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

(57) The present invention relates to a rotary-drum laundry dryer. A rotary-drum laundry dryer according to the invention comprises a revolving drum (3) adapted to receive laundry to be dried, a hot-air generator (6) structured to circulate an airflow (f) through said revolving drum (3), 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), and an upper cabinet (10) associated to the lower supporting base or socle (9) and structured so as to house the revolving drum (3), said upper cabinet (10) having a back wall (25) comprising an aperture (26). The hot-air generator (6) comprises an air recirculating conduit (12) allowing said 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). The air recirculating conduit (12) comprises an intermediate portion (12b) extending across the lower supporting base or socle (9), and a back cover (24) fitted to the back wall (25) of the upper cabinet (10) and/or to the lower supporting base or socle (9) to close said aperture (26) so as to define at least part of said air recirculating conduit (12). The laundry dryer is characterized in that the back cover (24) comprises a first air passage (31) connected in fluid-tight manner to the lower supporting base or socle (9) and a second air passage (32) connected in fluid-tight manner to said aperture (26) of the back wall.

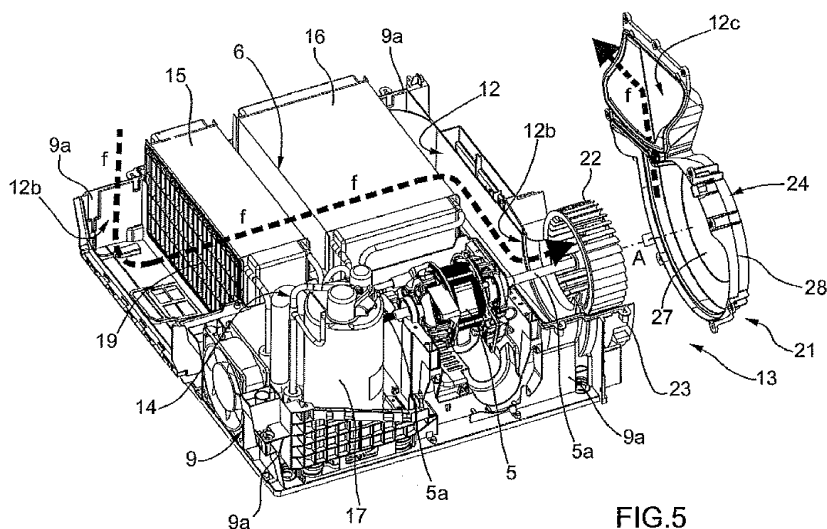


FIG.5

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. The following description and the attached drawings refer to a heat pump type laundry drying machine, but, as it will be apparent from the following specification, the present invention may be embodied in a laundry drying machine wherein the drying air is heated by an electric resistance and dehumidified by an air-to-air heat exchanger.

[0003] As is known, today's rotary-drum home laundry dryers comprise a lower supporting base or socle shaped for resting on the floor; an upper cabinet, which is associated to the lower supporting base or socle, and has a back wall extending substantially over the whole height of the lower supporting base or socle; a substantially cylindrical revolving drum for the laundry to be dried which is housed in axially rotating manner inside the upper cabinet to rotate about its horizontally-oriented longitudinal axis, directly facing a laundry loading/unloading opening formed in the front wall of the upper cabinet; a porthole door hinged to the front wall of the upper cabinet to rotate to and from a closing position in which the door rests completely against the front wall of the upper cabinet to close the laundry loading/ unloading opening and airtight seal the revolving drum; and an electric motor assembly for driving into rotation the revolving drum about its longitudinal axis.

[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 comprising an air recirculating conduit having its two ends fluidly connected to the revolving drum, on opposite sides of the latter; an electric centrifugal fan located along a portion of the air recirculating conduit to produce, inside the latter, an air-flow which flows through the revolving drum for drying laundry; and a heat-pump assembly provided with two heat exchangers located one after the other along the air recirculating conduit.

The portion of the air recirculating conduit housing the electric centrifugal fan is at least partially delimited by the back wall of the upper cabinet and by a back cover removably fitted to the back wall to allow easy access to the electric centrifugal fan. To avoid any air leakage out-

side the laundry dryer, the back wall of the upper cabinet is connected in fluid-tight manner to the lower supporting base or socle by means of a first sealing member while the back cover is connected in fluid-tight manner to the back wall of the upper cabinet by means of a second sealing member extending along the whole peripheral edge of the back cover and, thus, rather complicated and expensive.

[0006] It is an object of the present invention to simplify the structure of today's laundry dryers and the assembly of the laundry dryer.

According to the present invention there is provided a rotary-drum laundry dryer as claimed in the attached claims.

[0007] 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 partly-exploded isometric view of the rear side of the Figure 1 laundry-dryer;
- Figure 3 is a sectioned side view of the lower front portion of the Figure 1 laundry-dryer, with parts removed for clarity;
- Figure 4 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 5 shows in isometric view the inside of the Figure 4 lower supporting base or socle of the laundry-dryer, with parts removed for clarity;
- Figure 6 shows in isometric view a detail of Figures 2 and 5; and
- Figure 7 is a sectioned isometric view of the lower back portion of the Figure 1 laundry-dryer, with parts removed for clarity.

[0008] With reference to Figure 1, 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.

[0009] 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.

[0010] 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 boxlike upper cabinet 10 which is associated to the top of the lower supporting base or socle 9 and it is structured so as to house the revolving drum 3.

[0011] In the example shown, in particular, the revolving drum 3 preferably extends inside the upper 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 upper cabinet 10.

[0012] With reference to Figures 1 and 4, 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.

[0013] The laundry loading/unloading opening of casing 2 is therefore realized in the front wall of the upper cabinet 10, and the porthole door 4 is hinged to the front wall of the upper cabinet 10.

[0014] In addition to the above, the lower supporting base or socle 9 is also preferably structured so to directly support the electric motor 5.

[0015] The closed-circuit, hot-air generator 6 preferably is 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.

[0016] In other words, with reference to Figures 3, 4 and 5, the hot-air generator 6 provides for continually dehumidifying and heating the air circulating inside re-

volving 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/ fluidly 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 fed into revolving drum 3 is rapidly heated to a temperature higher than or equal to that of the airflow f coming out of the revolving drum 3.

[0017] With reference to Figures 1, 3 and 5, 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 fed 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.

[0018] 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.

[0019] 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.

[0020] With reference to Figure 3, in the example shown, the air recirculating conduit 12 comprises a first portion 12a for feeding the airflow *f* from the revolving drum 3 to the heat-pump assembly 14.

The first portion 12a is defined in the front wall of the upper cabinet 10 when the porthole door 4 is arranged in the closing position so as to substantially airtight seal the laundry loading/unloading opening, and is in direct communication with the inside of revolving drum 3.

The air recirculating conduit 12 further comprises an intermediate second portion 12b, which 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 second portion 12b of the air recirculating conduit 12 preferably extends inside the lower supporting base or socle 9 substantially horizontally.

[0021] With reference to Figures 3 and 5, 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 also unremovably fixed inside the second portion 12b 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 prevent a generic hard foreign body from bumping against the evaporator 15.

[0022] 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

the air recirculating conduit 12.

With reference to Figures 3, 4 and 5, 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 cabinet 10 and preferably also the front and rear idle rollers 11 that support in free revolving manner the revolving drum 3.

The lower half-shell 9a and the upper half-shell 9b are furthermore preferably shaped for being substantially airtight coupled to one another, so as to form, when coupled to one another, the substantially horizontally-oriented, whole second portion 12b of the air recirculating conduit 12 which houses, one downstream the other along the flowing direction of the airflow *f*, in unremovable manner the protective grid-like assembly 19 and both the evaporator 15 and the condenser 16 of the heat-pump assembly 14.

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

[0023] In addition to the above, with reference to Figures 4 and 5, in the example shown the lower half-shell 9a and upper half-shell 9b are also preferably, though not necessarily, structured so that the second portion 12b of the air recirculating conduit 12 is substantially L-shaped, and is oriented so that a first segment of the second portion 12b extends below the revolving drum 3 while remaining locally substantially parallel to the longitudinal axis *L* of revolving drum 3, and that a second segment of the second portion 12b extends below the revolving drum 3 remaining locally substantially perpendicular to the longitudinal axis *L* of revolving drum 3.

As shown in Figures 2, 5, and 7, the air recirculating conduit 12 further comprises a third portion 12c which communicates with the second portion 12b and feeds the airflow *f* back into the revolving drum 3.

The third portion 12c comprises a housing 21 which is located on the back of the lower supporting base or socle 9, at the end-opening of the second portion 12b of the air recirculating conduit 12, so to directly communicate, i.e. be flowingly/fluidly connected to, both the second portion 12b of the air recirculating conduit 12 and the inside of revolving drum 3.

An impeller 22 of the centrifugal fan 13 is housed in axially rotating manner inside the housing 21 to generate the airflow *f* when rotating about its reference axis *A*.

[0024] In the example shown, 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 second portion 12b of the air recirculating

conduit 12; the impeller 22 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; and the impeller housing 21 is locally substantially coaxial to the drive shaft 5a of electric motor 5.

[0025] Furthermore, with reference to Figures 2, 4, and 5, in the example shown the impeller housing 21 preferably comprises a substantially cylindrical sleeve 23 incorporated as a unitary piece in the lower supporting base or socle 9, at the end-opening of the second portion 12b of the air recirculating conduit 12, and a back cover 24 which is structured/shaped for being releasably coupled to the lower supporting base or socle 9 and to a back wall 25 of the upper cabinet 10, for example by means of screws passing through eyelets 36 provided on a peripheral portion of the back cover 24.

[0026] Accordingly, once fitted to the lower supporting base or socle 9 and to the back wall 25, the back cover 24 defines at least part of the third portion 12c of the air recirculating conduit 12 and closes both an aperture 26 made through the back wall 25 for feeding the airflow f back to the revolving drum 3 and the cylindrical sleeve 23 for covering up the impeller 22 that is preferably at least partly recessed inside the cylindrical sleeve 23. A further portion of the impeller housing 21 is preferably defined by the back cover 24.

According to a first variant not shown, the back cover 24 may be screwed to the lower supporting base or socle 9 only and may be coupled by interference to the back wall 25 of the upper cabinet 10. According to a further variant not shown, the back cover 24 may be screwed to the back wall 25 of the upper cabinet 10 only and may be coupled by interference to the lower supporting base or socle 9. In both cases a lower number of eyelets 36 is needed compared to the embodiment shown in Figure 6.

[0027] The cylindrical sleeve 23 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 cylindrical sleeve 23 is formed when the two half-shells 9a and 9b are coupled to one another.

[0028] With reference to Figures 5 and 6, back cover 24 is a cup-shaped, rigid cover comprising a bottom wall 27, a side wall 28 protruding from the bottom wall 27, and a bracket 29 extending across the side wall 28. The bracket 29 defines, together with a peripheral edge 30 of the back cover 24, a first air passage 31 and a second air passage 32. Each air passage 31, 32 comprises a first portion extending along the side wall 28 and a second portion extending along the bracket 29, thereby defining fluid apertures having a configuration extending on different geometrical planes. Once the back cover 24 is fitted to the lower supporting base or socle 9 and to the back wall 25, the air passage 31 is coupled in fluid-tight manner to the cylindrical sleeve 23 by means of a first loop-like gasket 33, i.e. a gasket extending along a curved line bended round itself and having coincident ends, and the air passage 32 is coupled in fluid-tight man-

ner to the region of the back wall 25 surrounding the aperture 26 by means of a second loop-like gasket 34.

[0029] Thus, as shown in Figure 5, the airflow f coming from the second portion 12b enters the back cover 24 through the air passage 31, flows behind the bracket 29, leaves the back cover 24 through the air passage 32, and enters the upper cabinet 10 through the aperture 26 without any air leakage outside the laundry dryer 1. Preferably, the gaskets 33 and 34 are over-injected on the peripheral edges of the air passages 31 and 32 respectively.

[0030] With reference to Figures 2 and 7, it is worth to be noted that the back wall 25 is coupled to the lower supporting base or socle 9 along a bottom connecting edge 35 extending between the gaskets 33 and 34, and preferably extending completely outside of the air recirculating conduit 12.

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

[0031] Clearly, changes may be made to the rotary-drum laundry dryer 1 as described herein without, however, departing from the scope of the present invention.

Claims

1. Rotary-drum laundry dryer comprising a revolving drum (3) adapted to receive laundry to be dried, a hot-air generator (6) structured to circulate an airflow (f) through said revolving drum (3), 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), and an upper cabinet (10) associated to the lower supporting base or socle (9) and structured so as to house the revolving drum (3), said upper cabinet (10) having a back wall (25) comprising an aperture (26);
the hot-air generator (6) comprising an air recirculating conduit (12) allowing said 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);
the air recirculating conduit (12) comprising an intermediate portion (12b) extending across the lower supporting base or socle (9), and a back cover (24) fitted to the back wall (25) of the upper cabinet (10) and/or to the lower supporting base or socle (9) to close said aperture (26) so as to define at least part of said air recirculating conduit (12);
the laundry dryer being **characterized in that** the back cover (24) comprises a first air passage (31) connected in fluid-tight manner to the lower supporting base or socle (9) and a second air passage (32) connected in fluid-tight manner to said aperture (26) of the back wall (25).

2. Rotary-drum laundry dryer according to Claim 1 and further comprising a first sealing member (33) and a second sealing member (34) for connecting in fluid-tight manner the back cover (24) to the lower supporting base or socle (9) and the back wall (25) respectively. 5
3. Rotary-drum laundry dryer according to Claim 2, wherein the back wall (25) of the upper cabinet (10) is connected to the lower supporting base or socle (9) along a connecting edge (35) that extends between said first and second sealing members (33,34). 10
4. Rotary-drum laundry dryer according to Claim 3, wherein the connecting edge (35) extends completely outside of the air recirculating conduit (12). 15
5. Rotary-drum laundry dryer according to any of the Claims from 2 to 4, wherein said first and second sealing members (33, 34) are over-injected in the back cover (24). 20
6. Rotary-drum laundry dryer according to any of the preceding Claims, wherein the back cover (24) is substantially cup-shaped and comprises a bottom wall (27), a side wall (28), and a connecting bracket (29) extending across the side wall (28) so as to delimit said first and second air passages (31, 32). 25
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7. Rotary-drum laundry dryer according to any of the preceding Claims, wherein the back wall (25) of the upper cabinet (10) is connected to the top of the lower supporting base or socle (9). 35
8. Rotary-drum laundry dryer according to any of the preceding Claims, wherein the back cover (24) is removably fitted to the back wall (25) of the upper cabinet (10) and to the lower supporting base or socle (9). 40
9. Rotary-drum laundry dryer according to any of the preceding Claims, wherein the air recirculating conduit (12) comprises an impeller housing (21) communicating with said intermediate portion (12b) and housing an impeller (22) for generating the airflow (f); said impeller housing (21) comprising a substantially cylindrical sleeve (23) made integral and in one piece with the lower supporting base or socle (9). 45
50
10. Rotary-drum laundry dryer according to Claim 9, wherein the back cover (24) is removably fitted to the back wall (25) of the upper cabinet (10) and to the lower supporting base or socle (9) to define at least part of the impeller housing (21) and to close said cylindrical sleeve (23) and said aperture (26) so as to define at least part of a feeding portion (12c) of the air recirculating conduit (12) feeding the airflow (f) back into the revolving drum (3). 55
11. Rotary-drum laundry dryer according to Claim 9 or 10, wherein the lower supporting base or socle (9) comprises a lower shell (9a) and an upper shell (9b) which are structured/shaped for being coupled to one another to form the intermediate portion (12b) of the air recirculating conduit (12) and the cylindrical sleeve (23) of the impeller housing (21).

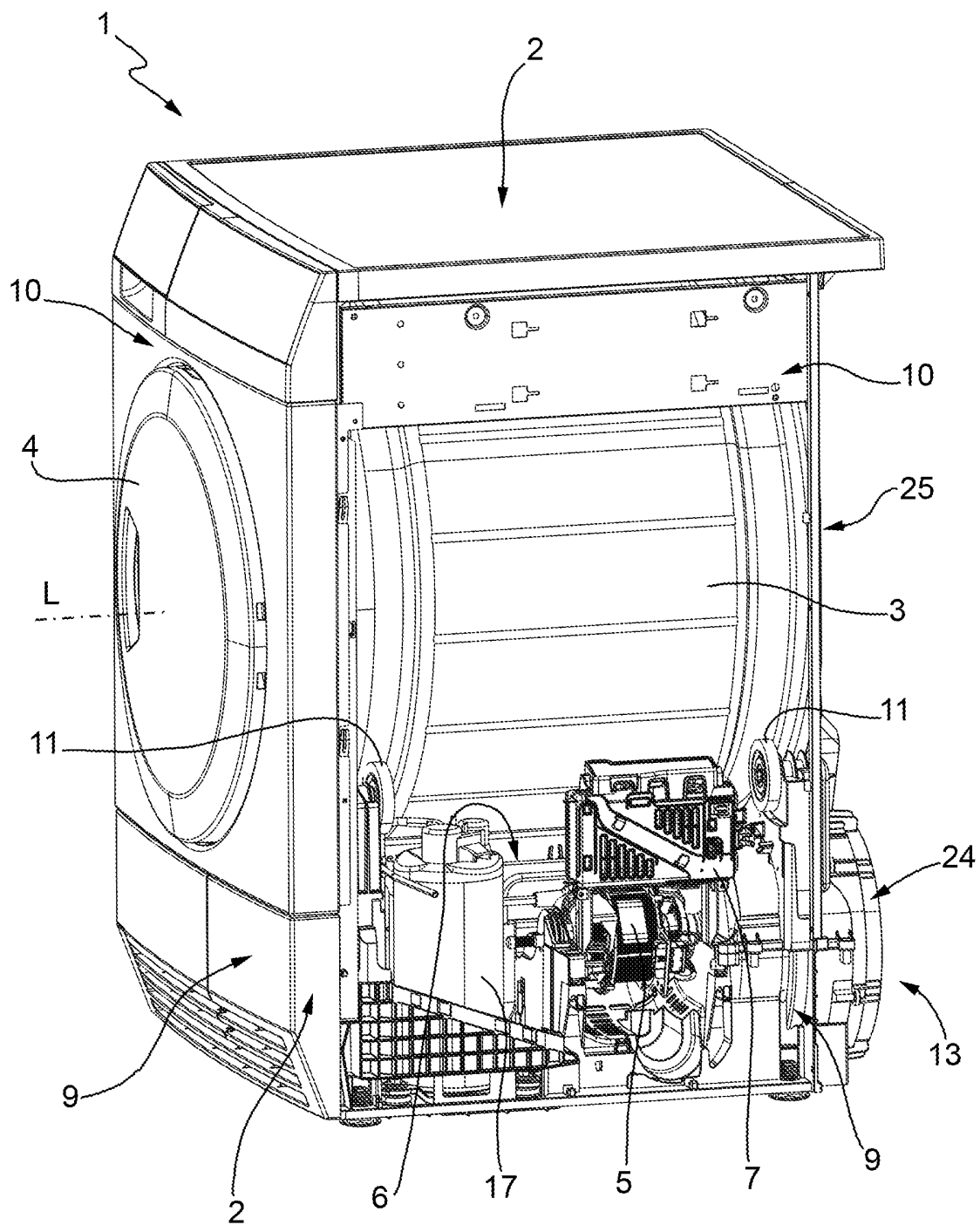


FIG.1

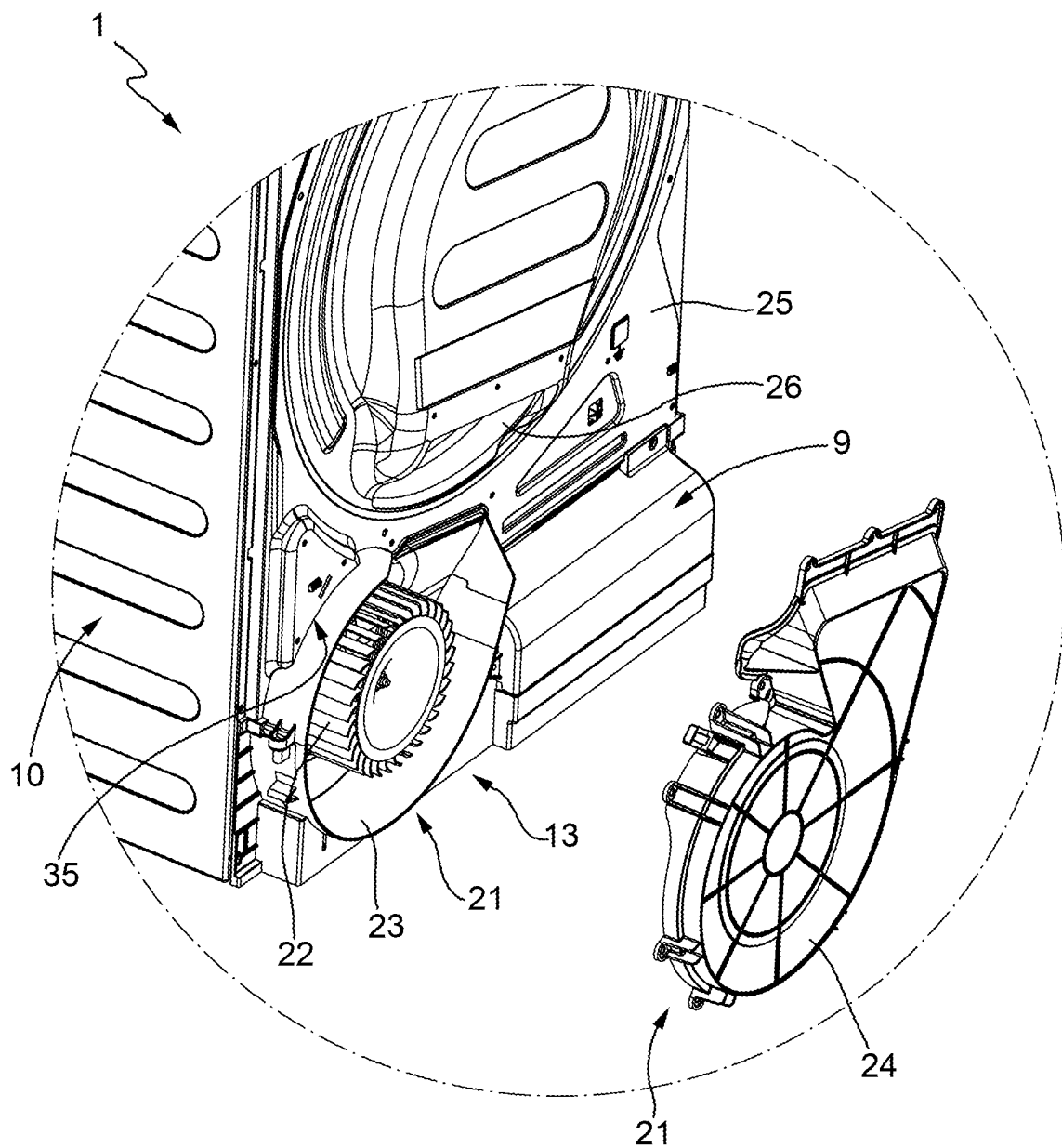
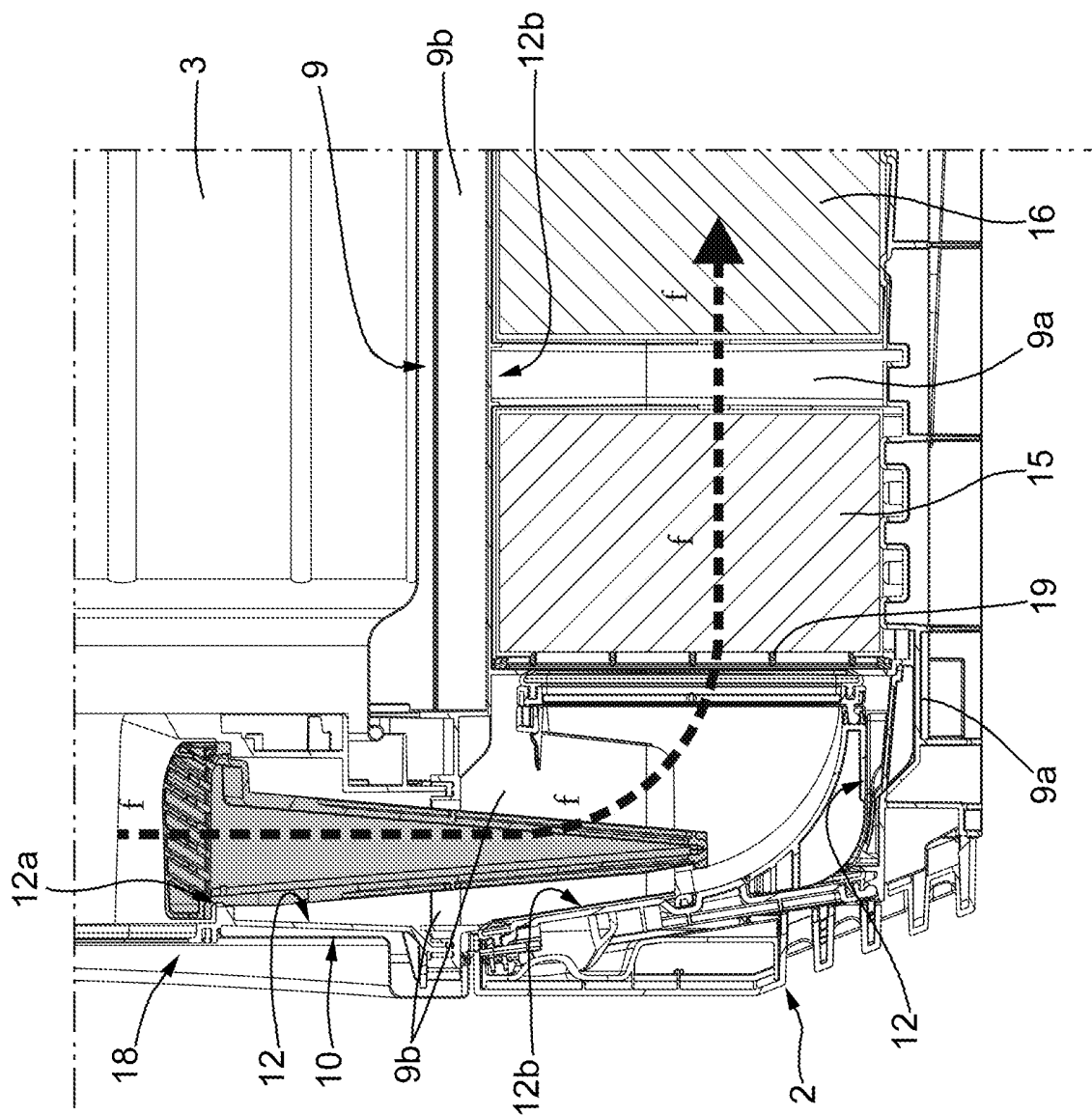
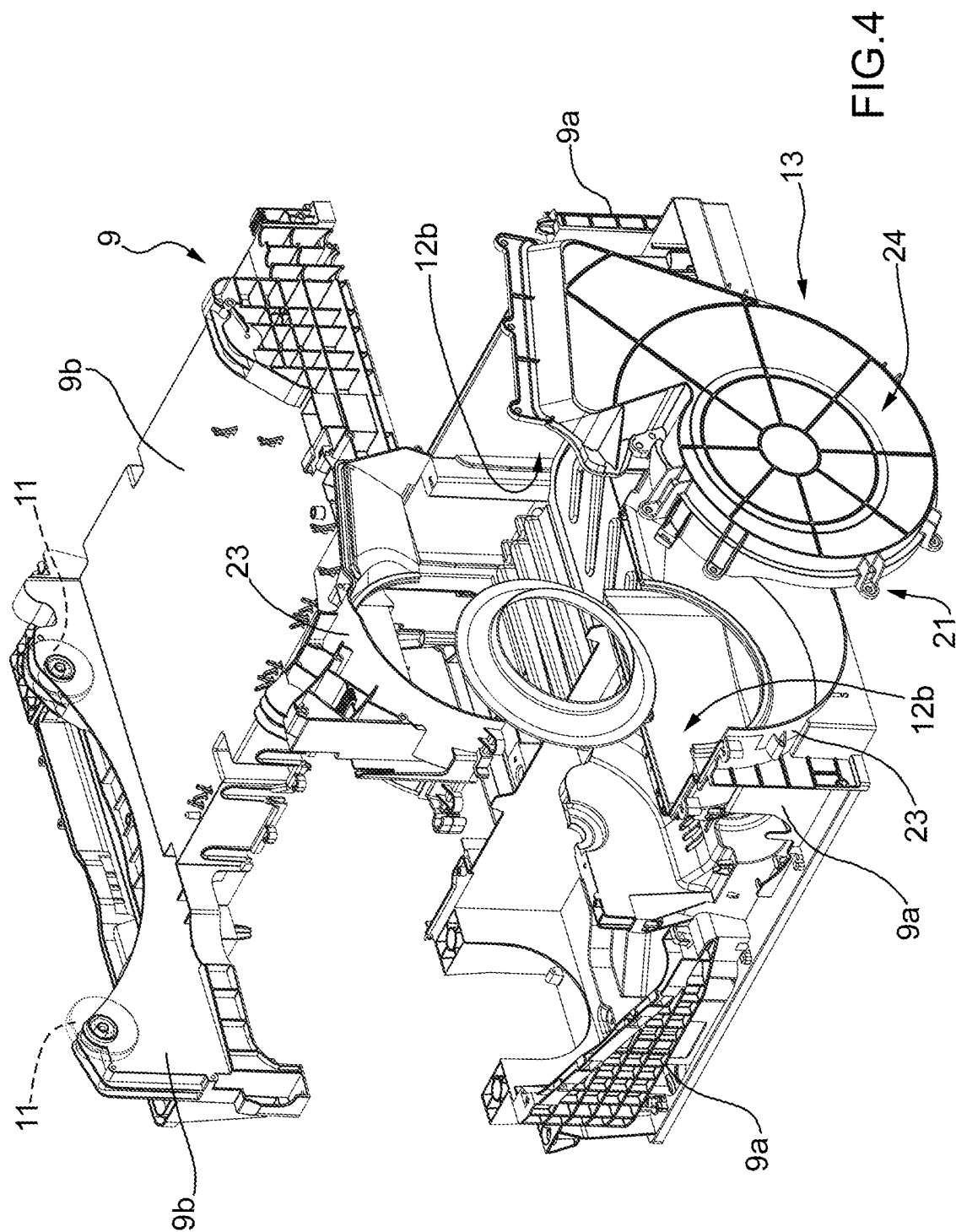


FIG.2



3
G
F



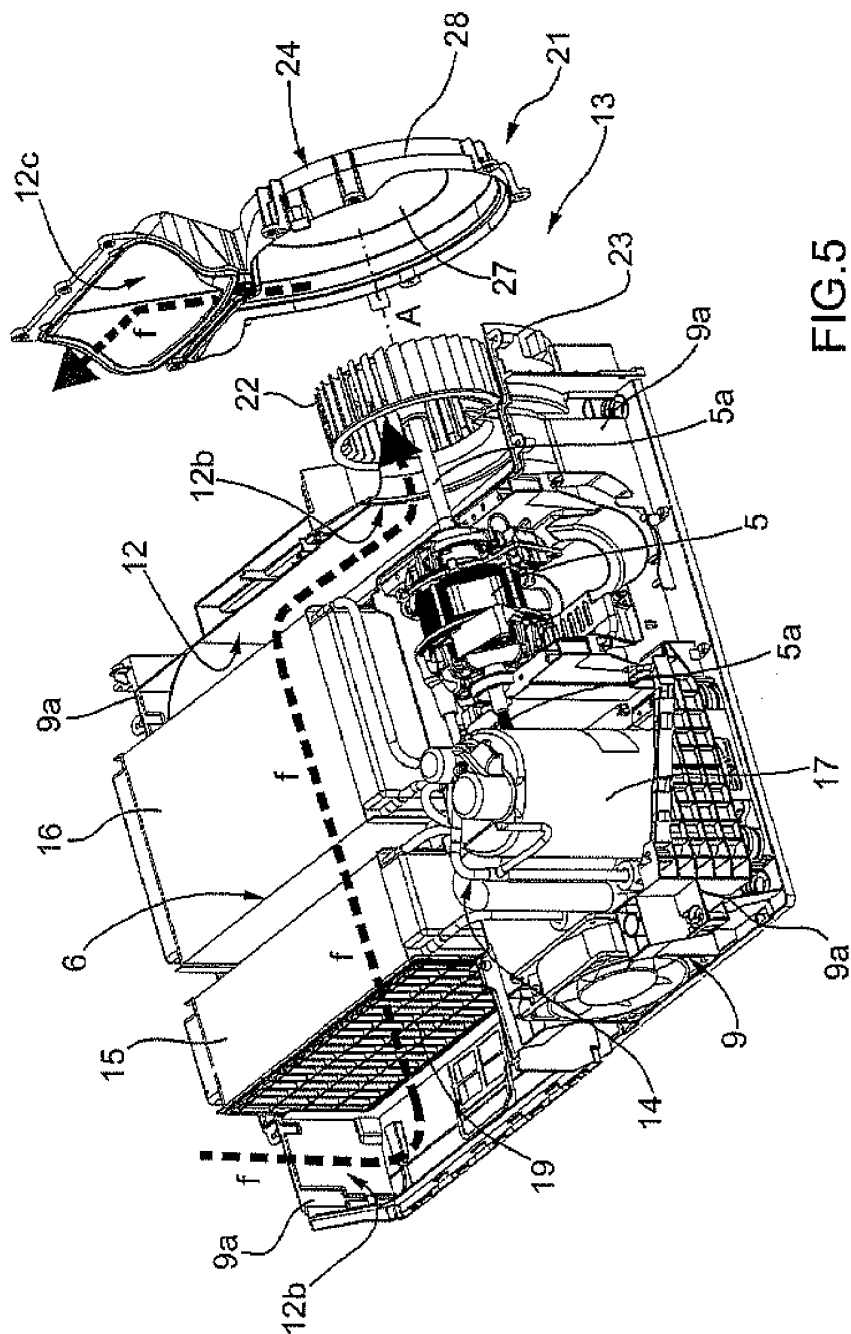


FIG. 5

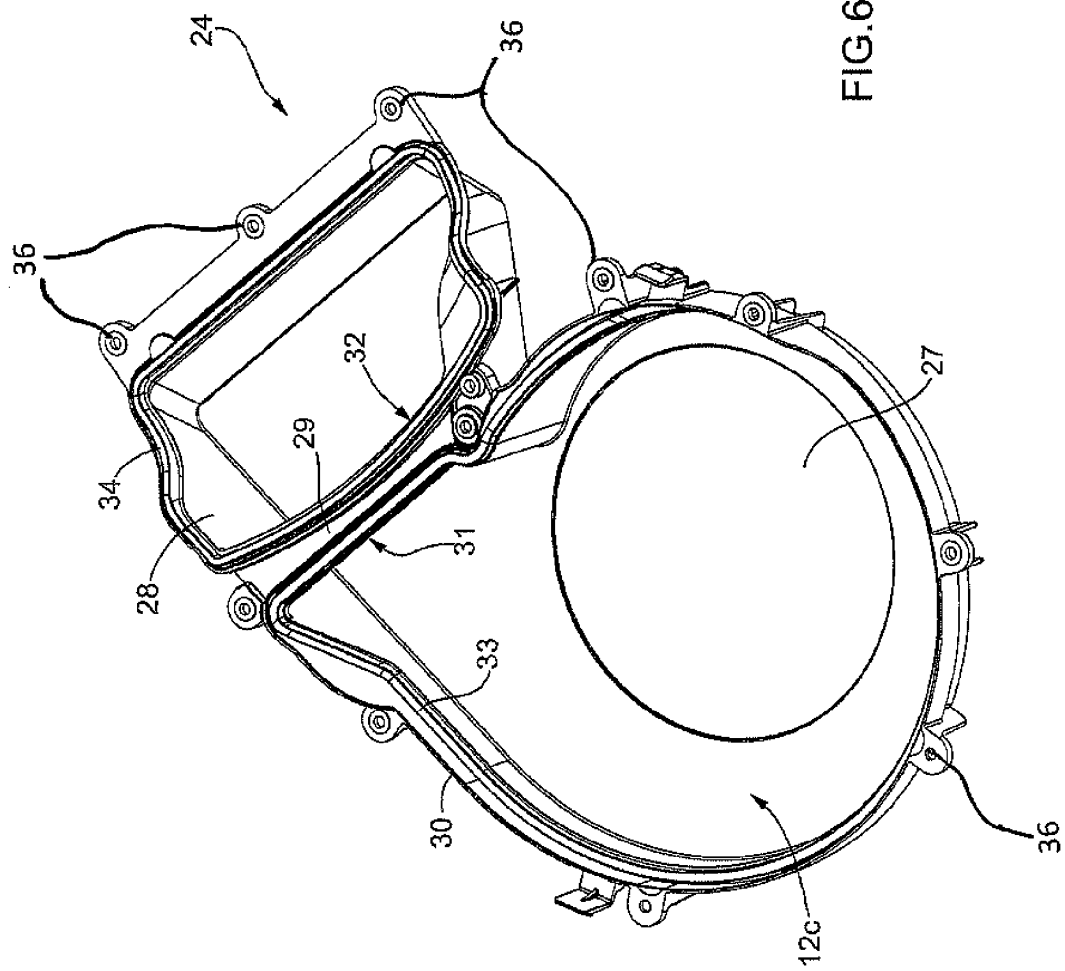
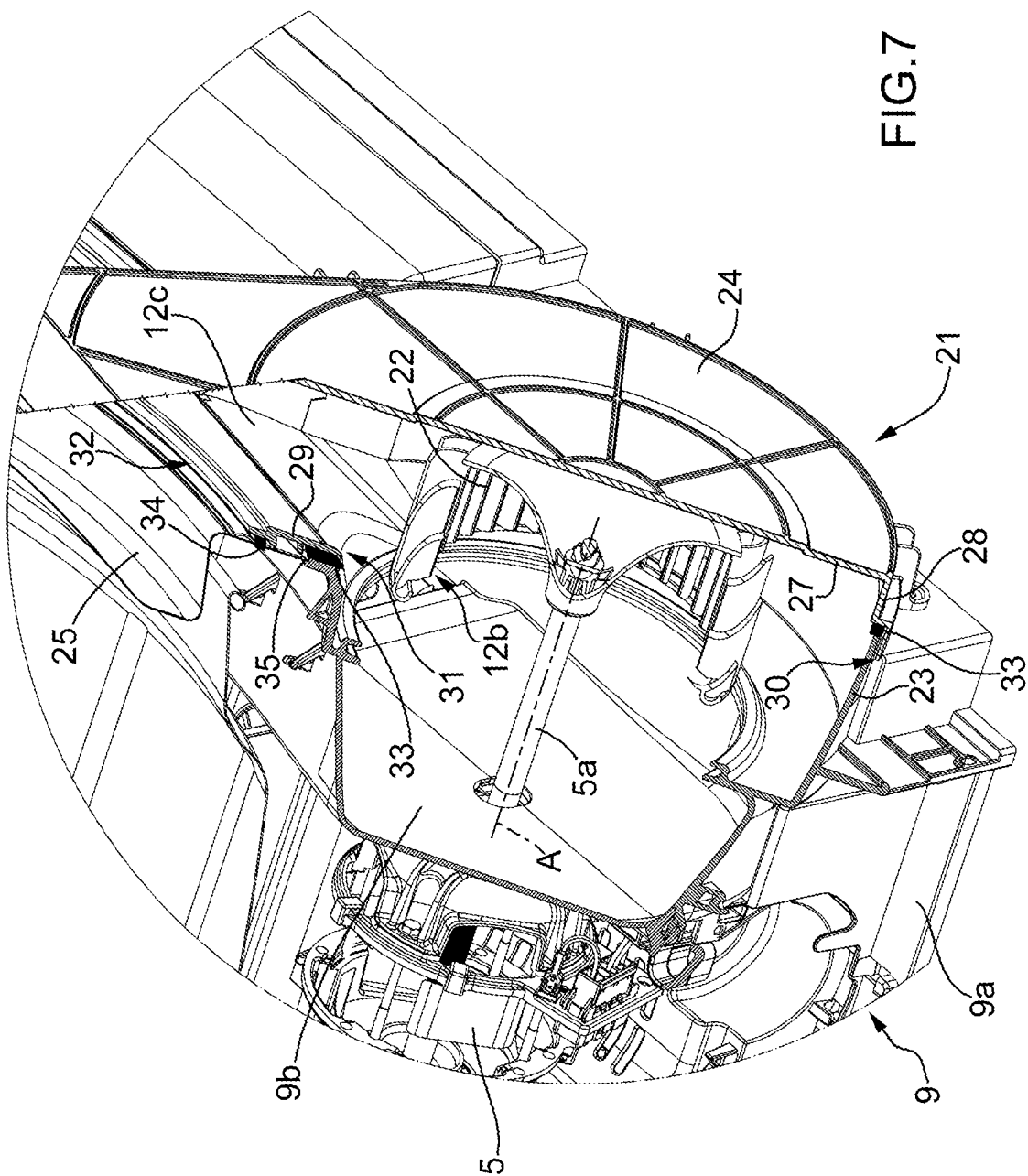


FIG. 6





EUROPEAN SEARCH REPORT

Application Number
EP 11 16 7975

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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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			

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EPO FORM 1503 03/02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 11 16 7975

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
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