



(12) **EUROPEAN PATENT APPLICATION**

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

(51) Int Cl.:
D06F 58/20 (2006.01)

(21) Application number: **11167964.3**

(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

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(54) **Rotary-drum laundry dryer**

(57) Rotary-drum laundry dryer (1) comprising a revolving drum (3) structured for housing the laundry to be dried, a hot-air generator (6) structured to circulate a stream of hot air through said revolving drum (3), 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) in turn comprising: an air recirculating conduit (12) having its two ends connected to the revolving drum (3); air circulating means (13) which are located along the air recirculating conduit (12) and are structured to produce, inside the air recirculating conduit (12), an airflow (f) which flows through the revolving drum (3) and over the laundry inside the drum (3); and at least one heat exchanger (15) located along the air recirculating conduit (12) and structured to cool the moist air arriving from the rotatable drum (3) so to cause the condensation of the surplus moisture inside the airflow (f);

the lower supporting base or socle (9) comprising a lower half-shell (9a) structured for resting on the floor, and an upper half-shell (9b) stacked up on top of, and rigidly coupled to said lower half-shell (9a); said lower half-shell (9a) and upper half-shell (9b) being shaped so as to form, when coupled to one another, a section of the air recirculating conduit (12) which houses at least the heat exchanger (15) of said hot-air generator (6);

the air circulating means (13) of the hot-air generator (6) comprising an impeller housing (18) which communicates with said section of the air recirculating conduit (12), and an impeller (19) which is housed in axially rotating manner inside the impeller housing (18) to generate the airflow (f);

the laundry dryer (1) being characterized in that the im-

PELLER HOUSING (18) OF THE AIR CIRCULATING MEANS (13) COMPRISES A FIRST PORTION (18a) REALIZED IN ONE PIECE WITH THE LOWER HALF-SHELL (9a), AND A SECOND PORTION (18b) REALIZED IN ONE PIECE WITH THE UPPER HALF-SHELL (9b); AND IN THAT SAID FIRST PORTION (18a) AND SAID SECOND PORTION (18b) ARE STRUCTURED FOR BEING COUPLED TO ONE ANOTHER SO AS TO FORM A SUBSTANTIALLY CIRCULAR, BASIN-SHAPED CASING (18a, 18b) THAT AT LEAST PARTLY COVERS THE IMPELLER VANES (19a).

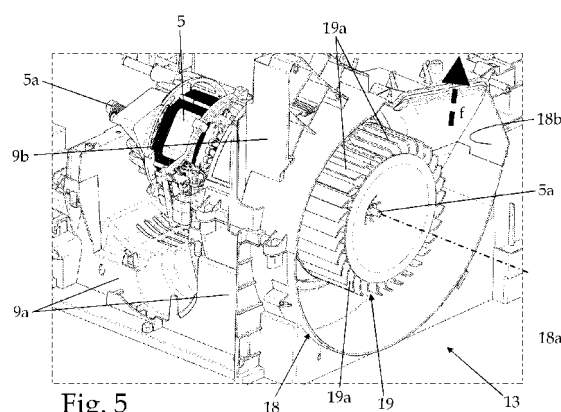


Fig. 5

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 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 connected to the revolving drum, on opposite sides of the latter; an electrically-operated centrifugal fan located along the air recirculating conduit to produce, inside the latter, an air flow which flows through the revolving drum; and finally a heat-pump assembly having its two heat exchangers located one after the other, along the air recirculating conduit.

[0006] EP-2034084 discloses a heat-pump type, rotary-drum home laundry dryer of the above type.

[0007] Aim of the present invention is to simplify the structure of today's laundry dryers, so to reduce the number of component parts and to simplify the airtight coupling of said component parts to reduce possible air leakages.

[0008] In compliance with the above aims, according to the present invention there is provided a rotary-drum laundry dryer comprising a revolving drum structured for housing the laundry to be dried, a hot-air generator structured to circulate a stream of hot air through said revolving drum, 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 in turn comprising: an air recirculating conduit having its two ends connected to the revolving drum; air circulating means which are located along the air recirculating conduit and are structured to produce, inside the air recirculating conduit, an airflow which flows through the revolving drum and over the laundry inside the drum; and at least one heat exchanger located along the air recirculating conduit and structured to cool the moist air arriving from the rotatable drum so to cause the condensation of the surplus moisture inside the airflow; the lower supporting base or socle comprising a lower half-shell structured for resting on the floor, and an upper half-shell stacked up on top of, and rigidly coupled to said lower half-shell; said lower half-shell and upper half-shell being shaped so as to form, when coupled to one another, a section of the air recirculating conduit which houses at least the heat exchanger of said hot-air generator; the air circulating means of the hot-air generator comprising an impeller housing which communicates with said section of the air recirculating conduit, and an impeller which is housed in axially rotating manner inside the impeller housing to generate the airflow; the laundry dryer being characterized in that the impeller housing of the air circulating means comprises a first portion realized in one piece with the lower half-shell, and a second portion realized in one piece with the upper half-shell; and in that said first portion and said second portion are structured for being coupled to one another so as to form a substantially circular casing that at least partly covers the impeller vanes.

[0009] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterized in that the impeller housing further comprises a completely separated cover which is shaped/structured for being coupled to said first and second portions to cover the casing formed by said first and second portions.

[0010] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterized in that said first and second portions are shaped so as to form, when coupled to one another, a first approximately half-volute of the impeller housing.

[0011] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterized in that said completely separated cover forms the remaining and complementary second half-volute of the impeller housing of the air circulating means, and is structured for being coupled to the first half-volute formed by the first and second portion to complete the volute of the impeller housing.

[0012] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterized in that the impeller housing is located on the back of lower supporting base or socle, at an end-opening of said section of the air recirculating conduit.

[0013] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterized in that the first portion of the impeller housing protrudes

from the lower half-shell, and that the second portion of the impeller housing protrudes from the upper half-shell.

[0014] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterized in that the first portion of the impeller housing sticks out of the lower half-shell more than the second portion of the impeller housing sticks out of the upper half-shell.

[0015] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterized in that the first and/or the second portion of the impeller housing is dimensioned to cover more than 50% of the nominal high of the impeller vanes.

[0016] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterized by also comprising an electric motor assembly which is mechanically connected to the revolving drum for rotating said drum about its longitudinal axis; and in that the impeller of said air circulating means is mechanically connected to said electric motor assembly so to be driven into rotation by the latter.

[0017] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterized in that the lower half-shell and the upper half-shell are structured so that said section of the air recirculating conduit is substantially L-shaped; a first portion of the central section of the air recirculating conduit being locally substantially parallel to the longitudinal axis of the revolving drum; and in that the air circulating means are located at the end of the second transversal portion of said section of the air recirculating conduit, with the impeller locally aligned to the electric motor assembly.

[0018] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterized in that the air circulating means also comprise a substantially funnel-shaped, intake manifold which is located at the end-opening of said section of the air recirculating conduit, and extends within the impeller housing towards the impeller.

[0019] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterized in that said intake manifold consists in a substantially frustoconical sleeve which is provided with an outwards projecting peripheral flange all-around the larger mouth, and in that said peripheral flange is structured to fit into two corresponding coplanar semicircular grooves realized one in the lower half-shell, and the other in the upper half-shell.

[0020] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterized 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 characterized in that the longitudinal axis of the revolving drum is substantially horizontally-oriented, and in that the revolving drum rests on a number of supporting rollers which are arranged substantially at the two axial ends of the revolving

drum, and are fixed in free revolving manner directly to the top of the upper half-shell.

[0022] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterized in that the hot-air generator is a heat-pump type, hot-air generator which comprises: a first air/refrigerant heat exchanger which is located inside the central section of the air recirculating conduit, and is structured for rapidly cooling down the airflow arriving from the revolving drum to condense and restrain the surplus moisture in the airflow; a second air/refrigerant heat exchanger which is located inside the central section of the air recirculating conduit, downstream of the first air/refrigerant heat exchanger, and which is structured for rapidly heating the airflow arriving from the first air/ refrigerant heat exchanger and directed back to the revolving drum; a refrigerant compressing device which is interposed between the refrigerant-outlet of the first air/ refrigerant heat exchanger and the refrigerant-inlet of the second air/refrigerant heat exchanger, and which is structured for compressing the gaseous-state refrigerant directed towards the second air/refrigerant heat exchanger; and a refrigerant expansion device which is interposed between the refrigerant-outlet of the second air/refrigerant heat exchanger and the refrigerant-inlet of the first air/refrigerant heat exchanger, and it is structured so as to cause a rapid expansion of the refrigerant directed towards the first air/ refrigerant heat exchanger.

[0023] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterized in that the lower half-shell and the upper half-shell are both realized in plastic material preferably via an injection molding process.

[0024] As an alternative, according to the present invention there is provided a rotary-drum laundry dryer comprising an outer casing structured for resting on the floor, a revolving drum structured for housing the laundry to be dried and which is fixed in axially rotating manner inside the casing, and a hot-air generator which is located inside the outer casing and is structured to circulate a stream of hot air through said revolving drum; the hot-air generator in turn comprising: an air recirculating conduit having its two ends connected to the revolving drum on opposite sides of the latter; air circulating means which are located along the air recirculating conduit and are structured to produce, inside the air recirculating conduit, an airflow which flows through the revolving drum and over the laundry inside the drum; and a heat exchanger which is located along the air recirculating conduit and is structured to rapidly cool the moist air arriving from the revolving drum so to cause the condensation of the surplus moisture inside the airflow; the outer boxlike casing instead comprising: 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; and 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;

the lower supporting base or socle comprising a lower half-shell structured for resting on the floor, and an upper half-shell stacked up on top of, and rigidly coupled to said lower half-shell; said lower half-shell and upper half-shell being shaped so as to form, when coupled to one another, a central section of the air recirculating conduit which houses at least the air cooling means of said hot-air generator;

the air circulating means of the hot-air generator being instead located on the lower supporting base or socle, at the end-opening of the central section of the air recirculating conduit, and comprising an impeller housing which communicates with the end-opening of the central section of the air recirculating conduit, and an impeller which is housed in axially rotating manner inside the impeller housing to generate the airflow;

the laundry dryer being characterized in that the impeller housing of the air circulating means comprises a first portion realized in one piece with lower half-shell, and a second portion realized in one piece with upper half-shell; and in that said first portion and second portion are structured for being coupled to one another so as to form a substantially circular, basin-shaped casing that at least partly covers the impeller vanes.

[0025] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterized in that the impeller housing further comprises a completely separated, cap-shaped cover which is shaped/structured for being coupled to said first and second portions to completely cover and seal the substantially circular, basin-shaped casing formed by said first and second portions.

[0026] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterized in that said first and second shell are shaped to form a first approximately half-volute of the impeller housing.

[0027] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterized in that the said completely separated, cap-shaped cover forms the remaining and complementary second half-volute of the impeller housing of the air circulating means, and is structured for being coupled to the first half-volute formed by the first and second portion to complete the volute of the impeller housing.

[0028] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterized in that the first portion of the impeller housing protrudes from the lower half-shell, and that the second portion of the impeller housing protrudes from the upper half-shell.

[0029] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterized in that the first portion of the impeller housing sticks out of the lower half-shell more than the second portion of the impeller housing sticks out of the upper half-shell.

[0030] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterized in that the first portion of the impeller housing is dimensioned to cover more than 50% of the nominal high of the impeller vanes.

[0031] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterized by also comprising, inside the casing, an electric motor assembly which is mechanically connected to the revolving drum for rotating said drum about its longitudinal axis; and in that the impeller of the air circulating means is mechanically connected to said electric motor assembly so to be driven into rotation by the latter.

[0032] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterized in that the lower half-shell and the upper half-shell are structured so that the central section of the air recirculating conduit is substantially L-shaped; in that the electric motor is fixed on the lower supporting base or socle beside a first portion of the central section of the air recirculating conduit locally substantially parallel to the longitudinal axis of the revolving drum; and in that the air circulating means are located at the end of the second transversal portion of the central section of the air recirculating conduit, with the impeller locally aligned to the electric motor assembly.

[0033] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterized in that the air circulating means also comprise a substantially funnel-shaped, intake manifold which is located at the end-opening of the central section of the air recirculating conduit, and extends within the impeller housing towards the impeller.

[0034] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterized in that said intake manifold consists in a substantially frustoconical sleeve which is provided with an outwards projecting peripheral flange all-around the larger mouth, and in that said peripheral flange is structured to fit into two corresponding coplanar semicircular grooves realized one in the lower half-shell, and the other in the upper half-shell.

[0035] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterized in that longitudinal axis of the revolving drum is substantially horizontally-oriented, and in that the revolving drum rests on a number of idle supporting rollers which are arranged substantially at the two axial ends of the revolving drum, and are fixed in free revolving manner directly to the top of the upper half-shell.

[0036] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterized in that the hot-air generator is a heat-pump type, hot-air generator which comprises: a first air/refrigerant heat exchanger which is located inside the central section of the air recirculating conduit, and is structured for rapidly cooling down the airflow arriving from the revolving drum to condense and restrain the surplus moisture in the airflow; a second air/refrigerant heat exchanger which is located inside the central section of the air recirculating conduit, downstream of the first air/refrigerant heat exchanger, and which is structured for rapidly heating the airflow arriving from the first air/ refrigerant heat exchanger and

directed back to the revolving drum; a refrigerant compressing device which is interposed between the refrigerant-outlet of the first air/refrigerant heat exchanger and the refrigerant-inlet of the second air/refrigerant heat exchanger, and which is structured for compressing the gaseous-state refrigerant directed towards the second air/refrigerant heat exchanger; and a refrigerant expansion device which is interposed between the refrigerant-outlet of the second air/refrigerant heat exchanger and the refrigerant-inlet of the first air/refrigerant heat exchanger, and it is structured so as to cause a rapid expansion of the refrigerant directed towards the first air/refrigerant heat exchanger.

[0037] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterized in that the refrigerant compressing device and the refrigerant expansion device are fixed directly onto the lower half-shell of the supporting base or socle, beside the central section of the air recirculating conduit.

[0038] Furthermore and preferably, though not necessarily, the rotary-drum laundry dryer is characterized in that the lower half-shell and the upper half-shell are both realized in plastic material preferably via an injection molding process.

[0039] A non-limiting embodiment of the present invention will now be described by way of example with reference to the accompanying drawings, in which:

- Figures 1 and 2 show 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 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;
- 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; whereas
- Figures 5 and 6 are two enlarged views of the Figure 3 lower supporting base or socle of the laundry-dryer, with parts removed for clarity.

[0040] 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,

ily, 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.

[0041] Inside the outer 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.

[0042] More specifically, with reference to Figures 1 and 2, the outer boxlike casing 2 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.

[0043] 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.

[0044] In the example shown, in particular, 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.

[0045] 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.

[0046] In addition to the above, the lower supporting base or socle 9 is also preferably structured so to directly support the electric motor 5.

[0047] With reference to Figures 1, 2 and 4, the closed-circuit, hot-air generator 6 instead preferably comprises of 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.

[0048] In other words, with reference to Figure 4, 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, the two ends of which are 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 heated rapidly to a temperature higher than or equal to that of the airflow *f* coming out of the drum.

[0049] More specifically, with reference to Figure 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.

[0050] 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.

[0051] 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.

[0052] With reference to Figures 3 and 4, the lower supporting base or socle 9 of outer casing 2 is formed by a lower half-hulk or half-shell 9a which is structured for resting on the floor; and by an upper half-hulk or half-shell 9b which is structured for being stacked up on top of, and rigidly coupled to, the lower half-hulk 9a, so to preferably directly support the parallelepiped-shaped upper boxlike cabinet 10 and preferably also the front and rear idle rollers 11 that support in free revolving manner the revolving drum 3.

[0053] In addition to the above, the lower half-hulk 9a and the upper half-hulk 9b are structured so as to form, when coupled to one another, a substantially horizontally-oriented central section of the air recirculating conduit 12 that is shaped so as to house both the evaporator 15 and the condenser 16 of the heat-pump assembly 14 one after the other along the flowing direction of the airflow *f*.

[0054] In other words, the lower half-hulk 9a and upper half-hulk 9b are shaped so as to form the two halves of the substantially horizontally-oriented central section of the air recirculating conduit 12, and are structured so to be substantially airtight coupled one another to compose/form the aforesaid central section of the air recirculating conduit 12 that houses the evaporator 15 and the condenser 16 of the heat-pump assembly 14.

[0055] In the example shown, both the lower half-hulk 9a and the upper half-hulk 9b are preferably, though not necessarily, realized in plastic material by means of an injection molding process.

[0056] With reference to Figures 4 and 5, the electric

refrigerant compressing device 17 and the refrigerant expansion device are preferably fixed/recessed directly onto the lower half-hulk 9a of the supporting base or socle 9, beside the aforesaid central section of the air recirculating conduit 12, preferably together with the electric motor 5; whereas the centrifugal fan 13 of hot-air generator 6 is located on the back of the lower supporting base or socle 9 formed by the two half-hulks 9a and 9b, at the end-opening or outlet of the central section of the air recirculating conduit 12.

[0057] In particular, the centrifugal fan 13 of hot-air generator 6 protrudes/juts out of the lower supporting base or socle 9 and is preferably, though not necessarily, arranged on the back of the lower supporting base or socle 9 so to be locally aligned to electric motor 5.

[0058] Additionally, with reference to Figures 3-6, in the example shown the lower half-hulk 9a and the upper half-hulk 9b are preferably, though not necessarily, structured so that the central section of the air recirculating conduit 12 is substantially L-shaped, and is oriented so that a first portion of the central section of the air recirculating conduit 12 extends below the revolving drum 3 remaining locally substantially parallel to the longitudinal axis L of revolving drum 3, and that a second transversal portion of the central section of the air recirculating conduit 12 extends below the revolving drum 3 remaining locally substantially perpendicular to the longitudinal axis L of drum 3.

[0059] The evaporator 15 and the condenser 16 of the heat-pump assembly 14 are located, one downstream the other, inside the first portion of the aforesaid central section of the air recirculating conduit 12; whereas the refrigerant compressing device 17 and electric motor 5 are aligned one after the other in a direction locally parallel to the longitudinal axis L of revolving drum 3, beside the first portion of the central section of the air recirculating conduit 12.

[0060] The centrifugal fan 13 is instead located on the back of the lower supporting base or socle 9, at the end-opening or outlet of the second portion of the central section of the air recirculating conduit 12, preferably locally aligned to the drive shaft 5a of electric motor 5.

[0061] In particular, with reference to Figures 3-6, the centrifugal fan 13 of hot-air generator 6 comprises an outer housing or impeller housing 18 which is located on the back of the lower supporting base or socle 9, at the end-opening of the central section of the air recirculating conduit 12, so to directly communicate with, i.e. to be fluidly connected to, the end-opening of the aforesaid central section of the air recirculating conduit 12, and also with the inside of revolving drum 3; and an impeller 19 which is housed in axially rotating manner inside the outer housing 18 to generate the airflow f when rotating about its reference axis.

[0062] In the example shown, in particular, the impeller 19 is preferably, though not necessarily, rigidly fitted to one of the two axial ends of the drive shaft 5a of electric motor 5 so to be directly driven into rotation by the latter.

[0063] In addition to the above, with reference to Figures 3, 5 and 6, the outer housing 18 of centrifugal fan 13 comprises a first portion 18a realized in one piece with the lower half-hulk 9a, and a second portion 18b realized in one piece with the upper half-hulk 9b, and these first and second portions 18a and 19b are shaped/structured for being substantially airtight coupled to one another so as to form a substantially circular, basin-shaped casing that at least partly surrounds and covers/encompasses the impeller vanes 19a. In addition to the above, the outer housing 18 further comprises a completely separated, rigid cap-shaped cover 18c which is shaped/structured for being substantially airtight coupled to the first and second portions 18a and 19b to completely cover and seal the substantially circular, basin-shaped casing formed by the aforesaid first and second portions 18a and 19b.

[0064] In other words, the outer housing 18 of centrifugal fan 13 is spitted into three distinct and separated shells 18a, 18b and 18c which are structured for being substantially airtight coupled to one another to form the volute of the outer housing 18.

[0065] The first shell 18a and the second shell 18b are realized in one piece, respectively, with the lower half-hulk 9a and with the upper half-hulk 9b, so to be integral with the lower supporting base or socle 9, and are shaped to form a first approximately half-volute of the outer housing 18. The third shell 18c instead consists in a completely separated cap-shaped, rigid cover 18c that forms the remaining, complementary second half-volute of the outer housing 18 of centrifugal fan 13, and which is structured for being substantially airtight coupled to the first half-volute formed by the shells 18a and 18b to complete the outer housing 18 of the centrifugal fan 13.

[0066] In the example shown, in particular, the first shell or portion 18a preferably protrudes from the lower half-hulk 9a, whereas the second shell or portion 18b preferably protrudes from the upper half-hulk 9b.

[0067] In addition to the above, with reference to Figures 5 and 6, in the example shown the nominal high h_a of the first shell or portion 18a is preferably greater than the nominal high h_b of the second shell or portion 18b. In other words, the first shell or portion 18a of outer housing 18 sticks out of the lower half-hulk 9a more than the second shell or portion 18b of outer housing 18 sticks out of the upper half-hulk 9b.

[0068] Furthermore, the nominal high h_a of the first shell or portion 18a is preferably greater than 50% of the nominal high of the impeller vanes 19a.

[0069] Obviously in a different embodiment also the nominal high h_b of the second shell or portion 18b could be preferably greater than 50% of the nominal high of the impeller vanes 19a.

[0070] With reference to Figure 3, the centrifugal fan 13 is preferably, though not necessarily, additionally provided with a substantially funnel-shaped, air intake manifold 20 which is located at the end-opening of the central section of the air recirculating conduit 12, and extends

inside the outer housing 18 of centrifugal fan 13 towards the impeller 19 while remaining substantially coaxial with the rotation axis of impeller 19.

[0071] In the example shown in particular, the intake manifold 20 consists in a substantially frustoconical sleeve 20 which is provided with an outwards projecting peripheral flange 20a all-around the larger mouth. This peripheral flange 20a is structured to fit into two corresponding coplanar semicircular grooves realized one in the lower half-hulk 9a and the other in the upper half-hulk 9b, so to trap and firmly fix the sleeve 20 between the lower half-hulk 9a and the upper half-hulk 9b when said half-hulks 9a and 9b are coupled to one another to form the lower supporting base or socle 9 and the central section of the air recirculating conduit 12.

[0072] General operation of the rotary-drum home laundry drier 1 is clearly inferable from the above description, with no further explanation required.

[0073] The advantages connected to the particular structure of the centrifugal fan 13 are large in number.

[0074] First of all, the partial integration of the outer housing or volute 18 of the centrifugal fan 13 into the two-pieces lower supporting base or socle 9 allows to significantly reduce the number of component parts while improving the coupling between said component parts.

[0075] The fact that the whole central section of the air recirculating conduit 12 is formed when the lower half-hulk 9a and the upper half-hulk 9b are firmly coupled one another greatly simplifies the assembly of the laundry-dryer, with all advantages concerned.

[0076] 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.

[0077] 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.

[0078] In particular, 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, and instead comprises: an air/air heat exchanger which is located along the central section 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.

[0079] The air/air heat exchanger is structured for being 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.

Claims

1. Rotary-drum laundry dryer (1) comprising a revolving drum (3) structured for housing the laundry to be dried, a hot-air generator (6) structured to circulate a stream of hot air through said revolving drum (3), 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) in turn comprising: an air recirculating conduit (12) having its two ends connected to the revolving drum (3); air circulating means (13) which are located along the air recirculating conduit (12) and are structured to produce, inside the air recirculating conduit (12), an airflow (f) which flows through the revolving drum (3) and over the laundry inside the drum (3); and at least one heat exchanger (15) located along the air recirculating conduit (12) and structured to cool the moist air arriving from the rotatable drum (3) so to cause the condensation of the surplus moisture inside the airflow (f);
the lower supporting base or socle (9) comprising a lower half-shell (9a) structured for resting on the floor, and an upper half-shell (9b) stacked up on top of, and rigidly coupled to said lower half-shell (9a); said lower half-shell (9a) and upper half-shell (9b) being shaped so as to form, when coupled to one another, a section of the air recirculating conduit (12) which houses at least the heat exchanger (15) of said hot-air generator (6);
the air circulating means (13) of the hot-air generator (6) comprising an impeller housing (18) which communicates with said section of the air recirculating conduit (12), and an impeller (19) which is housed in axially rotating manner inside the impeller housing (18) to generate the airflow (f);
the laundry dryer (1) **being characterized in that** the impeller housing (18) of the air circulating means (13) comprises a first portion (18a) realized in one piece with the lower half-shell (9a), and a second portion (18b) realized in one piece with the upper half-shell (9b); and **in that** said first portion (18a) and said second portion (18b) are structured for being coupled to one another so as to form a substantially circular casing (18a, 18b) that at least partly covers the impeller vanes (19a).
2. Rotary-drum laundry dryer according to Claim 1, **characterized in that** the impeller housing (18) further comprises a completely separated cover (18c) which is shaped/structured for being coupled to said first (18a) and second portions (19b) to cover the casing formed by said first and second portions (18a, 19b).
3. Rotary-drum laundry dryer according to Claim 1 or 2, **characterized in that** said first (18a) and second

portions (18b) are shaped so as to form, when coupled to one another, a first approximately half-volute of the impeller housing (18).

4. Rotary-drum laundry dryer according to Claim 3, **characterized in that** said completely separated cover (18c) forms the remaining and complementary second half-volute of the impeller housing (18) of the air circulating means (13), and is structured for being coupled to the first half-volute formed by the first (18a) and second portion (18b) to complete the volute of the impeller housing (18).
5. Rotary-drum laundry dryer according to any one of the foregoing claims, **characterized in that** the impeller housing (18) is located on the back of lower supporting base or socle (9), at an end-opening of said section of the air recirculating conduit (12).
6. Rotary-drum laundry dryer according to any one of the foregoing claims, **characterized in that** the first portion (18a) of the impeller housing (18) protrudes from the lower half-shell (9a), and that the second portion (18b) of the impeller housing (18) protrudes from the upper half-shell (9b).
7. Rotary-drum laundry dryer according to Claim 6, **characterized in that** the first portion (18a) of the impeller housing (18) sticks out of the lower half-shell (9a) more than the second portion (18b) of the impeller housing (18) sticks out of the upper half-shell (9b).
8. Rotary-drum laundry dryer according to any one of the foregoing claims, **characterized in that** the first (18a) and/or the second portion (18b) of the impeller housing (18) is dimensioned to cover more than 50% of the nominal high of the impeller vanes (19a).
9. Rotary-drum laundry dryer according to any one of the foregoing claims, **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); and in that the impeller (19) of said air circulating means (13) is mechanically connected to said electric motor assembly (5) so to be driven into rotation by the latter.
10. Rotary-drum laundry dryer according to Claim 9, **characterized in that** the lower half-shell (9a) and the upper half-shell (9b) are structured so that said section of the air recirculating conduit (12) is substantially L-shaped; a first portion of the central section of the air recirculating conduit (12) being locally substantially parallel to the longitudinal axis (L) of the revolving drum (3); and **in that** the air circulating means (13) are located at the end of the second

transversal portion of said section of the air recirculating conduit (12), with the impeller (19) locally aligned to the electric motor assembly (5).

11. Rotary-drum laundry dryer according to any one of the foregoing claims, **characterized in that** the air circulating means (13) also comprise a substantially funnel-shaped, intake manifold (20) which is located at the end-opening of said section of the air recirculating conduit (12), and extends within the impeller housing (18) towards the impeller (19).
12. Rotary-drum laundry dryer according to Claims 11, **characterized in that** said intake manifold (20) consists in a substantially frustoconical sleeve (20) which is provided with an outwards projecting peripheral flange (20a) all-around the larger mouth, and **in that** said peripheral flange (20a) is structured to fit into two corresponding coplanar semicircular grooves realized one in the lower half-shell (9a), and the other in the upper half-shell (9b).
13. 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).
14. Rotary-drum laundry dryer according to Claim 13, **characterized in that** the longitudinal axis (L) of the revolving drum (3) is substantially horizontally-oriented, and **in that** the revolving drum (3) rests on a number of supporting rollers (11) which are arranged substantially at the two axial ends of the revolving drum (3), and are fixed in free revolving manner directly to the top of the upper half-shell (9b).
15. Rotary-drum laundry dryer according to any one of the foregoing claims, **characterized in that** the hot-air generator (6) is a heat-pump type, hot-air generator (6) which comprises: a first air/refrigerant heat exchanger (15) which is located inside the central section of the air recirculating conduit (12), and is structured for rapidly cooling down the airflow (f) arriving from the revolving drum (3) to condense and restrain the surplus moisture in the airflow (f); a second air/refrigerant heat exchanger (16) which is located inside the central section of the air recirculating conduit (12), downstream of the first air/refrigerant heat exchanger (15), and which is structured for rapidly heating the airflow (f) arriving from the first air/refrigerant heat exchanger (15) and directed back to the revolving drum (3); a refrigerant compressing device (17) which is interposed between the refrigerant-outlet of the first air/ refrigerant heat exchanger (15) and the refrigerant-inlet of the second air/refrigerant heat exchanger (16), and which is structured for

compressing the gaseous-state refrigerant directed towards the second air/refrigerant heat exchanger (16); and a refrigerant expansion device which is interposed between the refrigerant-outlet of the second air/refrigerant heat exchanger (16) and the refrigerant-inlet of the first air/refrigerant 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).

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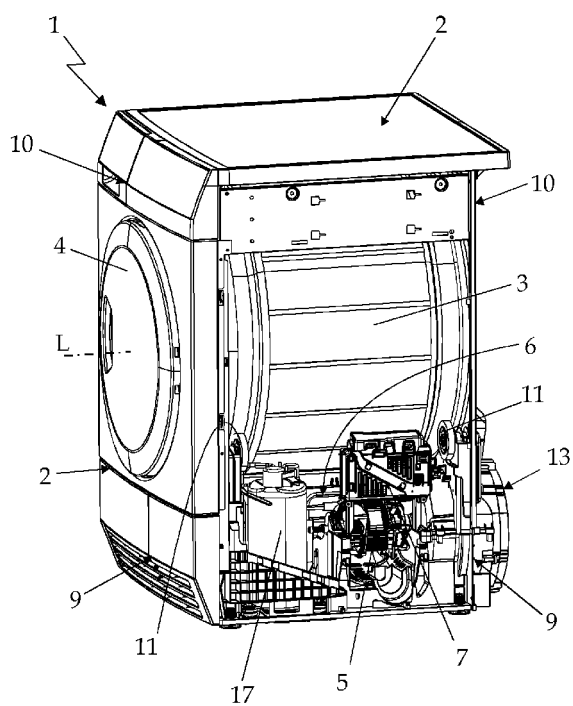


Fig. 1

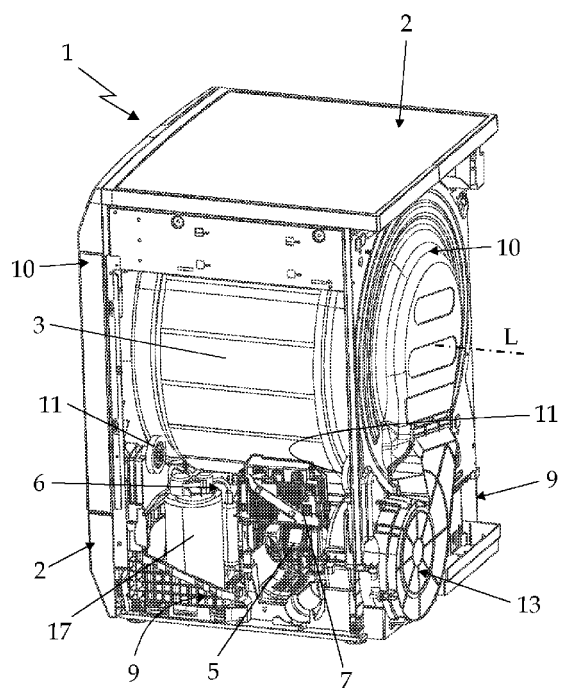


Fig. 2

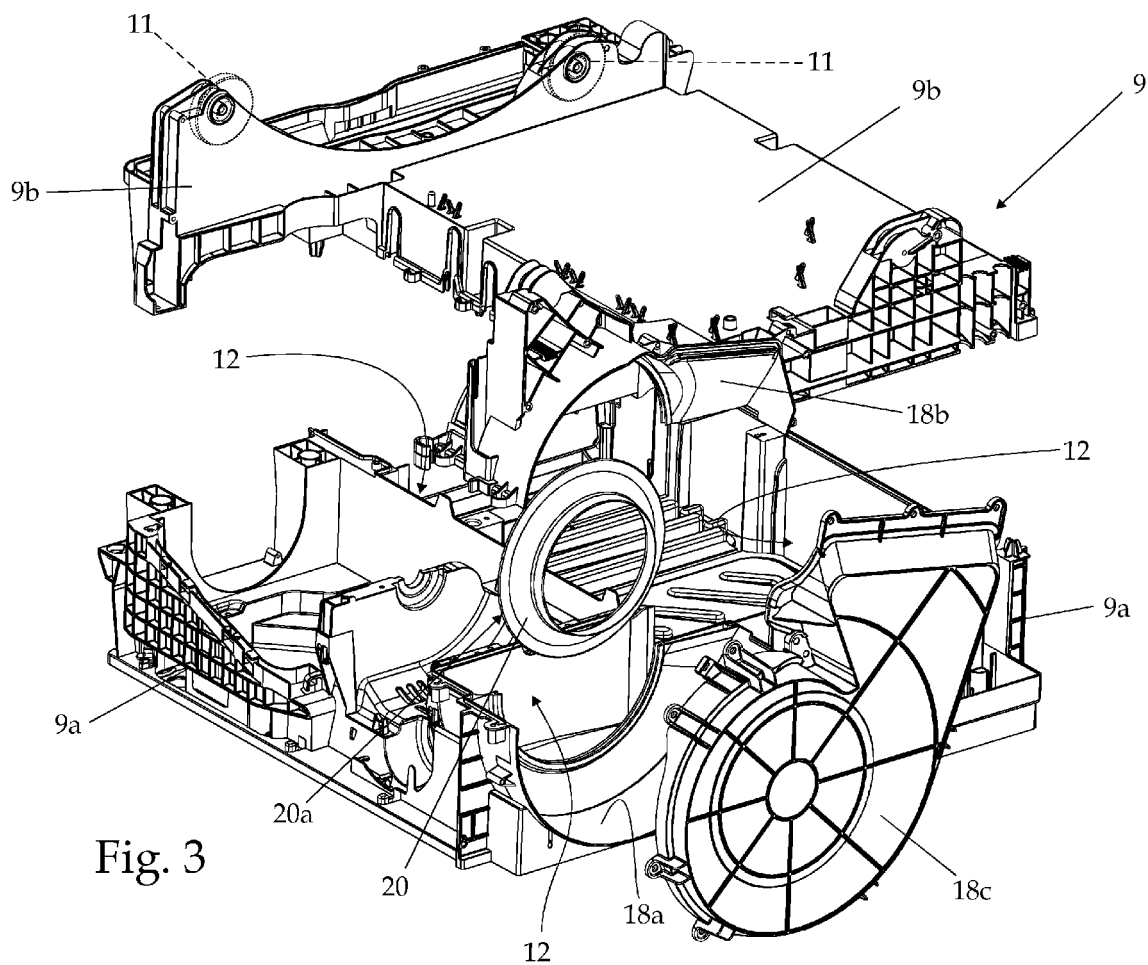
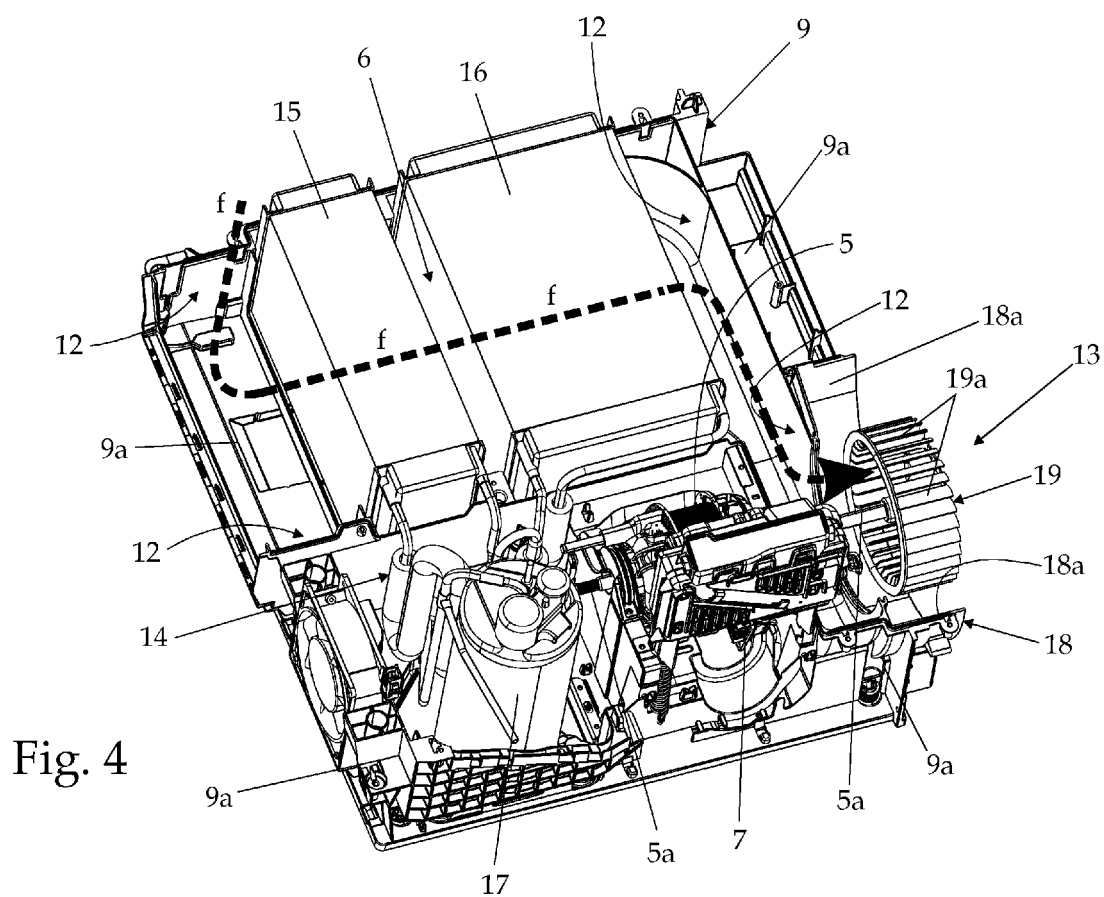
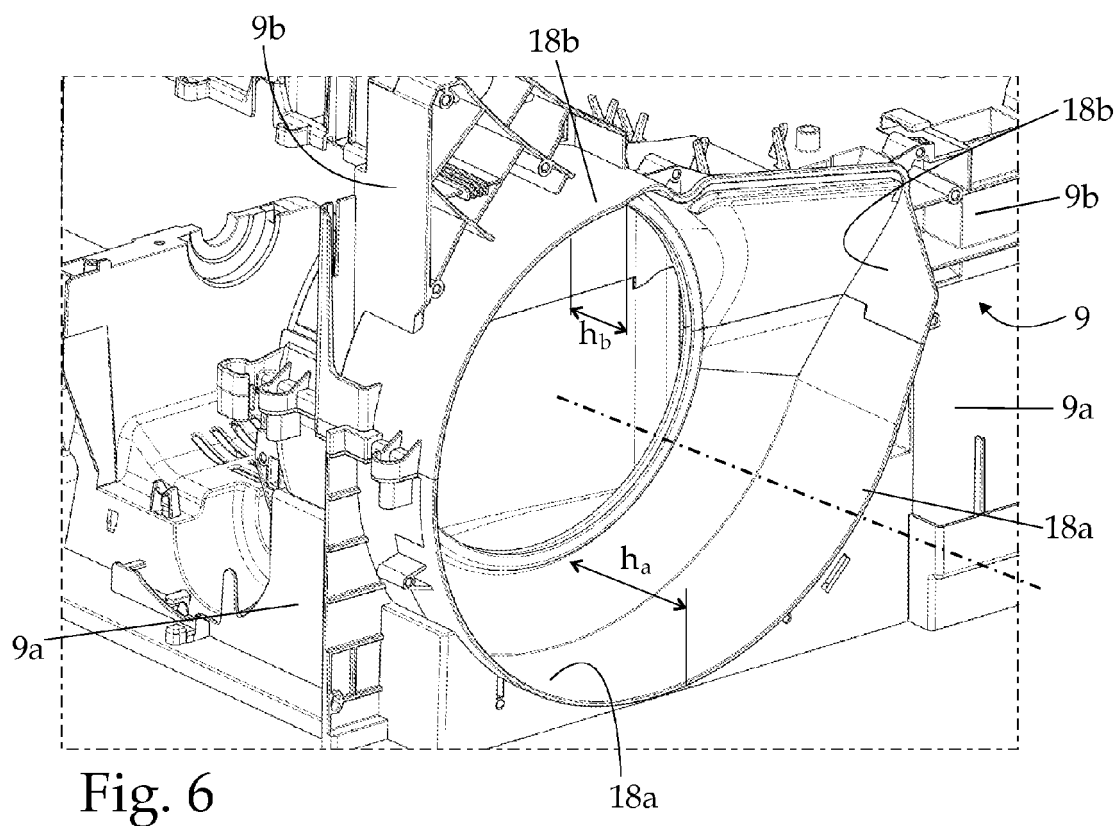
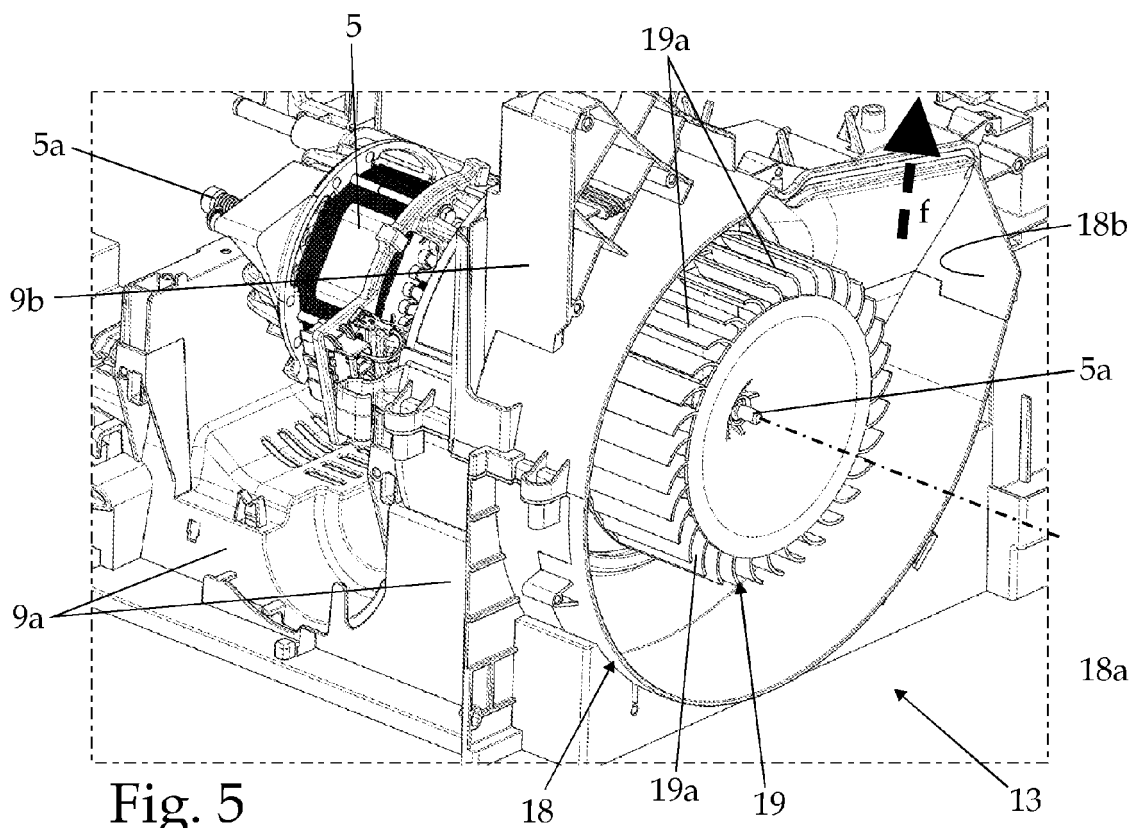


Fig. 3







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Application Number
EP 11 16 7964

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			D06F
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 10 October 2011	Examiner Hannam, Martin
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