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(54) **Laundry dryer**

(57) A laundry dryer (1) provided with an external casing (2); a drum (3) fixed in a rotating manner inside the casing (2); an air circulating conduit (12); a heat exchanger (15); a through opening (22a) obtained through the casing (2) and adapted to allow access from outside to the air circulating conduit (12) and to the heat exchanger (15); an inner door (23) to open/close the opening (22a); and an outer door (24) to cover the inner door (23); the inner door (23) being provided with a locking device (37) mobile from and to a locked position and having a driving handle (43) projecting towards the outer door (24), and the outer door (24) presenting, on one own inner surface (29), an impression (47) engaged by the handle (43) when the same is placed in the locked position.

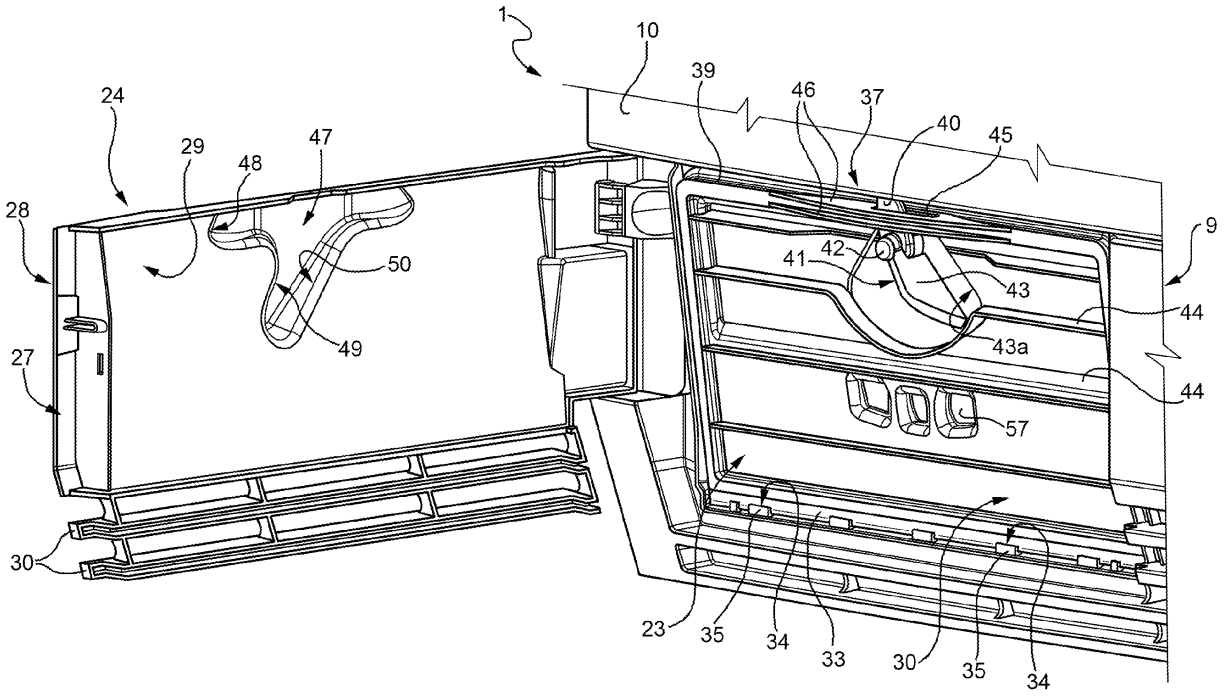

FIG. 6

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Description

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

[0002] In particular, the present invention relates to a 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, a drum home laundry dryer normally comprises a substantially parallelepiped-shaped outer boxlike casing structured for resting on the floor; a substantially cylindrical drum, which is structured for housing the laundry to be dried, and which is fixed inside the outer casing, directly facing a laundry loading/unloading opening formed in the front wall of the outer casing itself, to rotate about its substantially horizontally-oriented longitudinal axis, a porthole door hinged to the front wall of the outer casing to rotate from and to a closing position in which the porthole door rests against the front wall to close the laundry loading/unloading opening and airtight seal the drum; and an electric motor for driving into rotation the drum about the aforesaid longitudinal axis.

[0004] A laundry dryer of such a known type is also provided with an open-circuit or closed-circuit, hot-air generator which is structured to circulate, in use, inside the drum a stream of hot air having a low moisture content, to rapidly dry the laundry disposed inside the drum itself; and with an electronic central control unit which controls both the motor assembly and the hot-air generator during the performing of the user-selectable drying cycles stored in the same central control unit.

[0005] In today's high-end laundry dryers, the hot-air generator is usually a closed-circuit, heat-pump type, hot-air generator that comprises: an air circulating conduit having its two ends connected to respective opposite sides of the drum; an electric centrifugal fan located along the air circulating conduit to produce, inside the latter, an airflow which flows through the drum; a heat-pump assembly, having its two heat exchangers located one after the other, along the air circulating conduit; and finally a manually-removable filtering element, which is fixed in correspondence of an inlet of the air circulating conduit located upstream of the two heat exchangers, and which is structured to stop lint carried by the drying air flow upstream of the two heat exchangers and of the centrifugal fan.

[0006] EP-2034084 discloses a drum home laundry dryer having a closed-circuit, heat-pump type, hot-air generator.

[0007] Aim of the present invention is to improve the structure of a laundry dryer of the known type above described so to ensure and simplify the maintenance of the filtering member and guarantee the efficiency of the hot-air generator.

[0008] According to the present invention is provided a laundry dryer according to the accompanying claims.

[0009] The present invention will now be described with reference to the accompanying drawings that illustrate a non-limiting embodiment thereof, in which:

- Figure 1 shows in perspective view, and with parts removed for clarity, a preferred embodiment of the laundry dryer of the present invention;
- Figure 2 shows, in section and with parts removed for clarity a detail of the laundry dryer of figure 1;
- Figure 3 is an exploded view of a supporting base of the laundry-dryer of Figure 1, with parts removed for clarity;
- Figure 4 is a perspective view, with parts removed for clarity and with repositioned parts, of the inside of the

[0010] support base of Figure 3;

- Figure 5 shows, in side elevation, a detail of Figure 1;
- Figure 6 shows, in perspective view, the detail of Figure 5 in a different operating configuration;
- Figure 7 is a section along the line VII-VII of Figure 5, and
- Figures 8 and 9 show, in perspective view, two details of Figure 7.

[0011] In figure 1, number 1 indicates as a whole a household drum laundry dryer which comprises:

- a substantially parallelepiped-shaped outer boxlike casing 2 structured for resting on the floor;
- a substantially cylindrical, drum 3 structured for housing the laundry to be dried, and which is fixed in a 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 substantially vertical axis, from and to 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 drum 3.

[0012] Inside the boxlike casing 2, the laundry dryer additionally comprises an electric motor 5, which is mechanically connected to the drum 3 for driving, in use, into rotation the drum 3 about its longitudinal axis; a closed-circuit, hot-air generator 6 which is structured to circulate in use, through the drum 3 a stream of hot air having a low moisture level to rapidly dry the laundry located inside drum 3 itself; and finally an electronic central control unit 7 which controls both the electric motor 5 and the hot-air generator 6 while performing the user-selectable drying cycles preferably, though not necessarily, stored in the same central control unit 7.

[0013] The 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 box-like body 10 which is rigidly

connected to the top of the socle 9 and it houses the drum 3.

[0014] In particular, in the illustrated example, the mentioned laundry loading/unloading opening is realized in the front wall of the body 10, and the porthole door 4 is hinged to the front wall itself, and the drum 3 is disposed inside the body 10 coaxial to a substantially horizontally-oriented longitudinal axis L, and rests on four supporting rollers 11 which are located in pairs in correspondence of respective axial front and rear ends of the drum 3, and are fixed to the casing 2 in a free revolving manner about the respective longitudinal axes, therefore allowing the drum to freely rotate about the axis L.

[0015] According to Figures 1 and 3, the front and rear supporting rollers 11 are preferably fixed directly on a portion of the top of the socle 9, which is preferably structured to also directly support the electric motor 5.

[0016] With reference to Figures 1, 2 and 3, the closed-circuit, hot-air generator 6 preferably consists in a heat-pump type, hot-air generator 6 which is structured for drawing air from drum 3, rapidly cooling down the air arriving from drum 3 so to extract and retain the surplus moisture in the air itself; rapidly heating the dehumidified air to a predetermined temperature; and finally feeding the heated, dehumidified air back into the drum 3, to dry the laundry contained therein.

[0017] In other words, according to Figures 2, 3 and 4, the hot-air generator 6 provides for continually dehumidifying and heating the air circulating through drum 3 to rapidly dry the laundry, and comprises:

- an air circulating conduit 12 in which two ends are in fluid communication with the drum 3 on opposite sides of the drum 3 itself;
- a centrifugal fan 13 which is located along the air circulating conduit 12 to produce, inside the air circulating conduit 12 itself, an airflow f which flows through the drum 3, and through the laundry located inside the drum 3 itself; and
- a heat-pump assembly 14 which is able to rapidly cool the airflow f coming out from drum 3 for condensing and retaining the surplus moisture in the airflow f itself, and to rapidly heat the airflow f returning back into the drum 3, so that the airflow f entering into drum 3 is at a temperature higher than or equal to that of the airflow f coming out of the drum.

[0018] With reference to Figures 1, 2 and 4, the heat-pump assembly 14 comprises:

- a first air/refrigerant heat exchanger 15 which is located along the air circulating conduit 12 and is structured for rapidly cooling down the airflow f arriving from drum 3 to condense and retain the surplus moisture in the airflow f itself;
- a second air/refrigerant heat exchanger 16 which is located along the air circulating conduit 12, downstream of the heat exchanger 15, and which is structured for rapidly heating the airflow f arriving from heat exchanger 15 and directed back to drum 3, so that the airflow f re-entering into drum 3 is at a temperature higher than or equal to that of the airflow 7 exiting drum 3;
- an electrically-powered refrigerant compressing device 17, which is electric-power driven, is interposed between an outlet of heat exchanger 15 and an inlet of heat exchanger 16, and has a function of compressing the refrigerant provided in a gaseous-state from the heat exchanger 15 so that refrigerant pressure and temperature are much higher at the inlet of heat exchanger 16 than at the outlet of heat exchanger 15; and finally
- an expansion valve or similar passive or active operated refrigerant expansion device (for example a capillary tube, a thermostatic valve or an electrically-controlled expansion valve) in which the expansion valve is interposed between the outlet of heat exchanger 16 and the inlet of heat exchanger 15, and it is structured so as to cause a rapid expansion of the refrigerant directed towards the heat exchanger 15, so that refrigerant pressure and temperature are much higher at the outlet of heat exchanger 16 than at the inlet of heat exchanger 15.

[0019] The heat exchanger 15 is conventionally referred to as the "evaporator" of the heat-pump assembly 14, and is structured so that the airflow f arriving from drum 3 and the low-pressure and low-temperature refrigerant directed to the suction inlet of the compressing device 17 can flow through it simultaneously, allowing the refrigerant, which has a temperature lower than that of the airflow f, to absorb heat from the airflow f itself, thus causing condensation of the surplus moisture in the airflow f arriving from drum 3.

[0020] The heat exchanger 16, in turn, is conventionally referred to as the "condenser" of the heat-pump assembly 14, and it is structured so that the airflow f exiting the heat exchanger and directed back into drum 3 and the high-pressure and high-temperature refrigerant arriving from the delivery of the 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 determining the rapid heating of airflow f entering drum 3.

[0021] With reference to Figure 2, in the example shown, an inlet portion 12i of the air circulating conduit 12 is integrated in the peripheral frame of body 10 delimiting 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 the inlet portion 12i in direct communication with the inside of drum 3.

[0022] In addition, according to Figures 2, 3 and 4, a central/intermediate portion 12c of the air circulating conduit 12 is disposed through socle 9, and is shaped/di-

mensioned 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 portion 12c of air circulating conduit 12 extends inside the socle 9 in a substantially horizontal direction.

[0023] The fun 13 is preferably located outside of the socle 9, preferably correspondingly to one of the end-openings of the central portion 12c so to directly communicate with both the central portion 12c itself and the inside of drum 3. In particular the fan 13 is preferably located on the back of the socle 9, at the exit end of the central portion 12c of the air circulating conduit 12, i.e. downstream of both the evaporator 15 and the condenser 16.

[0024] According 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 circulating conduit 12, upstream of the evaporator 15, and is structured so as to stop lint carried by the air flow from the drum 3 upstream of both the evaporator 15 and the condenser 16; and a rigid, protective grid-like assembly 19 which is firmly and preferably also removably fixed inside the central portion 12c of the air circulating conduit 12, downstream of the filtering assembly 18 and immediately upstream of the evaporator 15, so as to bar through the central portion 12c of the air circulating conduit 12 for preventing a generic hard foreign body to bump against the evaporator 15.

[0025] 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 air-passage free assembly 18.

[0026] In the example shown, in particular, the protective grid-like assembly 19 preferably comprises a flat, rigid, large-meshed grid 19 which is preferably complementary in shape to the air circulating conduit 12 and is preferably realized in a metal or plastic material.

[0027] With reference to Figures 2, 3 and 4, in the example shown, in particular, the socle 9 of outer casing 2 is formed 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 body 10 and preferably also the front and rear rollers 11 that support the drum 3.

[0028] Furthermore, the lower half-shell 9a and the upper half-shell 9b, when coupled to one another, define the substantially horizontally-oriented, whole central portion 12c 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. In particular, the lower half-shell 9a and the upper half-shell 9b are preferably shaped so as to firmly block in between themselves the grid 19, and preferably also the evaporator 15 and the condenser 16.

[0029] 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 portion 12c of the air circulating conduit 12, and for being substantially airtight coupled to one another, so as to form the whole central portion 12c and, at the same time, block in position the grid 19, the evaporator 15 and the condenser 16.

[0030] In the example shown, the lower half-shell 9a and the upper half-shell 9b are preferably, though not necessarily, realized in plastic material by means of an injection molding process.

[0031] According to Figures 2 and 4, the filtering assembly 18 in turn preferably comprises a first and a second manually-removable, air-filtering devices which are located, one downstream the other along the air circulating conduit 12, upstream of the protective grid-like assembly 19, evaporator 15 and condenser 16. The first air-filtering device preferably comprises a substantially plug-shaped, air-filtering device 20 which is inserted in easy extractable manner into the inlet portion 12i of the air circulating conduit 12 to stop lint at the entrance of the air circulating conduit 12 itself.

[0032] The second air-filtering device comprises an air-permeable panel, preferably formed by a narrow-meshed net 21 which is located inside the central portion 12c of the air circulating conduit 12, immediately upstream of the protecting grid-like assembly 19, so as to completely obstruct the local air-passage section of the central portion 12c and, so as to stop lint upstream of evaporator 15.

[0033] The air-passage free surface ratio of the air-permeable panel 21 is less than half the air-passage free surface ratio of the air-permeable grid 19.

[0034] Moreover, in the example shown, the panel 21 is rigidly fixed on a supporting drawer 22 which is removably inserted, into a corresponding access opening 22a realized on the front of the socle 9, and directly communicating with the air circulating conduit 12, upstream of the protective grid-like assembly 19.

[0035] When the supporting drawer 22 is completely inserted into the opening 22a, the panel 21 is in abutment against the protecting grid-like device 19.

[0036] To airtight seal the opening 22a and to hide the drawer 22, the laundry dryer 1 is provided with an inner door 23 for closing the opening 22a and an outer door 24 for covering the inner door 23, which will be described in detail in the following.

[0037] Referring to Figures 3 and 4, the fan 13 preferably comprises a housing 25 which is located on the back of the socle 9, at the end of the central portion 12c of the air circulating conduit 12, so to be in fluid communication with both the central portion 12c itself, and the inside of drum 3; and an impeller 26, which is fixed inside the housing 25 to rotate around an axis A and generate, in use, the airflow f.

[0038] In the example shown, the electric motor 5 is rigidly fixed on the socle 9 so that its output shaft 5a extends outside the rear portion of the socle 9, in correspondence to the end of the central portion 12c of the air circulating conduit 12, and the fan 13 is mechanically

connected to the electric motor 5.

[0039] The fan 13 is axially aligned to the output shaft 5a of the electric motor 5 so that the housing 25 is substantially coaxial to the shaft 5a and the impeller 26 is keyed to the end shaft 5a to be directly driven in rotation by the electric motor 5.

[0040] Referring to figures 3 and 4, the housing 25 is integrated at least partially in the back portion of the socle 9 formed by the half-shells 9a and 9b. In other words, the housing 25 comprises a first portion 25a incorporated directly into the socle 9 in correspondence to the end of the central portion 12c of the air circulating conduit 12, and a second portion 25b, which is shaped to be tightly coupled, although in an easily releasable manner, to first portion 25a for closing the first portion 25a itself and cover the impeller 26 that is at least partially fitted within the first portion 25a.

[0041] Preferably, the first portion 25a is realized in one piece with the socle 9, while the second portion 25b is defined by a substantially cup-shaped, rigid cover 25b which is fixed in a rigid and stable, though easily releasable, manner to the area of the socle 9 forming the first portion 25a so as to substantially airtight close the first portion 25a and completely cover the impeller 26.

[0042] The first portion 25a is preferably divided into two distinct and separate sections, which are integrally realized, respectively, with the lower half-shell 9a and the upper half-shell 9b so that the whole first portion 25a is completely formed when the two half-shells 9a and 9b are coupled to one another. Particularly, in the shown example, the aforesaid two sections forming the first portion 25a form, when coupled, a first half-volute of the housing 25; whereas the second portion 25b forms a second half-volute complementary to the first half-volute and structured for being airtight coupled to the latter to define, in their assembly, the housing 25.

[0043] As illustrated in Figures 3 and 4, the lower half-shell 9a and the upper half-shell 9b are, preferably, shaped in such a way that the central portion 12c of the air circulation conduit 12 is substantially L-shaped and comprises a first segment extending below the drum 3 and substantially parallel to the axis L of the drum 3 itself, and a second transversal segment extending below the drum 3 and substantially perpendicular to the axis L.

[0044] The protective grid-like device 19, the evaporator 15 and the condenser 16 are arranged in series following this order, within the central portion 12c of the air circulating conduit 12; the refrigerant compressing device 17 and the electric motor 5 are preferably fixed on the socle 9 and are aligned one to another in a direction parallel to axis L of the drum 3, behind the central portion 12c of the air circulating conduit 12, so that the shaft 5a of the electric motor 5 extends outside a back portion of socle 9, in correspondence to one end of the central portion 12c.

[0045] In the shown example, the electric motor 5 and the compressing device 17 are directly fixed on the lower half-shell 9a, behind the first segment of the central portion 12c of the air circulating conduit 12.

[0046] According to Figure 4, the fan 13 is therefore located, in the back of the socle 9, at the end of the second segment of the central portion 12c of the air circulating conduit 12, and is axially aligned to the shaft 5a of the electric motor 5.

[0047] In the following, with reference to figures 5 through 9, the bottom front portion of the laundry dryer 1 will be described in detail, particularly the part regarding the drawer 22, the inner door 23 and the outer door 24.

[0048] According to Figures 5 and 6, the outer door 24 is defined by an upper portion 27, which has an outer surface 28 and an inner surface 29 that faces the inner door 23, and a lower portion, which is rigidly connected to a bottom edge of the upper portion and is defined by a set of horizontal fins 30 stacked together and aligned with corresponding vent fins obtained through the front wall of the socle 9, next to the door 24.

[0049] The outer door 24 is hinged to the socle 9 in correspondence to a side edge of the upper portion 27 in proximity to an angle of the socle 9 to rotate around a substantially vertical axis between a closed position (Figures 1 and 5), in which a peripheral region of the inner surface 29 is engaged in the socle 9 and the outer door 24 covers the inner door 23 preventing access to the latter, and one open position (Figure 6), in which the outer door 24 is rotated towards the outside and makes completely accessible the inner door 23 which closes the opening 22a.

[0050] According to Figures 6, 7 and 8, the inner door 23 is defined by a panel which has an outer surface 31 facing the outer door 24 and an inner surface 32 facing the drawer 22. The inner door 23 is fixed in a removable manner, on the socle 9 to rotate about its own longitudinal bottom edge between a closed position (Figures 6 and 7), in which the inner door 23 is arranged between the drawer 22 and the outside door 24 airtight sealing the opening 22a, and an open position (not shown), in which the inner door 23 is tilted towards the outside and leaves opening 22a completely free allowing an operator to easily remove the drawer 22.

[0051] To rotate between the above mentioned closing and opening positions the inner door 23 has, rigidly connected along its lower edge, a cylindrical rib 33, which pivotally engages, a series of semi-cylindrical cavities 34, which are formed in respective appendices 35 integral with the socle 9 and define in their assembly and with the rib 33, a hinge for the inner door 23. This hinge allows rotation of the inner door 23 along an axis substantially parallel to the support surface of the laundry dryer.

[0052] In order to airtight seal the opening 22a to prevent air leakage from the air circulating conduit 12, the inner door 23 is provided with a gasket 36, which extends along the entire periphery of the inner surface 32 and when the inner door 23 is closed, it is pressed against a peripheral portion of the opening 22a.

[0053] As shown in Figure 6, the inner door 23 can be

securely locked in the closed position by a locking device 37, which comprises a cavity 38, formed into the socle 9 on one side of opening 22a facing a top edge 39 of inner door 23 and arranged with its concave face downwards and towards the edge 39 itself, and a tooth 40 that is fixed on the inner door 23 near the midpoint of the edge 39 and is mobile from and towards a locked position, in which the tooth 40 transversally engages the cavity 38 locking the inner door 23 in the closed position.

[0054] The tooth 40 defines a first arm of a rocker element 41, which is mounted on the outer surface 31 near the edge 39, and pivots on a pin 42 for swinging about an axis substantially perpendicular to the outer surface 31 and comprises a second arm, which is opposed and integral with tooth 40, extending downwards from the pin 42 and defines a handle 43 adapted for being grasped by an operator to rotate the tooth 40 from and to the locked position and to move the inner door 23 towards the opening or closing position.

[0055] As shown in Figures 5, 6 and 7, the tooth 40 is preferably defined by a half-disc shaped flat element, which lies on a plane substantially parallel to the inner door 23 and extends from the pin 42 towards the opposite side to that in which lies the handle 43 beyond the edge 39 in order to be able to engage the cavity 38, when arranged in the locked position.

[0056] The handle 43 is defined, however, by a generally triangular body, which lies on a plane substantially perpendicular to the tooth 40 and to the inner door 23 and extends transversely from the outer surface 31 beyond a plurality of reinforcement beads 44 integral with the outer surface 31 itself.

[0057] The angular excursion of the rocker element 41, and thus of the handle 43 and of the tooth 40 around the pin 42 is limited by a slot 45 transversally engaged by the tooth 40 and defined by a pair of ribs 46 integral with the outer surface 31 and placed between the pin 42 and edge 39.

[0058] The longitudinal ends of the slot 45 define respective end of stroke shoulders for the tooth 40 and the length of the slot 45 determines the width of an angular oscillation sector 43a of the handle 43. In other words, the tooth 40 may be moved by rotating the handle 43, from the aforementioned locking position (Figures 5, 6 and 7), in which the handle 43 is arranged at a first end (on the right-hand in figures 5 and 6) of angular sector 43a and the tooth 40 abuts against a longitudinal end (on the left-hand in Figures 5 and 6) of the slot 45 and is partially inserted into the cavity 38, and a release position (not shown), in which the handle 43 is disposed at the second end of the angular sector 43a and the tooth 40 is abutting on the other longitudinal end of slot 45 and is completely outside the cavity 38 allowing, in this way, the opening of the innner door 23.

[0059] In this regard, it should be noted that, if necessary, for example for performing a very thorough cleaning, the inner door 23 can be completely detached from its seat by simply placing the tooth 40 in the unlocked position and pulling the inner door 23 itself upwardly and outwardly in order to extract the rib 33 through the transversal opening of the cavity 34. To reassemble the inner door 23 is sufficient to center the inner door 23 with respect to the opening 22a and downwardly push the rib 33 to determine the snap-fit thereof in of cavity 34.

[0060] As shown in figures 6 and 7, the laundry dryer 1 also comprises a security system which ensures that when the inner door 23 is closed, the handle 43 is disposed at the end of the first angular sector 43a, i.e. the end corresponding to the locked position of the tooth 40 and not, for example, in an intermediate position of the angular sector 43a. In the latter case, in fact, the seal created by the gasket 36 may not be effective and air leaks from the air circulating conduit 12 may occur during operation of the laundry dryer.

[0061] To this end, the outer door 24 has on its inner surface 29 and near its own top edge, an impression 47, which in negative reproduces, the overall dimensions of the ribs 46 and of the handle 43 when the latter is placed at the end of the first angular sector 43a. It follows that, in use, the outer door 24 may be closed, i.e. taken in facing position to the inner door 23 so as to cover it and prevent access to it, only if the tooth 40 is in the locked position. When the outer door 24 is closed, the impression 47 receives the handle 43 and maintains the locking device permanently in the locking position.

[0062] As shown in Figures 5 and 6, the impression 47 has a generally T-shape and comprises a horizontal portion 48, which is adjacent and parallel to the upper edge of the outer door 24 and is constructed to accommodate the ribs 46 when the outer door 24 is closed; and a portion 49, which downwardly extends from portion 48, i.e. towards the fins 30, and is inclined with respect to the portion 48 to accommodate the handle 43 placed in its angular end of stroke position correspondingly to the locked position of the tooth 40, when the outer door 24 is closed. Therefore, if, in use, the operator has not completed the rotation of the handle 43 until bringing the tooth 40 in the locked position, at the closing of the outer door 24, the handle 43 will not be in alignment with the portion 49 of the impression 47, but will contrast with the inner surface 29 alerting the operator of the defective closure of the inner door 23.

[0063] In addition, the portion 49 of the impression 47 is laterally bounded by two walls, one of which, corresponding to the shorter side of the portion 49, is substantially perpendicular to the inner surface 29, while the other, which is indicated with 50 and corresponds to the longer side of the portion 49, is countersunk towards the inner surface 29 to define a cam or slide, which, in case the handle 43 has not fully reached the first end of the angular sector 43a but is just next to the end of stroke position which corresponds to the locked position of the tooth 40, it performs the function of pushing the handle 43 to its end of stroke position, thereby reaching the locked position by the tooth 40 while the outer door 24 is moved next to the inner door 23 to be closed. Prefer-

ably, considering as a reference the angular end of stroke position of the handle 43 corresponding to the locked position of the tooth 40, when the outer door 24 is closed, the side surface 50 of the impression 47 engages the handle 43 if the latter is deviated from said reference by an angle α comprised within a predetermined range determined according to the geometry of the handle 43 and of the impression 47 (Figure 5). More preferably, the angle α is between 1° and 25°.

[0064] In the event the handle 43 is dislocated by an angle $\alpha > 25°$ from the angular end of stroke position taken as reference, for example due to improper tightening by a user, the impression 47 does not receive the handle 43 and the outer door 24 does not close. In this way, the user is informed of improper tightening of the locking device of the inner door 23 and can easily intervene to restore the normal operating condition by acting on the handle 43.

[0065] As shown in Figures 7 and 9, the drawer 22 comprises a frame 51 adapted for supporting the filtering panel 21 and a concave appendix 52, which is connected to the frame 51 and is interposed between the frame 51 and the inner door 23 defining a deviator of the drying air flow from the drum 3 and directed towards the evaporator 15.

[0066] The concave appendix 52 comprises two side walls 53 integral with their respective side edges of the frame 51, and a curved wall 54, which is integral with a bottom edge of the frame 51, connecting the side walls 53 and is placed with its concave side facing upwards. The curved wall 54, that preferably has a height equal to about half the height of the frame 51, is bounded from above by a straight edge 55 and has, at the edge 55 itself, three preferably through openings 56, defining a handle adapted to allow an operator to easily grasp and pull the drawer 22.

[0067] In addition to the above mentioned function, the openings 56 are also part of a centering device which ensures that the inner door 23, when closed, is perfectly centered with respect to the opening 22a actuating, therefore, an effective airtight closure of the opening 22a itself. It can happen, in fact, that, since the hinge formed by the rib 33 and the cavities 34 is not longitudinally constrained, the inner door 23 moves laterally, and once closed, does not allow the perfect fitting of the gasket 36 to the peripheral area of the opening 22a.

[0068] For this purpose, with reference to figures 7 and 8, the inner door 23 has on its inner surface 32, three projecting portions 57, which are part of the mentioned centering device and are conformed to precisely engage, when the inner door 23 is closed, the respective openings 56 of the drawer 22 so as to achieve the centering of the inner door 23 with respect to opening 22a and, in case of through openings 56, fluid-tight seal said openings 56 with the result of avoiding, in use, alteration and/or leakage of drying air flow from the drying air circulating conduit 12.

[0069] Obviously, according to various needs, the number and shape of the openings 56 and projecting portions 57 may differ from those of the above illustrated example without causing any substantial change to the operational concept.

[0070] Finally, it should be made clear that the above description referring to a laundry dryer operating with a heat pump assembly remains valid even if other known operating technologies are used, as in the case of a condensing laundry dryer with a condenser consisting of an air/air type heat exchanger.

Claims

1. A laundry dryer comprising an external casing (2); a drum (3) fixed in a rotating manner inside the casing (2), and an air circulating conduit (12) extending through the drum (3) and at least one heat exchanger (15); said casing (2) being provided with a through opening (22a), which communicates with the circulating conduit (12) and allows access to the heat exchanger (15); the laundry dryer (1) furthermore comprising, an inner door (23) to open/close said opening (22a) and an outer door (24) to cover the inner door (23), said outer door (24) being movable between a closed position which prevents access to the inner door (23) and an open position in which the inner door (23) is accessible; said inner door (23) presenting a locking device (37) movable from and to a locking position of the inner door (23) and comprising a driving handle (43); the laundry dryer (1) **being characterized in that** the outer door (24) comprises an inner surface (29) that faces the inner door (23), said inner surface (29) being provided with an impression (47) receiving said handle when the outer door (24) is placed in the closed position.

2. The laundry dryer according to claim 1, wherein the impression (47) has an inclined lateral surface (50) defining a cam or slide adapted for determining the movement of the handle (43) towards the locked position during the movement the outer door (24) towards the closed position.

3. The laundry dryer according to claim 2 wherein the side surface (50) and the handle (43) are shaped to be engaged during the movement of the outer door (24) towards its closed position when said handle (43) is deviated from its end of stroke position, corresponding to the locked position of said locking device (37), by an angle α comprised in a predetermined range.

4. The laundry dryer according to claim 3 wherein the angle α is between 1° and 25°.

5. The laundry dryer according to claim 3 or 4 wherein the impression (47) is prevented from engaging with

the handle (43) when the latter is deviated from its end of stroke position, corresponding to the locked position of said locking device (37), by an angle $\alpha >$ 25°.

6. The laundry dryer according to one of the preceding claims comprising a filter holding drawer (22) placed between the heat exchanger (15) and the opening (22a) and removable through the opening (22a) itself, said drawer (22) comprising a wall (54) presenting at least one opening (56); the inner door (23) being provided with at least one projecting portion (57) conformed to engage said at least one opening (56) when the inner door (23) closes the opening (22a).

7. The laundry dryer according to claim 6 wherein said at least one opening (56) is a through opening and said at least one projecting portion (57) fluid-tight seals said at least one opening (56).

8. The laundry dryer according to claim 6 or 7 wherein the engagement of said at least one projecting portion (57) within said at least one opening (56) actuates the centering of the inner door (23) with respect to the opening (22a).

9. The laundry dryer according to one of the preceding claims, wherein said locking device (37) comprises a cavity (38) obtained on the casing (2); the handle (43) defining a first arm of a rocker element (41), which pivots on the inner door (23) and comprises a second arm defined by a tooth (40) integral with the handle (43); the handle (43) being mounted to oscillate through an angular sector (43a) of determined width between a first end of stroke position, which corresponds to the locked position and in which the tooth (40) is placed inside the cavity (38), and a second end of stroke position, in which the tooth (40) is outside the cavity (38).

10. The laundry dryer according to claim 9, wherein the inner door (23) presents a portion (46) projecting toward the outer door (24) and is provided with a slot (45) transversally engaged by the tooth (40); the size of the mentioned angular sector (43a) being determined by the length of the slot (45), whose axial ends define respective end of stroke positions for the tooth (40).

11. The laundry dryer according to claim 10, wherein the impression (47) has a generally T-shape and comprises a first portion (48) shaped to receive said projecting portion (46) when the outer door (24) is in a closed position, and a second portion (49) extending from the first portion (48) downwards and is inclined with respect to the first portion (48), said second portion (49) being adapted to house the handle (43) placed in said first end of stroke position when the outer door (24) is in the closed position.

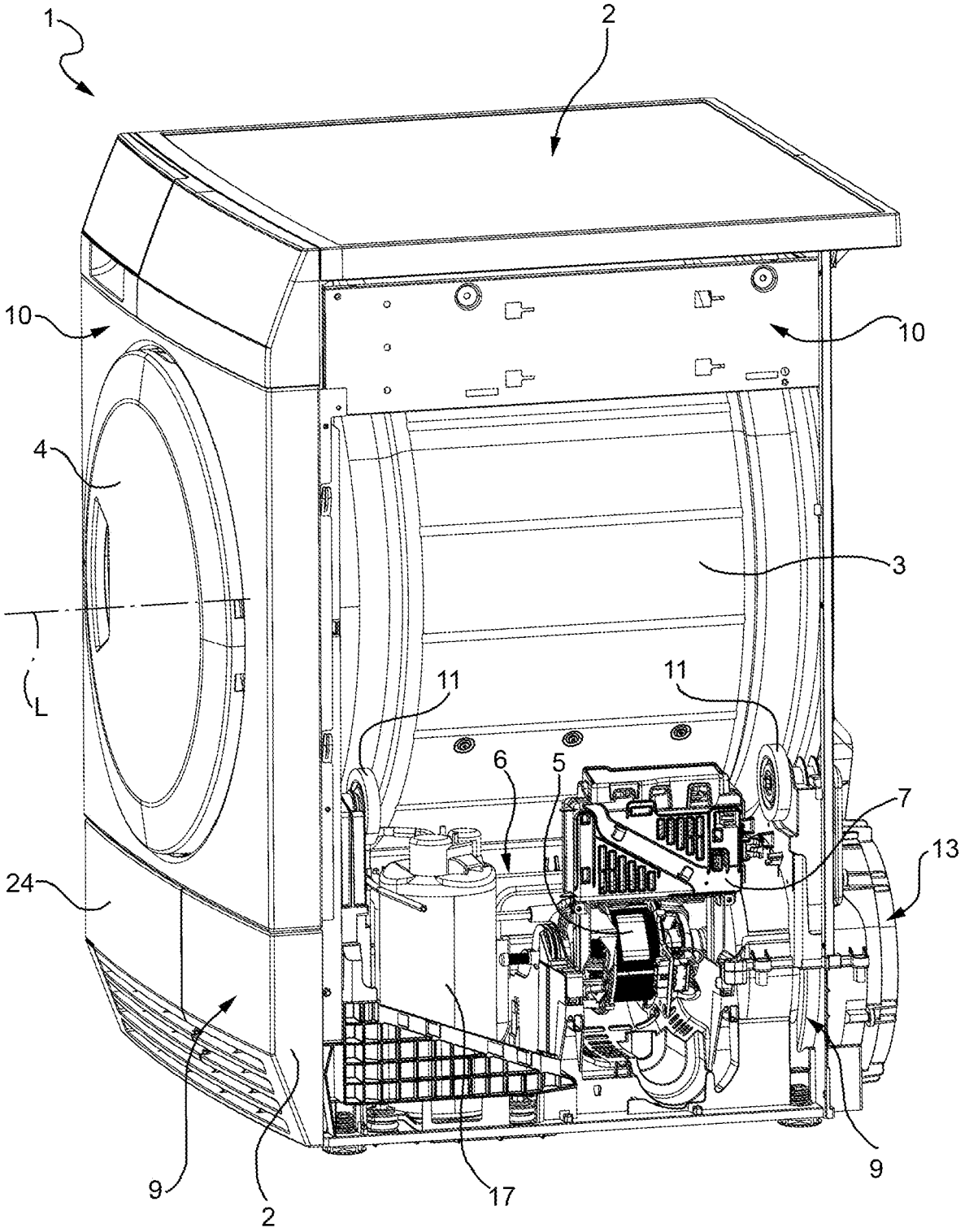


FIG. 1

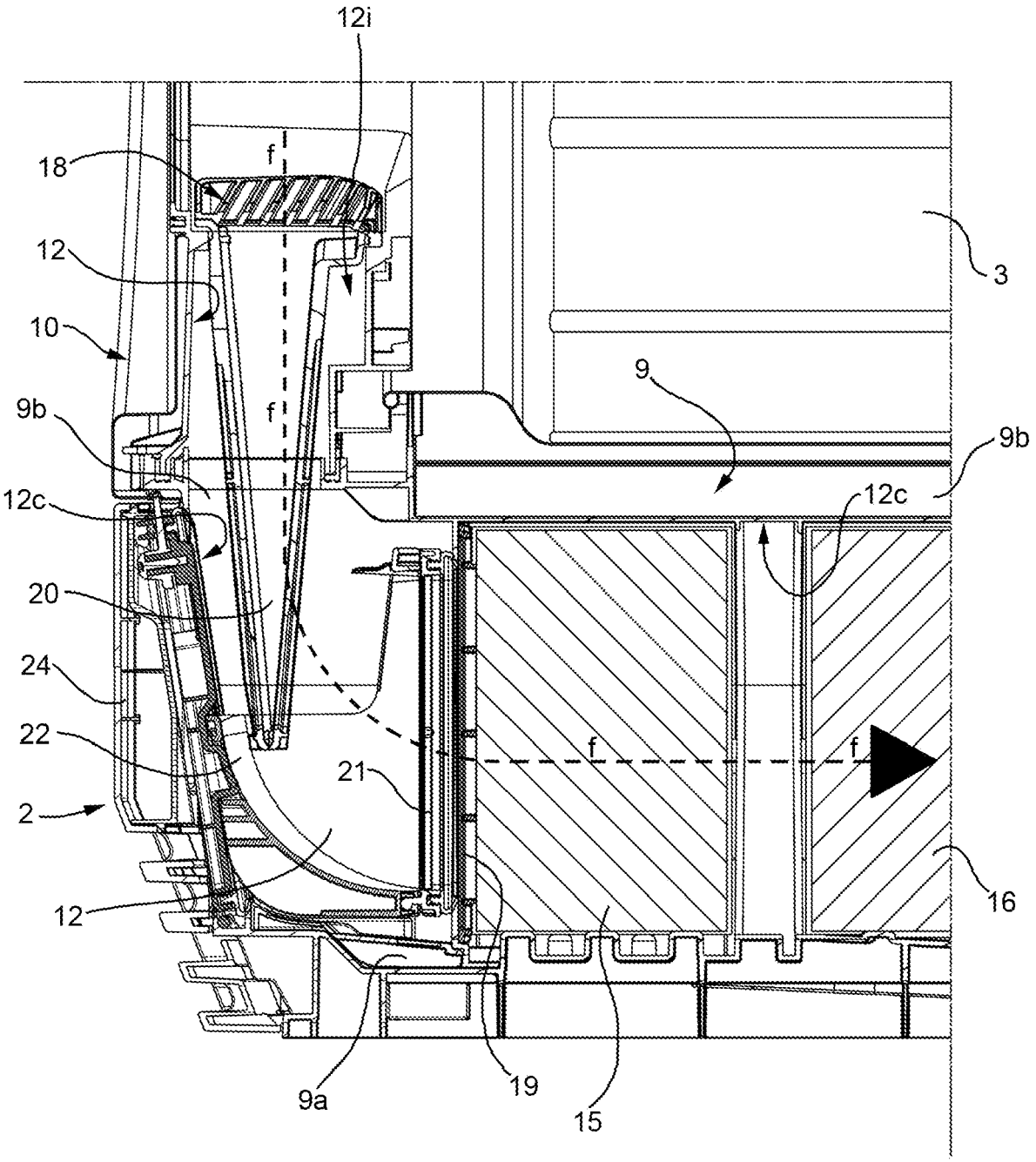


FIG. 2

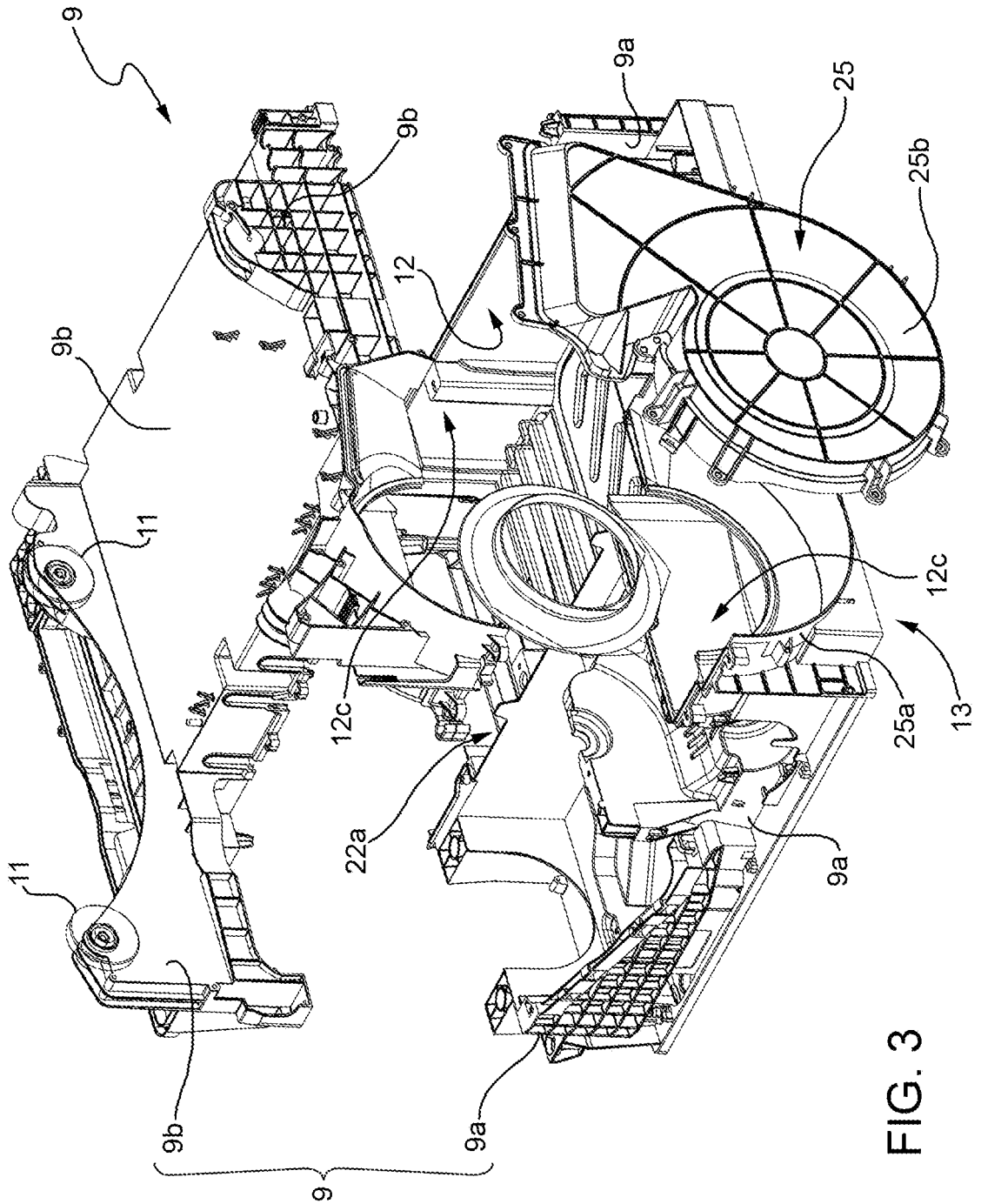
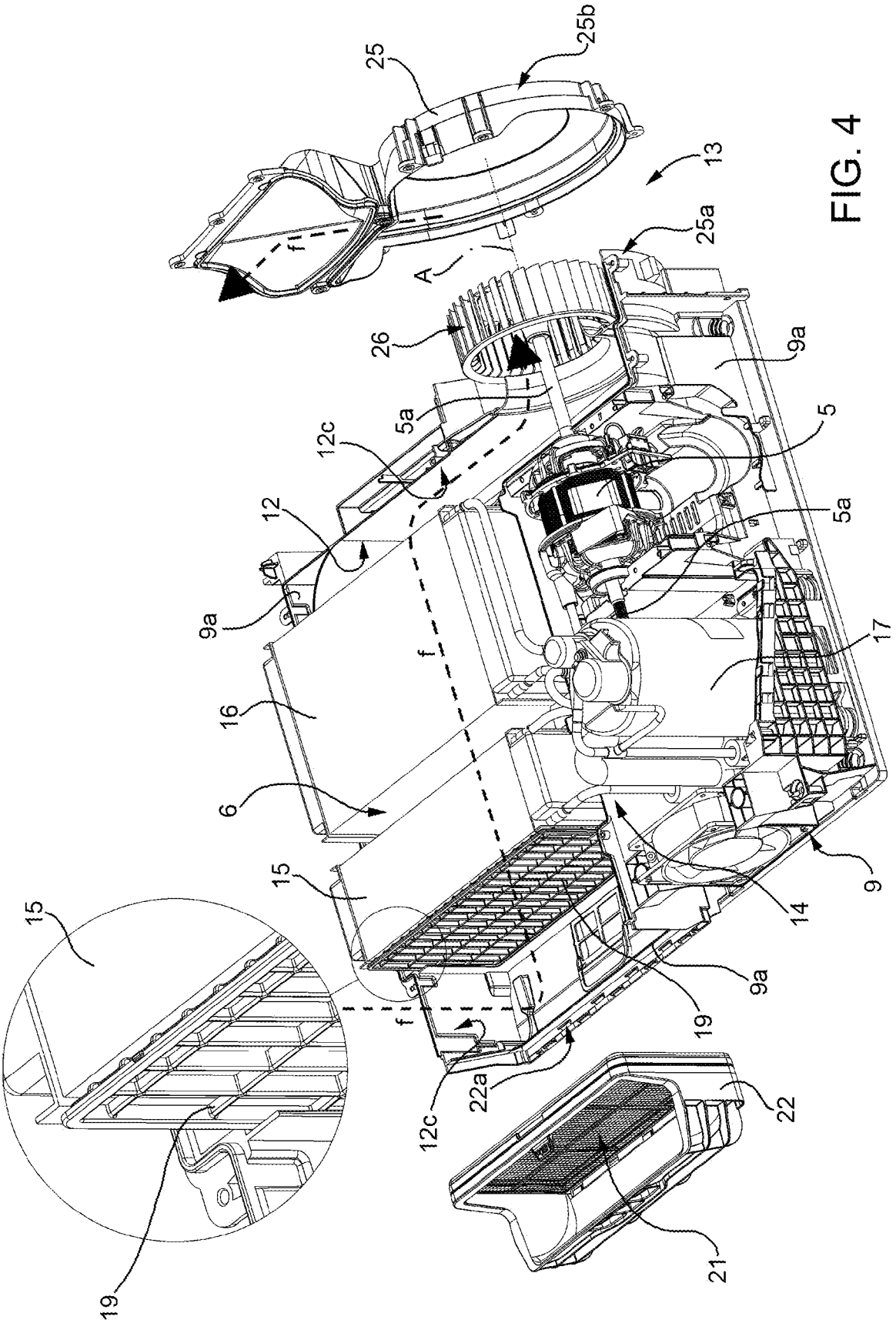


FIG. 3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12c
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9a
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FIG. 4

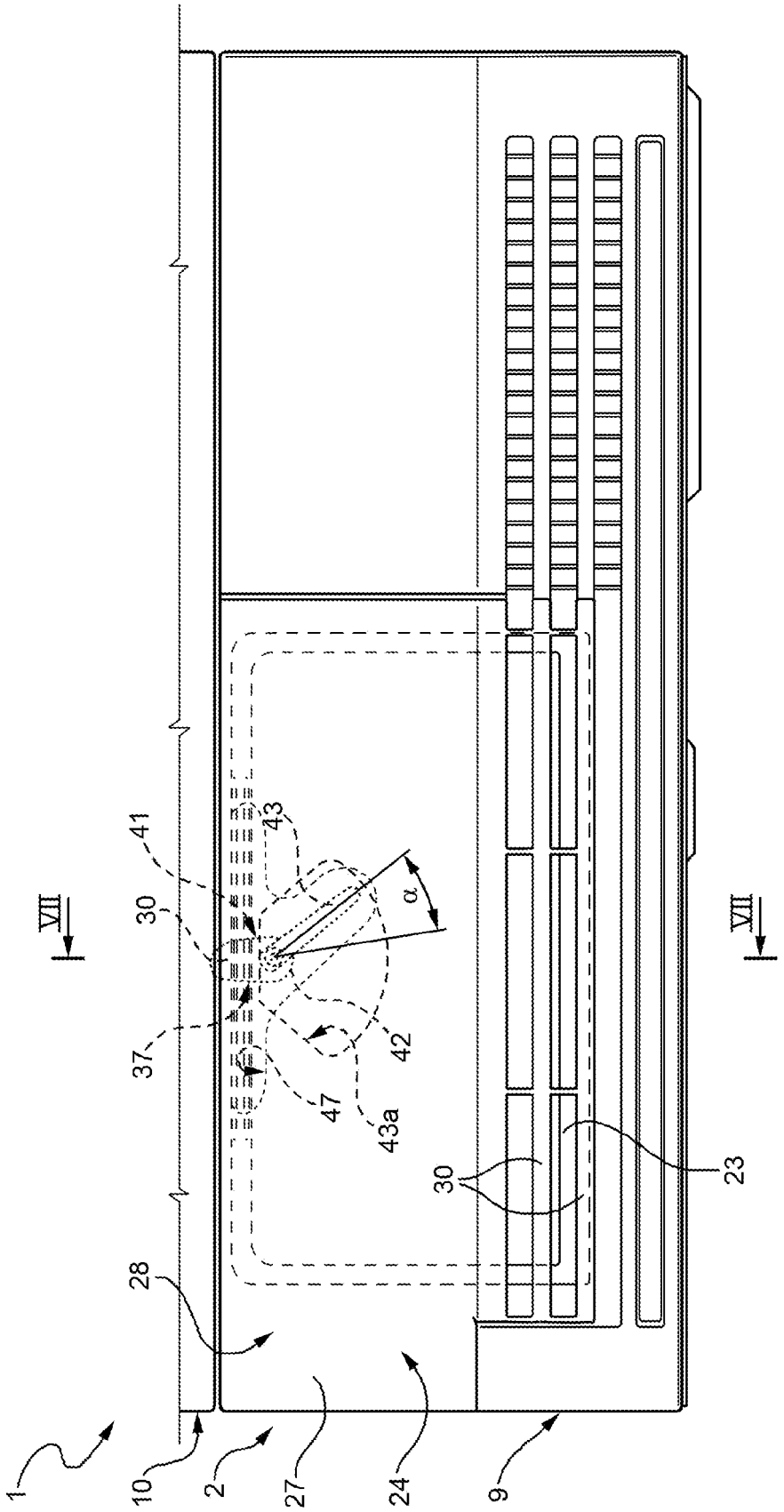

FIG. 5

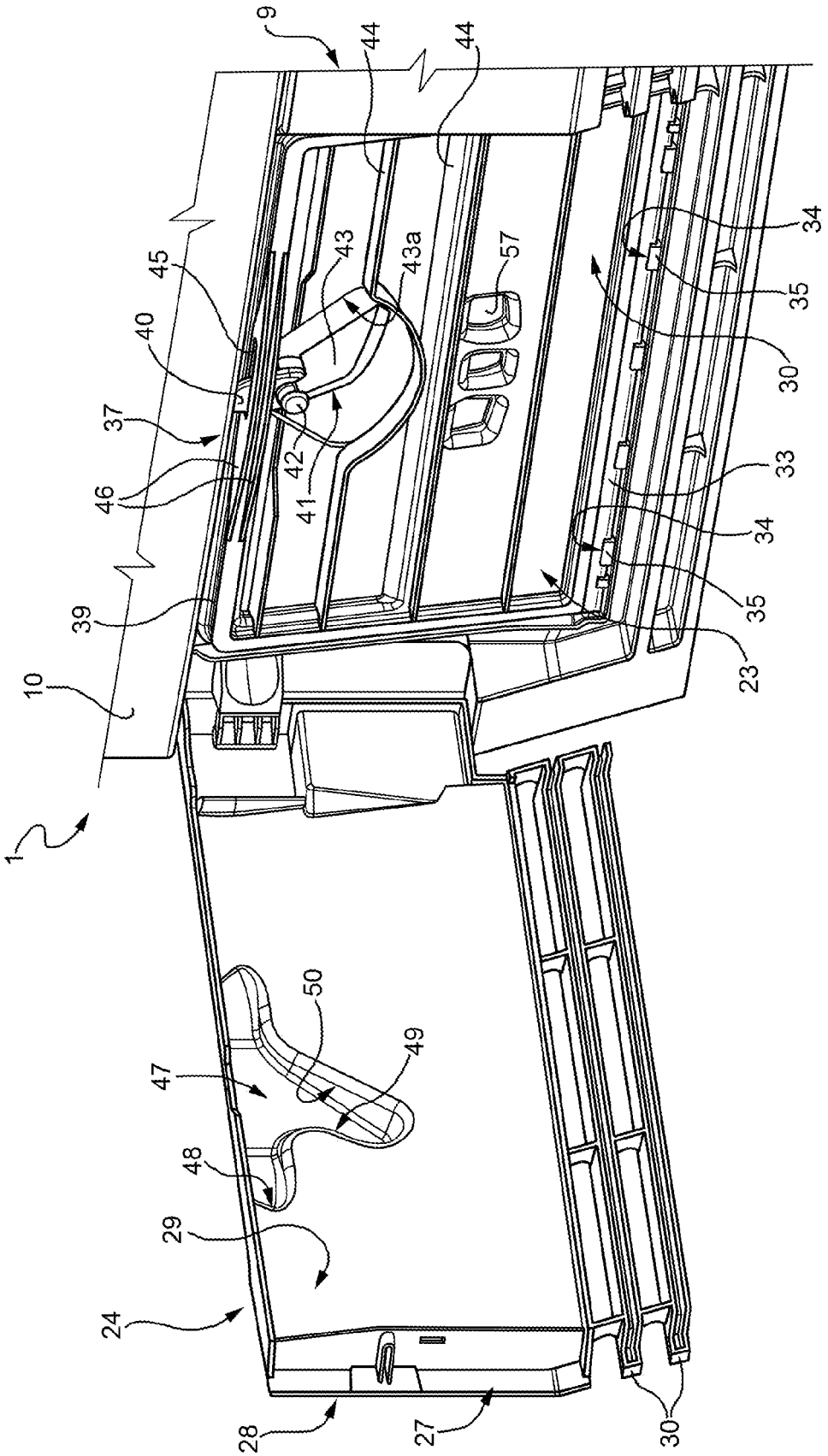
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FIG. 6

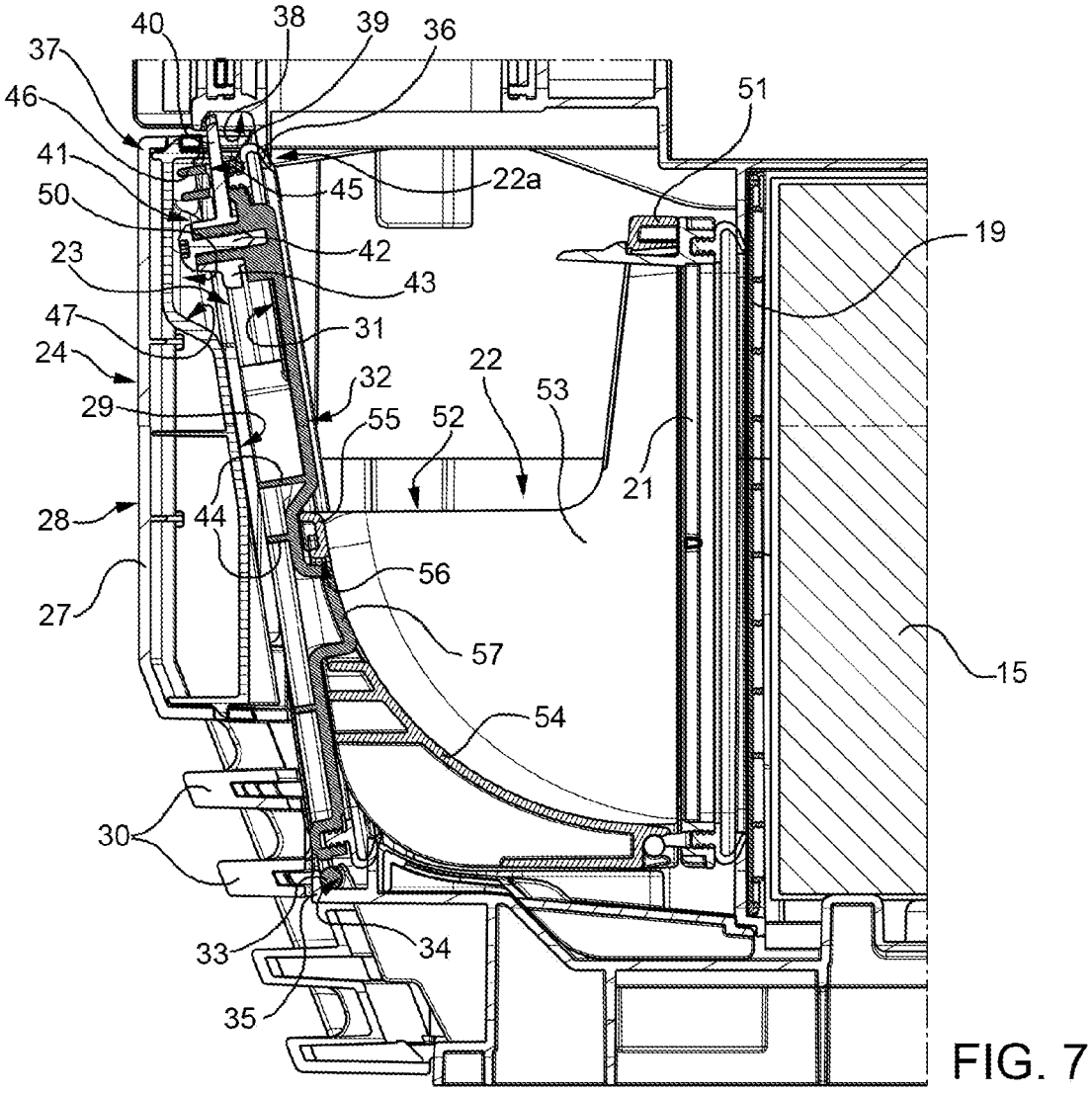

FIG. 7

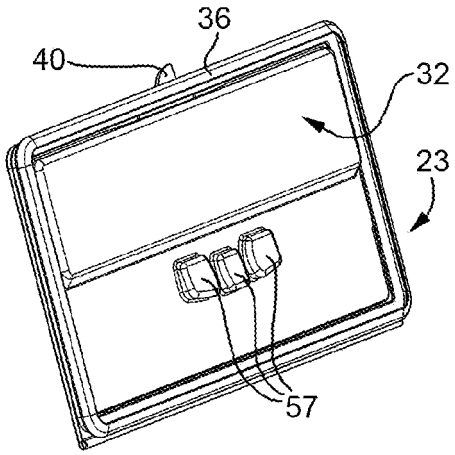

FIG. 8

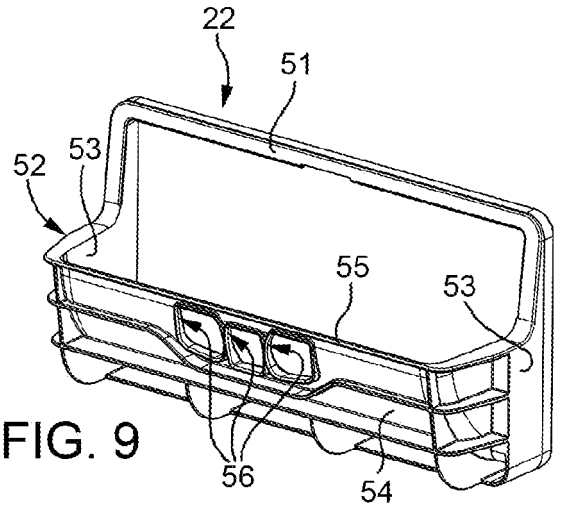

FIG. 9

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EUROPEAN SEARCH REPORT

Application Number
EP 11 16 7986

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 2 196 578 A1 (ELECTROLUX HOME PROD CORP [BE]) 16 June 2010 (2010-06-16) * paragraphs [0081] - [0082]; figures 4,5 *	1	INV. D06F58/24
A	WO 2007/074124 A1 (ARCELIK AS [TR]; CINAR LEVENT [TR]; KANLIKUYU RESUL [TR]; SAR CAN [TR]) 5 July 2007 (2007-07-05) * paragraphs [0017] - [0021]; figures *	1	
A	EP 2 309 053 A1 (MIELE & CIE [DE]) 13 April 2011 (2011-04-13) * paragraphs [0012] - [0013]; figures *	1	
A	EP 1 111 120 A2 (WHIRLPOOL CO [US]) 27 June 2001 (2001-06-27) * paragraphs [0014] - [0015]; figures *	1	

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	Stroppa, Giovanni

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04-11-2011

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 2196578 A1	16-06-2010	AT 525514 T	15-10-2011
WO 2007074124 A1	05-07-2007	EP 1966428 A1	10-09-2008
EP 2309053 A1	13-04-2011	NONE	
EP 1111120 A2	27-06-2001	DE 19960414 C1	15-03-2001
		ES 2214207 T3	16-09-2004

EPO FORM P0459

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Patent documents cited in the description

- EP 2034084 A **[0006]**