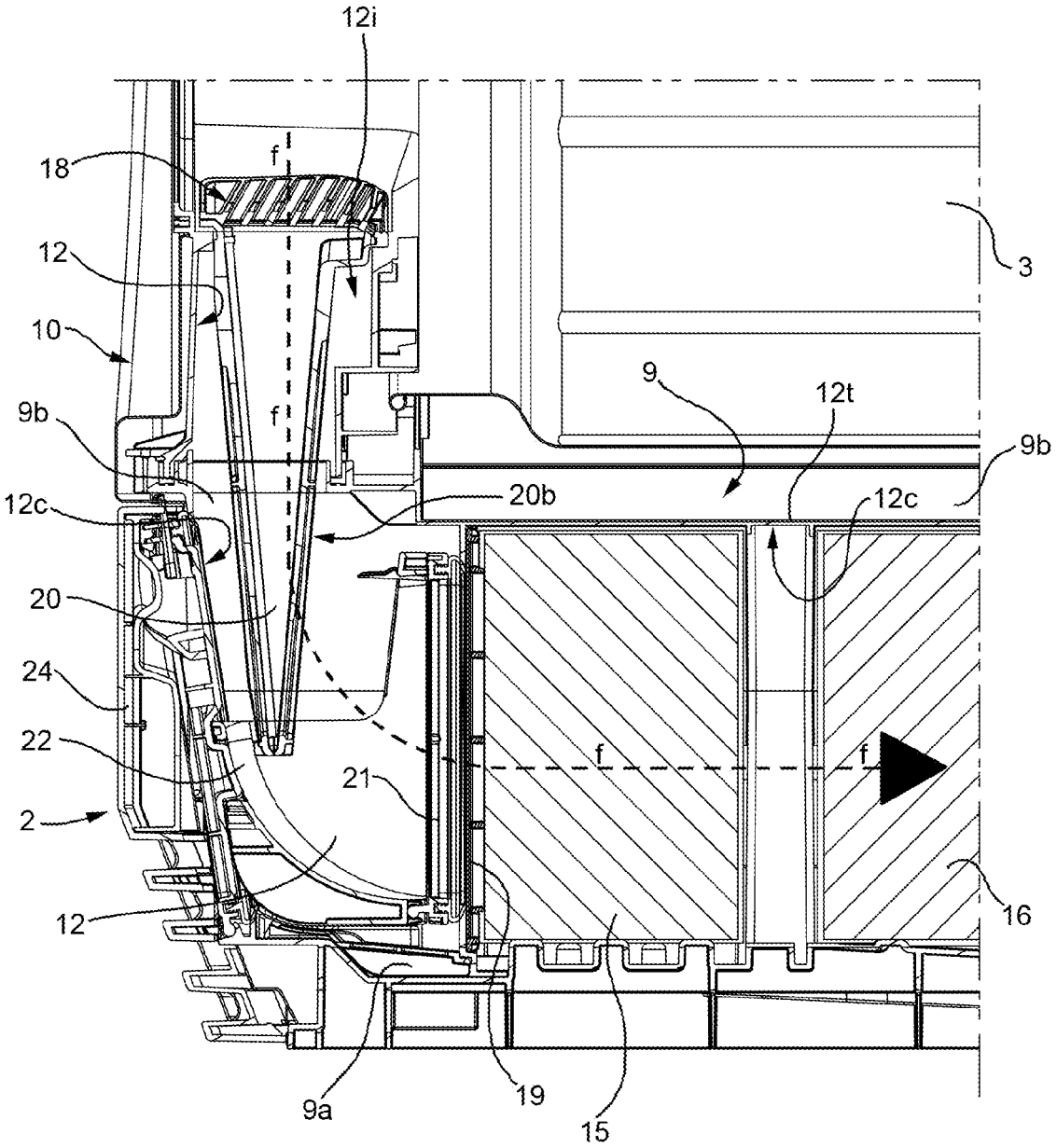
12i
18
f
12
10
3
9
12t
9b
f
9b
20b
12c
12c
20
24
22
f
f
21
2
12
16
9a
19
15

FIG. 2

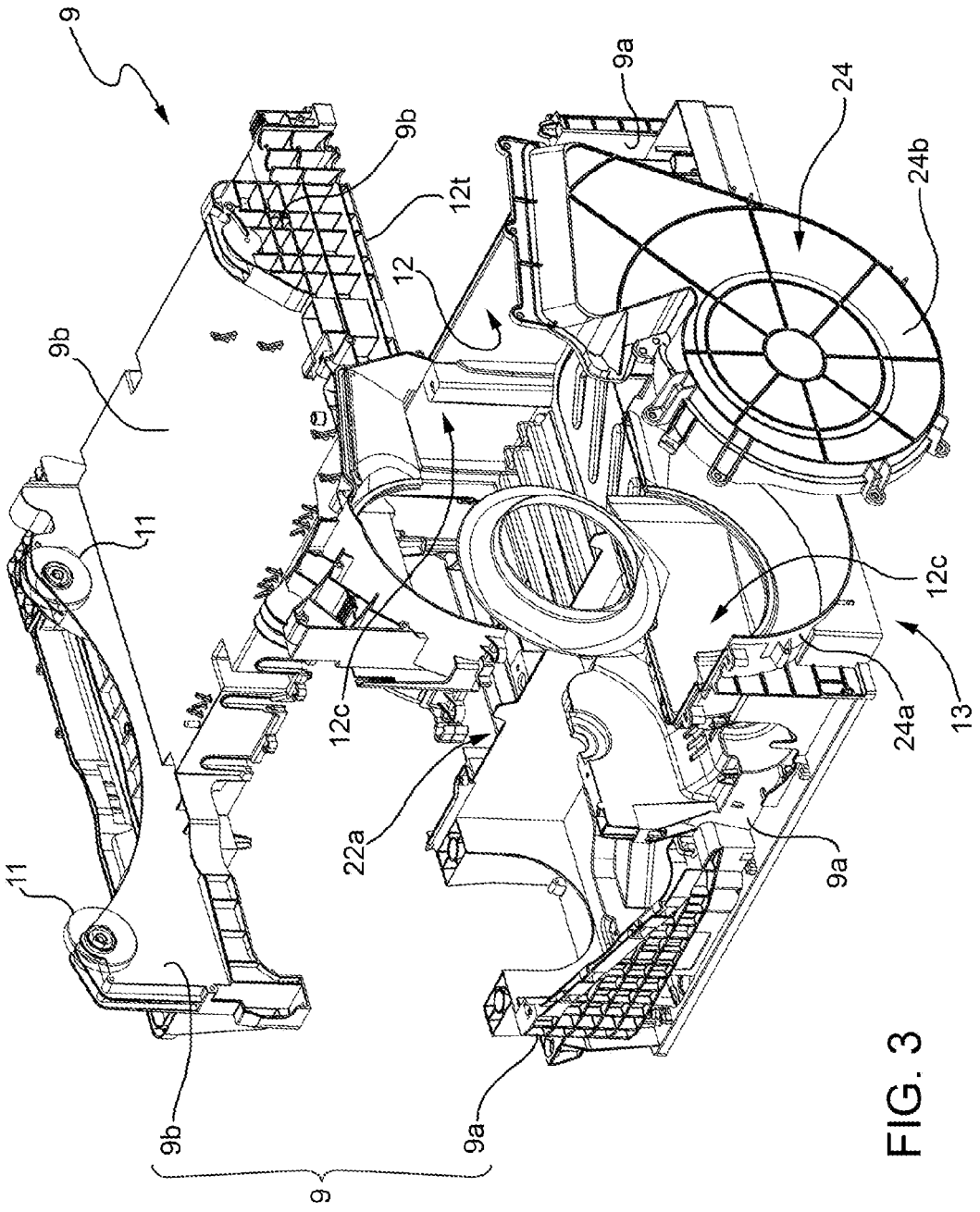

FIG. 3

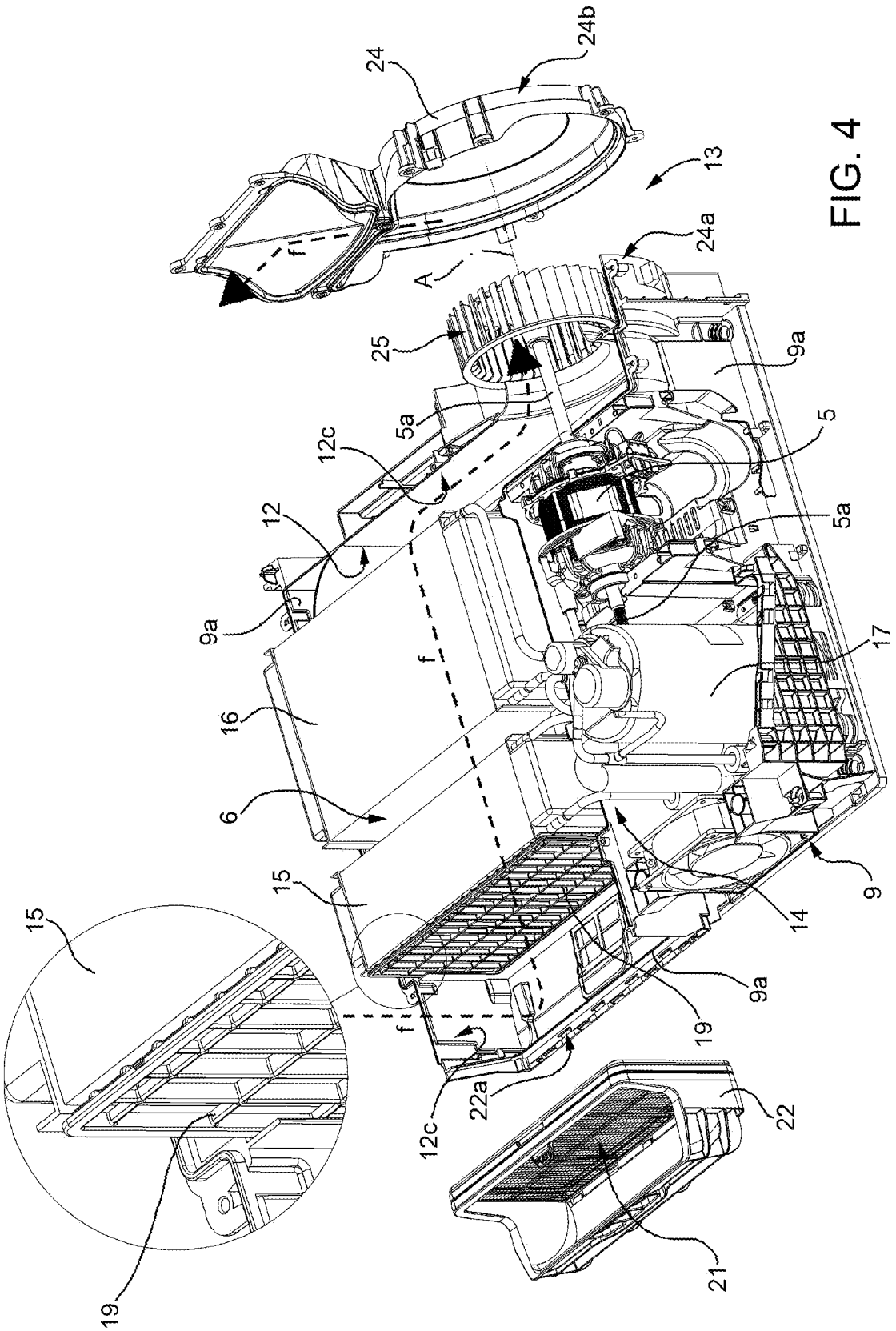
24
24b
13
24a
A
25
9a
5a
12c
5
12
5a
9a
17
f
16
6
15
9
14
9a
19
f
22a
12c
22
21
15
19

FIG. 4

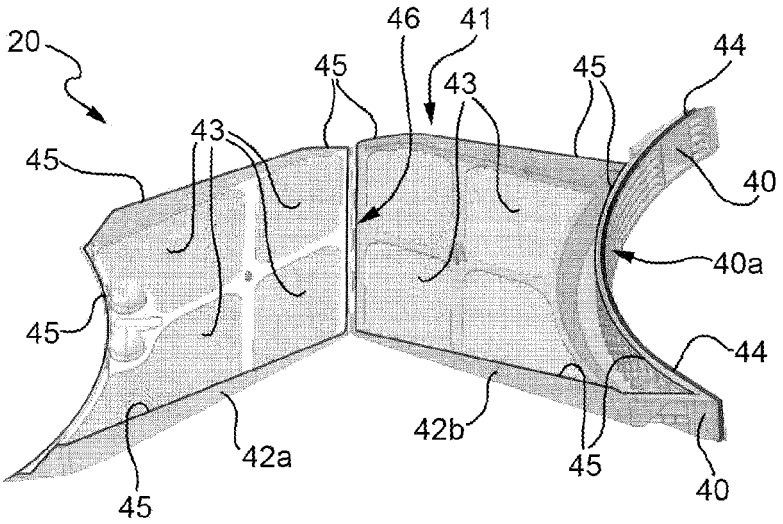
20
46
41
45
43
45
44
43
45
40
40a
45
44
42b
42a
45
45
40

FIG. 5

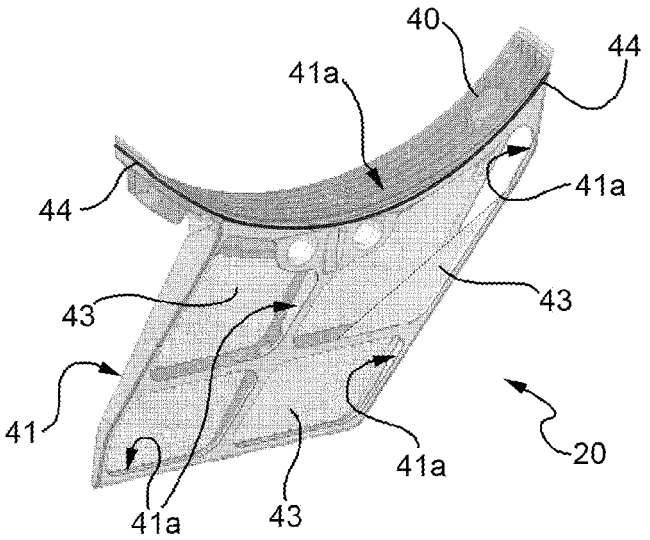
40
44
41a
44
41a
43
43
41
20
41a
41a
43

FIG. 6

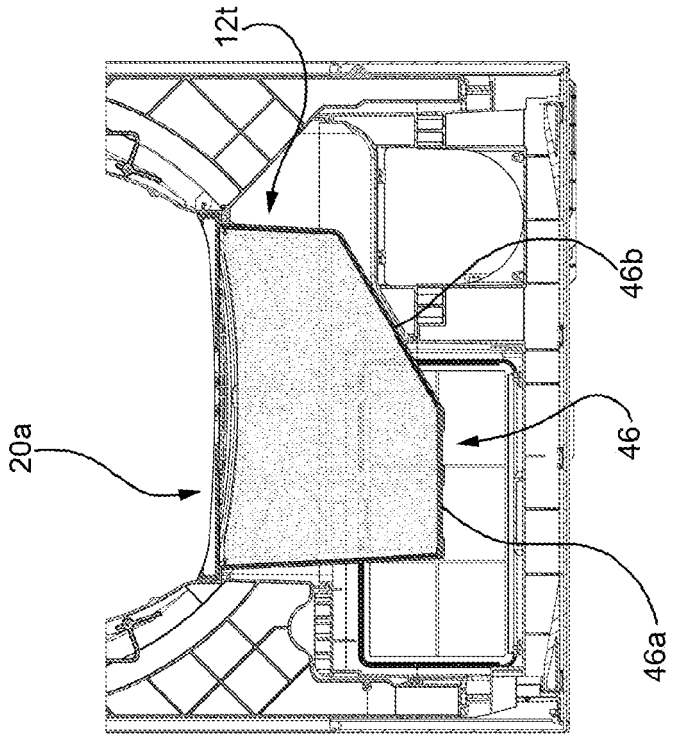

FIG. 8

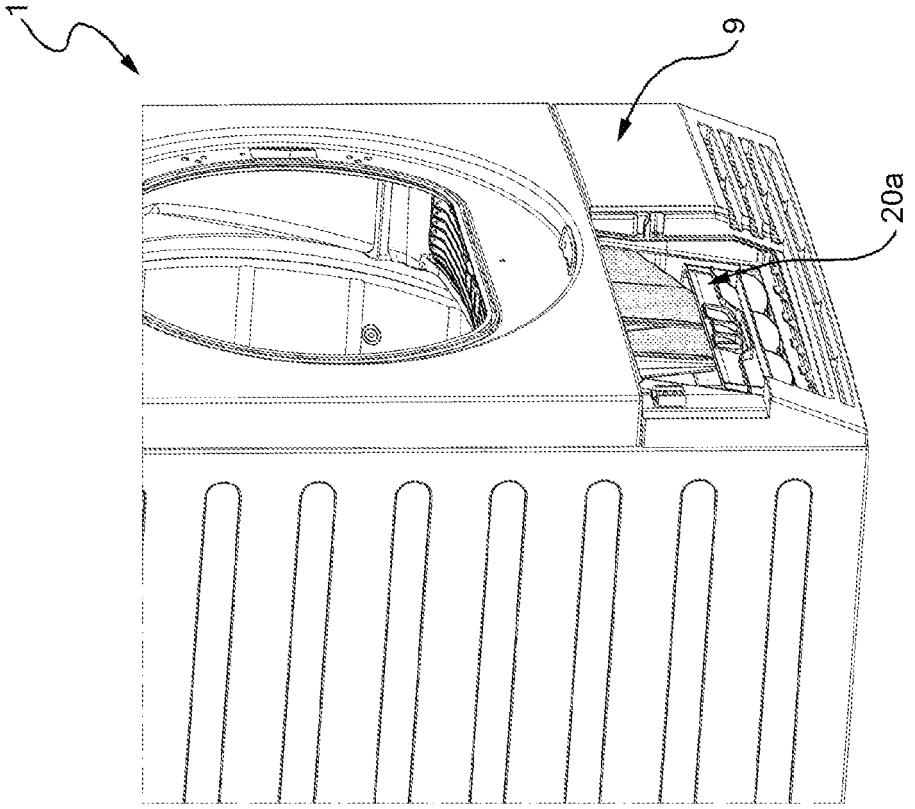

FIG. 7

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 11 16 7972

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	EP 2 145 999 A1 (ELECTROLUX HOME PROD CORP [BE]) 20 January 2010 (2010-01-20) * paragraph [0048] - paragraph [0059]; figures 1-3 *	1,4,12, 14 2-11,13, 15	INV. D06F58/22
Y	EP 2 230 349 A1 (ELECTROLUX HOME PROD CORP [BE]) 22 September 2010 (2010-09-22) * paragraph [0018] - paragraph [0042]; figures 1-3 *	2-11,13, 15	
A	EP 2 314 759 A1 (CANDY SPA [IT]) 27 April 2011 (2011-04-27) * paragraph [0013] - paragraph [0024]; figures 1-3 *	1-15	
A	US 3 378 934 A (ERICKSON CLIFFORD E) 23 April 1968 (1968-04-23) * column 2, line 3 - column 4, line 57; figures 1-3-5 *	1-15	
			TECHNICAL FIELDS SEARCHED (IPC) D06F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	4 November 2011	Hannam, Martin

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

1

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 11 16 7972

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

04-11-2011

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 2145999 A1	20-01-2010	AT 524595 T	15-09-2011
		CN 102099524 A	15-06-2011
		WO 2010006694 A1	21-01-2010
		US 2011173834 A1	21-07-2011
EP 2230349 A1	22-09-2010	RU 2010110539 A	27-09-2011
EP 2314759 A1	27-04-2011	NONE	
US 3378934 A	23-04-1968	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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

- EP 2034084 A **[0006]**