

(19)



(11)

EP 2 990 521 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
02.03.2016 Bulletin 2016/09

(51) Int Cl.:
D06F 58/06 (2006.01)
D06F 58/20 (2006.01) **D06F 58/08 (2006.01)**

(21) Application number: **14182918.4**

(22) Date of filing: **29.08.2014**

(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

- **Santarossa, Marco**
33080 Porcia (PN) (IT)
- **Dal Ben, Diego**
33080 Porcia (PN) (IT)
- **Giovannetti, Andrea**
33080 Porcia (PN) (IT)

(71) Applicant: **Electrolux Appliances Aktiebolag**
105 45 Stockholm (SE)

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

(72) Inventors:
• **Vian, Alessandro**
33080 Porcia (PN) (IT)

(54) **Laundry dryer**

(57) The present invention relates to a laundry dryer (1) comprising a dryer cabinet (2), comprising a front wall (20) and a rear wall (21), a drum (3) rotatably accommodated within said dryer cabinet (2), and a drying air generator (30), apt to generate a flow of drying air through said drum (3); and at least one drum support assembly (10; 41; 101; 40) to rotatably support said drum (3) along an axis (R) of rotation within said cabinet (2); wherein said front wall (20) comprises a front bulkhead (70) to which the first end (3a) of said drum (3) is coupled in an

axially rotating manner, said front bulkhead (70) being realized in plastic material as an integral piece, and said rear wall (21) comprises a rear bulkhead (60) to which the second end (3b) of said drum (3) is coupled in an axially rotating manner, said rear bulkhead (60) being realized as an integral piece in plastic material and facing on one side said drum (3) and on the other side the exterior of the cabinet (2), and including a portion (41; 101) of said at least one drum support assembly (10; 41; 101; 40).

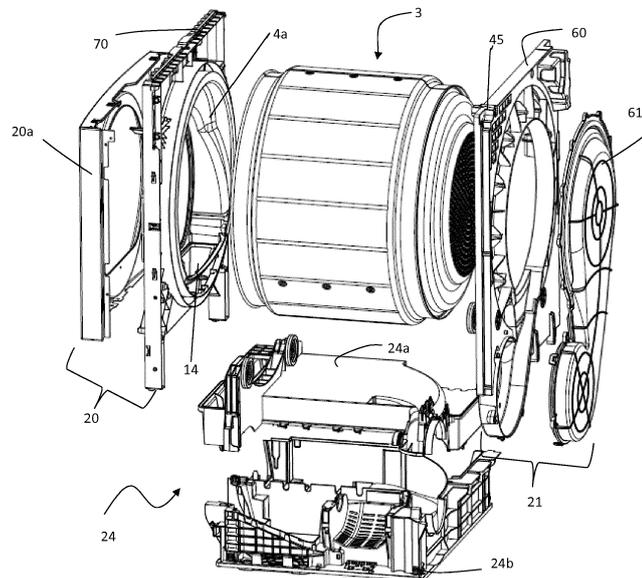


FIG. 4

EP 2 990 521 A1

Description

Technical field

[0001] The present invention relates to a laundry dryer having a cabinet in which a drum is rotatably supported. The drum has a back wall facing a plastic bulkhead which includes a portion of at least one drum support assembly.

Background of the invention

[0002] Laundry dryers typically have a bearing structure or cabinet which generally includes a basement on which a front wall and a rear wall, as well as lateral walls, are mounted. In the cabinet, accessible via a door, a laundry drum is mounted, rotatable around an axis. Such an axis can be horizontal, vertical or tilted. The drum, where the laundry items are contained in order to be dried, is actuated through an electric motor, for example by means of a drive belt, and it is rotatably supported in the front and rear areas thereof by means of pairs of wheels or rollers. In some other solutions, the drum is supported at the front part thereof through an abovementioned pair of rollers and at the rear part by a shaft, preferably coaxial with the rotational axis of the drum. The drum in operation is made to rotate in order to cause agitation of the laundry items to be dried, which repeatedly tumble with the drum while being exposed to a drying air flow.

[0003] The dryer air flow is generated by an air generator, which includes a circuit for conveying a flow of drying air, including a duct along which a fan forces the air into the drum, after the air itself has been heated. The hot air traverses the inside of the drum and is saturated with the moisture transferred by the laundry items contained therein, which items are thus progressively dried. The hot air is generated for example by means of an electrical resistance or using a heat pump. The hot air is generally introduced into the drum through the back of the same and the moist air exits from the drum through the front thereof, which is provided with a central opening, used - in case of front load machines - even with the aim of loading and unloading the laundry items.

[0004] In some prior art dryers, the drum practically consists of a cylindrical wall having open ends, and gaskets of large diameter are provided at the front end and rear end of the cylindrical wall. The laundry is therefore confined between the cylindrical wall, the door of the dryer and the back wall of the cabinet. This solution has several drawbacks, first of all the wear-and-tear of the large gaskets and the continuous contact and friction between the laundry items (which rotate) and the back wall of the cabinet (which is stationary). This movement may damage the laundry items or cause entanglement of the latter. In addition, friction between tumbling laundry and stationary back wall of the cabinet causes energy losses and undesired electrical power consumption to rotate the drum.

[0005] In other known solutions, the drum has a back

wall which is configured as a separate piece with respect to the peripheral cylindrical wall, and rigidly fixed thereto.

[0006] For such dryers, for example the one disclosed in EP 2631354, in some solutions an additional metal closing component is provided, that is cylindrical-shaped, protruding towards the outside of the cabinet and coupled to an opening of the rear wall of the cabinet in order to guarantee the passage of the drying air to the drum.

[0007] However, the construction of such rear wall of the cabinet is rather complex and requires many different components that have to be assembled together. This increases the overall costs of the final dryer.

Summary of the invention

[0008] The present invention relates to a laundry dryer in which the design of the rear portion, i.e. of the rear part, of the laundry dryer, is improved aiming for achieving a good compromise between performances of the laundry dryer and costs of the same.

[0009] Furthermore, another object of the laundry dryer of the invention is to reduce the number of components with respect to prior art laundry dryer, thereby simplifying the assembly of the same.

[0010] Last, but not least, a further object of the laundry dryer of the invention is to provide a rear portion that can be applicable to different types of laundry dryers, either supported by a shaft or by rollers or by a combination of the two, by means of simple modifications of the rear portion design. Advantageously, rollers comprise a plastic, i.e. polymeric, material. In this way noise generated by the contact between drum and rollers is reduced.

[0011] According to an aspect, the invention relates to a laundry dryer comprising:

- a dryer cabinet, comprising a front wall and a rear wall;
- a drum rotatably accommodated within said cabinet, said drum having a first and a second end, said second end being fixedly closed by a back wall which rotates unitarily with the drum;
- a drying air generator, apt to generate a flow of drying air through said drum;
- at least one drum support assembly to rotatably support said drum along an axis of rotation within said cabinet; wherein said rear wall comprises
 - a rear bulkhead to which the second end of said drum is coupled in an axially rotating manner, said rear bulkhead being realized as an integral piece in plastic material and facing on one side said drum back wall and on the other side the exterior of the cabinet, and including a portion of said at least one drum support assembly.

[0012] It should also be observed that, in the present description and in the attached claims, the terms "plastic material" and the like, are used to indicate any plastic, i. e. polymeric or synthetic material, or based on plastic, i. e. polymeric or synthetic material, possibly added with fillers suitable to improve the functional and robustness characteristics thereof, such as minerals, textile synthetic fillers and so on and so forth.

[0013] Furthermore, when relative terms such as "front", "back", "rear", "lateral", "top", "bottom", etc. are used, they refer to the normal operational position of the laundry dryer when in use, e.g. located on a floor which usually is (substantially) horizontal. The location of a door of the laundry dryer, generally coupled to a front wall of the cabinet in order to access the drum, defines the "front" of the dryer itself. Given the horizontal plane on which the laundry is located, "top" and "bottom" - as their normal common meaning - refer to the position of an object along a vertical axis.

[0014] With the term "laundry dryer" or "dryer" both an appliance having drying function only, or a combined washerdryer appliance, which is capable of performing both washing and drying cycles, are meant.

[0015] The laundry dryer of the invention includes a drying chamber, such as a drum, in which the load, e.g. clothes, or other laundry, to be dried is placed. The drum of the dryer of the invention is a closed drum, i.e. it includes a mantle, for example cylindrically shaped, one of whose ends is closed by a back wall or a flange, which rotates as a single piece together with the mantle when the drum is driven into rotation. The connection between the mantle and the back wall or flange can be of any type, and it depends on the material in which mantle and/or back wall or flange are/is realized. The back wall of the drum is preferably perforated, e.g. it includes a plurality of apertures, so that air to dry clothes or any other laundry can be introduced through the rear wall.

[0016] The drum is part of a process air circuit, in particular a closed-loop circuit in case of a condensed dryer or an open circuit in case of a vented dryer, which in both cases includes a process air conduit for channeling a stream of air to dry the load. The process air circuit is connected with its two opposite ends to the drum. More specifically, hot dry air is fed into the drying chamber, flowing over the laundry, and the resulting humid (and to a lower temperature cooled down) air exits the same. In case of a closed-loop drying air circuit, the humid air stream, rich in water vapor, is then fed into a humidity removal element, such as a heat exchanger. In a preferred embodiment of the invention, the humid air is fed to an evaporator of a heat pump system, where the moist process air is further cooled down and the humidity present therein condenses. The resulting cool dry air is then heated up before re-entering again in the drying chamber by means of a hot drying air generator, which can be for example a condenser of the heat pump system, and the whole loop is repeated till the end of the drying cycle. Alternatively or in addition, to remove humidity

from humid air stream exiting the drum, an air-air type heat exchanger may be used. Such heat exchanger receives ambient air as cooling fluid to cool down and remove humidity from humid air stream passing there-through. Furthermore, the hot drying air generator may comprise an electrical or gas powered heating device. In a vented dryer, ambient air is taken into the dryer via an inlet duct, such air is heated up by a hot drying air generator, such as condenser of the heat pump system and/or an electrical or gas powered heating device, before entering the drum. Heated air flowing through and on humid laundry contained in the drum, removes humidity from laundry. Humid air stream exiting the drum may be optionally dehumidified by an evaporator of a heat pump system, or an air-air type heat exchanger as explained above, before being exhausted outside the dryer.

[0017] Thus, the process air conduit to channel the flow of drying air includes an air passage that brings such drying air from the hot drying air generator to the inside of the drum from its rear end, i.e. through its back wall. In other possible solutions of laundry dryer, air is fed from the front of the drum and flows in direction of the rear of the drum.

[0018] The dryer furthermore includes a cabinet or bearing structure, comprising preferably a basement, a front wall and a rear wall. A power cord, provided with a plug, exits from the rear wall of the cabinet and serves for powering the laundry dryer when connected to power mains. The front wall is advantageously provided with a through opening, at which a door is mounted to access the drum in order to locate or remove the laundry. Front wall includes a front bulkhead which is preferably made of a plastic, i.e. polymeric, material, as an integral, i.e. single, unitary piece. The front bulkhead is preferably formed by an injection moulding process. In this way, a number of components arranged in the front part of the cabinet may be advantageously integrated in a single unitary plastic piece forming the front bulkhead. A front part of the drum is rotatably coupled to the front bulkhead. In the front bulkhead a through opening is preferably provided, a door is mounted at said opening to access the drum in order to locate or remove the laundry. The front bulkhead is then preferably covered by a panel which extends around the through opening and defines the external front surface of the front wall of cabinet.

[0019] The basement rests on a floor and its vertical distance from the floor may be advantageously adjusted through regulating feet provided on the lower surface of the basement facing the floor.

[0020] The rear wall of the cabinet forms a rear bulkhead which may include an aperture facing the back wall of the drum or it has one or more wall portions facing the back wall of the drum. Furthermore, the rear bulkhead might include further or different aperture(s). The rear bulkhead forms part of the air process circuit that brings process air to (or from) the drum. Preferably, a rim of the rear drum end abuts against the rear bulkhead and even

more preferably a gasket is interposed therein between. The rear bulkhead is substantially the major part of the rear wall of the cabinet, facing on one side the back wall of the drum, or anyhow the interior of the cabinet, and on

the other side the exterior or the outside of the cabinet. **[0021]** According to the invention, the rear bulkhead is realized in plastic, e.g. polymeric, material as a single, unitary element. The fact that the rear bulkhead is realized in plastic allows a minimization of the numbers of elements included in the rear wall of the dryer of the invention, as it will be better detailed below. Indeed, with a single producing process, for example with the same molding process, preferably an injection molding process, the bulkhead can be realized including a plurality of additional functional elements for the dryer that do not have to be realized separately and then assembled.

[0022] Within the cabinet, the drum is rotatably mounted for rotating according to a substantially horizontal or tilted rotation axis. At least one drum support assembly for rotatably supporting the drum in this rotation around this given rotation axis is provided for within the cabinet.

[0023] According to the invention, a portion of the at least one of said drum support assembly of the drum is formed at the rear bulkhead. The rear bulkhead thus has also the function to hold at least partially via a support assembly the drum for its rotation.

[0024] In this way, the plastic rear bulkhead integrates different functions, it forms part of the drying air circuit, and it includes a portion of the support assembly for the rotatable support of the drum. The configuration of the rear portion of the dryer is thus simplified, limiting the number of elements, and thereby reducing the assembly time, in particular of the rear wall of the cabinet.

[0025] According to the above mentioned aspect, the dryer of the invention may include, alternatively or in combination, one or more of the following characteristics.

[0026] Advantageously, said drum support assembly includes a holder and a drum support element, said holder being provided on said rear bulkhead.

[0027] The drum support assembly includes a drum support element which is for example a shaft or a roller (or both) and a respective holder is provided according to this embodiment at the rear bulkhead. The holder can be of any type and it depends or follows the configuration of the drum supporting element.

[0028] In an embodiment, said rear bulkhead includes a drum aperture facing the back wall of the drum and said rear wall further includes a rear cover connected to said rear bulkhead for closing said drum aperture so that said rear bulkhead and said rear cover form an air passage for said drying air flow to said back wall of said drum.

[0029] As mentioned above, in the process air circuit, the process air exits the drum, preferably passes through the basement where generally the hot air generator is located and then re-enters the drum. Preferably, a portion of the process air circuit is formed in the rear bulkhead as well.

[0030] In order to form the portion of the process air

circuit, or air passage, to introduce the drying air from the hot drying air generator into the drum, the rear wall of the cabinet further includes a rear cover which closes a drum opening preferably realized in the bulkhead itself, which faces the back wall of the drum, so that a close air passage for the drying air is so realized. The rear cover and bulkhead form a closed air passage for drying air exiting the basement and entering the drum. Preferably, such air is blown by a fan, which might be for example also housed in the bulkhead itself. Thus, in this embodiment the rear wall of the cabinet is substantially realized in two pieces, the bulkhead and the cover. The cover on one side faces the back wall of the drum and on the other side the exterior of the cabinet. The combination of the bulkhead and the cover forms the outer rear surface of the cabinet of the dryer. No further panels are preferably present covering said external rear surface.

[0031] The rear portion of the dryer thus includes only few elements in order to form the complete rear wall of the dryer cabinet.

[0032] Advantageously, said laundry dryer includes an impeller of a fan and said rear bulkhead includes a fan aperture for accessing said impeller.

[0033] Preferably, the process air is blown by a fan preferably located within the rear bulkhead and more preferably in the air passage formed in the rear bulkhead. In order to access the fan or the impeller of the same, a fan aperture is formed in the rear bulkhead.

[0034] More preferably, said rear bulkhead includes an integrally formed bulge portion facing said rear back wall of said drum and said rear wall includes a lid connected to said rear bulkhead to cover said fan aperture.

[0035] Instead of having a drum aperture and a fan aperture, in an embodiment the bulkhead includes a single aperture, the fan aperture, and a lid, which covers such a fan aperture. In this embodiment, the air passage for the drying air from the basement to the drum is formed by the rear bulkhead, which also preferably hosts the fan, and the lid which closes the fan aperture forming a closed passage. The air passage is thus substantially a closed cavity formed in the rear bulkhead.

[0036] Alternatively, said fan aperture is covered by said rear cover which extends to cover both said drum aperture and said fan aperture.

[0037] In this different embodiment, both apertures, the drum aperture and the fan aperture are present in the rear bulkhead, however in order to limit the number of components of the rear wall, the rear cover covers both of them, i.e. the cover extends widely enough to cover both apertures.

[0038] Preferably, the cover and/or lid are/is realized in plastic, i.e. polymeric, material.

[0039] In this way, also the cover and/or the lid can have easily any form or can be easily integrated to the rear bulkhead, or themselves/itself may integrate other components of the laundry dryer.

[0040] Preferably, said hot drying air generator includes a condenser of a heat pump system.

[0041] Heat pump dryers generate temperatures lower than dryers including electrical or gas powered air heating devices. Therefore it is preferred to equip a dryer having a plastic, i.e. polymeric, rear bulkhead with a heat pump system as hot drying air generator, so as to avoid any possible melting of the plastic bulkhead due to higher local temperatures at which different hot drying air generators may work.

[0042] In an advantageous embodiment, said drum support assembly includes a shaft, said shaft being connected to said back wall of the drum, said shaft defining said axis of rotation of said drum.

[0043] In order to rotate the drum around a given rotation axis, several possibilities are known. Among them, the drum can be rotatably supported by a shaft arranged at the drum back wall. Preferably, in addition to the shaft, also rollers, generally in the number of two, are used in combination to the shaft to support the drum and are present at or in proximity of the front end of the drum. Instead of rollers, a friction reducing surface may be provided in the region where the front drum end is rotatably coupled to the cabinet front wall. Such friction reducing surface acts as a supporting surface for the drum. The shaft can be supported by a bearing. Depending on whether the shaft is located on the rear bulkhead or in the back wall of the drum, the bearing can be respectively located at the drum itself, e.g. for example integrated or mounted in the back wall of the drum, or at the rear bulkhead, for example integrated or mounted to the latter. In the latter case, a metallic bearing cross integrated in the plastic of the rear bulkhead can be envisaged, e.g. cast to the plastic material of the bulkhead. More preferably, said shaft is fixed to said back wall and said portion of at least one drum support assembly includes a bearing for said shaft.

[0044] In case the drum support assembly includes a shaft and a bearing, the shaft could be located at the back wall of the drum, and the portion of drum support assembly located at the rear bulkhead includes the bearing. For example, the bearing might be embedded in a ring, provided to support the shaft, and said ring is held by supporting ribs which can be realized in the rear bulkhead as well, for example in the center of the drum aperture facing the back wall of the drum and closed by the cover. This ring is advantageously realized integral to said rear bulkhead, thanks to the plastic material of the latter that allows a relatively easy integration in a single piece of different elements.

[0045] In case said shaft is located at the rear bulkhead, the bearing - generally realized in metal - is fixed on the back wall of the drum itself.

[0046] Alternatively or in addition, said drum support assembly includes a roller.

[0047] The drum can be rotatably supported either by a shaft coupled with a bearing at the back of the drum and by rollers supporting the front of the drum, or only by rollers, for example two rollers at the back of the drum and two rollers at the front of the drum. However, any

different number of rollers is included in the invention as well.

[0048] More preferably, said at least drum support assembly includes a boss or a bracket for supporting said roller.

[0049] In case the dryer includes as supporting elements rollers in the back of the drum, in addition or alternatively to the shaft, the rear bulkhead includes a boss where the roller can be fixed. The boss might further include a pin where the roller can be fastened, for example by screws or a snap-fitting combination. Alternatively to bosses, brackets can be formed as well.

[0050] In an advantageous embodiment, said portion of drum support assembly is integrally formed with said rear bulkhead.

[0051] Due to the fact that the rear bulkhead is realized in plastic material as a single body, additional structural elements, such as the portion of drum support element, e.g. the holder of the drum support element, can be realized as well integrally, i.e. in a single unitary piece, therewith. In this way, the assembly of different parts is minimized.

[0052] Preferably, the dryer of the invention includes a basement having an upper shell and a lower shell, said basement defining an additional air passage for said drying air flow.

[0053] In a preferred embodiment, the cabinet includes a basement resting on a floor to which the rear wall and the front wall are connected. The hot drying air generator includes a drying air conduit for the process air, a portion of which is located, or formed, within the basement. Advantageously, the basement may comprise two members or portions forming the drying air conduit when joined one another. The basement further includes an outlet for the drying air.

[0054] In other words, the basement of the dryer also defines a part of the process air conduit for the drying air. For example, in case of a heat pump dryer, the basement is so arranged to house the heat exchangers of the heat pump system.

[0055] More preferably, said basement is realized in plastic, i.e. polymeric, material.

[0056] As seen, the use of plastic allows creating in a substantially free manner different shapes. In this way, the outline of the air channel can be optimized because the most suitable shape of the channel can be formed, enhancing the efficiency of the dryer. Preferably, such plastic basement is used in connection with a heat pump system and a rear bulkhead made in plastic as well, because lower temperatures than in a dryer having an electric or gas powered hot drying air generator are obtained.

[0057] In an advantageous embodiment, said bulkhead includes a water collector for the collection of condensed water, said water collector being integral to said bulkhead.

[0058] The plastic bulkhead allows the integration of many functional components of the dryer in a single unitary piece.

Brief description of the drawings

[0059] Further advantages of the present invention will be better understood with non-limiting reference to the appended drawings, where:

- Fig. 1 is a perspective view of a laundry dryer realized according to the present invention;
- Fig. 2 is a perspective view of the laundry dryer of Fig. 1 with an element of the casing removed for showing some internal components;
- Fig. 3 is a perspective view, in a disassembled configuration, of the basement of the dryer of fig. 1 or Fig. 2;
- Fig. 4 is a perspective exploded view of a portion of the previous Figures;
- Fig. 5 is a perspective exploded view of a first embodiment of a portion of the dryer of the invention;
- Fig. 6 is a perspective view partially disassembled of the rear wall of the cabinet of the dryer of the invention of the embodiment of fig. 5;
- Fig. 7 is a side view of the rear wall of the dryer cabinet of Fig. 6;
- Fig. 8 is a perspective exploded view of a second embodiment of a portion of the dryer of the invention;
- Fig. 9 is a perspective view partially disassembled of a variant of the second embodiment of the dryer of the invention of fig. 8;
- and
- Fig. 10a and Fig. 10b are a perspective view and a side view, respectively, of a detail of the rear wall of the dryer of the invention made according to a further preferred embodiment.

Detailed description of one or more embodiments of the invention

[0060] With initial reference to Figs. 1 and 2, a laundry dryer realized according to the present invention is globally indicated with 1.

[0061] Laundry dryer 1 comprises an outer box casing or cabinet 2, preferably but not necessarily parallelepiped-shaped, and a drying chamber, such as a drum 3, for example having the shape of a hollow cylinder, for housing the laundry and in general the clothes and garments to be dried. The drum 3 is preferably rotatably fixed to the cabinet 2. Access to the drum 3 is achieved for example via a door 4, preferably hinged to cabinet 2, which can open and close an opening 4a realized on the cabinet itself.

[0062] More in detail, cabinet 2 generally includes a front wall 20, a rear wall 21 and two sidewalls 25, all mounted on a basement 24. Preferably, the basement 24 is realized in plastic material. Preferably, basement 24 is molded via an injection molding process. Preferably, on the front wall 20, the door 4 is hinged so as to access the drum. The cabinet, with its walls, defines the volume of the laundry dryer 1. Advantageously, basement 24 in-

cludes an upper and a lower shell portion 24a, 24b (visible in figure 3 detailed below). The basement 24 rests on a floor and its vertical distance from the floor may be advantageously adjusted through regulating feet 46 provided on the lower surface of the basement facing the floor.

[0063] The dryer 1, and in particular basement 24, defines an horizontal plane (X,Y) which is substantially the plane of the ground on which the dryer 1 is situated, thus it is considered to be substantially horizontal, and a vertical direction Z perpendicular to the plane (X,Y).

[0064] Laundry dryer 1 also preferably comprises an electrical motor assembly 50 for rotating, on command, revolving drum 3 along its axis inside cabinet 2. Door 4 and electrical motor assembly 50 are common parts in the technical field and are considered to be known; therefore they will not be described in detail.

[0065] Further, laundry dryer 1 may include an electronic central control unit (not shown) which controls both the electrical motor assembly 50 and other components of the dryer 1 to perform, on command, one of the user-selectable drying cycles preferably stored in the same central control unit. The programs as well other parameters of the laundry dryer 1, or alarm and warning functions can be set and/or visualized in a control panel 11, preferably realized in a top portion of the dryer 1, such as above door 4.

[0066] With reference to Figures 2, and 5 to 9, the rotatable drum 3 includes a mantle, having preferably a substantially cylindrical, tubular body 3c, which is preferably made of metal material, is arranged inside the cabinet 2 and is apt to rotate around a general rotational axis R which can be horizontal, i.e. parallel to the (X,Y) plane, or tilted with respect to the latter. The mantle 3c defines a first end 3a and a second end 3b and the drum 3 is so arranged that the first end 3a (including a circular front rim 3f) of the mantle 3c is faced to the laundry loading/unloading opening realized on the front wall 20 of the cabinet 2 and the door 4, while the second end 3b has also a rim 3e which shows preferably a circular shape.

The second or rear end 3b of the drum 3 (including rim 3e) is closed by a back wall 8.

Preferably, drum back wall 8 is faced to the rear wall 21 of the cabinet 2 and is permanently and rigidly coupled to the second end 3b of mantle 3c of the drum 3 so as to close said second end 3b. Back wall 8 forms, together with lateral mantle 3c, a substantially cylindrical, cup-shaped rigid container structured for housing the laundry to be dried. Preferably the drum back wall 8 is coupled to the circular rim 3e second end 3b of mantle 3c of the drum 3.

In a preferred embodiment, the rotatable drum 3 is formed only by two bodies joined together, one of said two bodies being the mantle 3c and the other of said two bodies being the back wall 8 which is permanently fixed to the rear end 3b of said mantle 3c and rotates therewith when drum 3 rotates.

[0067] Preferably, the back wall 8 is furthermore suitably perforated so as to allow a stream of drying air to

flow through the back wall 8 of the tubular shaped body of the drum 3.

The perforated portion of back wall 8 is located approximately at the center of the back wall 8 so as to be substantially coaxial to the longitudinal rotational axis R of the rotatable drum 3, and is preferably substantially circular in shape. The remaining portion of the back wall 8, including an outer rim 8a thereof, is not perforated. Perforations in the back wall 8 will be called, in the following, vents 65.

[0068] Dryer 1 additionally includes a process air circuit which comprises the drum 3 and a process air conduit 18, depicted as a plurality of arrows showing the path flow of a process air stream through the dryer 1 (see Figures 3, 5 and 8). In the basement 24, process air conduit 18 is formed by the connection of the upper shell 24a and the lower shell 24b. Air process conduit 18 is preferably connected with its opposite ends to the two opposite sides of drum 3, i.e. first and second rear end 3a,3b of mantle 3c. Process air circuit also includes a fan or blower 12 (shown in fig. 3).

[0069] The dryer 1 of the invention additionally comprises a hot drying air generator, that in the depicted embodiment includes a condenser of a heat pump system 30. The heat pump system 30 includes a first heat exchanger (called also condenser) 31 and a second heat exchanger (called also evaporator) 32 (see figure 3). Heat pump 30 also includes a refrigerant closed circuit (partly depicted) in which a refrigerant fluid flows, when the dryer 1 is in operation, cools off and may condense in correspondence of the condenser 31, releasing heat, and warms up, in correspondence of the second heat exchanger (evaporator) 32, absorbing heat. A compressor 33 receives refrigerant in a gaseous state from the evaporator 32 and supplies the condenser 31, thereby closing the refrigerant cycle. In the following the heat exchangers are named either condenser and evaporator or first and second heat exchanger, respectively. More in detail, the heat pump circuit connects via piping 35 (see Fig. 3) the second heat exchanger (evaporator) 32 via the compressor 33 to the condenser 31. The outlet of condenser 31 is connected to the inlet of the evaporator 32 via an expansion device (not visible), such as a choke, a valve or a capillary tube.

[0070] Preferably, in correspondence of evaporator 32, the laundry dryer 1 of the invention may include a condensed-water canister (also not visible) which collects the condensed water produced, when the dryer 1 is in operation, inside evaporator 32 by condensation of the surplus moisture in the process air stream arriving from the drying chamber (i.e. drum) 3. The canister is located at the bottom of the evaporator 32. Preferably, through a connecting pipe and a pump (not shown in the drawings), the collected water is sent in a reservoir located in correspondence of the highest portion of the dryer 1 so as to facilitate a comfortable manual discharge of the water by the user of the dryer 1.

[0071] The condenser 31 and the evaporator 32 of the

heat pump 30 are located in correspondence of the process air conduit 18 formed in the basement 24.

[0072] In case of a condense-type dryer - as depicted in the appended figures - where the process air circuit is a closed loop circuit, the condenser 31 is located downstream of the evaporator 32. The air exiting the drum 3 enters the process air conduit 18 and reaches the evaporator 32 which cools down and dehumidifies the process air. The dry cool process air continues to flow through the process air conduit 18 till it enters the condenser 31, where it is warmed up by the heat pump 30 before re-entering the drum 3.

[0073] It is to be understood that in the dryer 1 of the invention, an air heater, such as an electrical heater, can also be present, in addition to the heat pump 30. In this case, heat pump 30 and heater can also work together to speed up the heating process (and thus reducing the drying cycle time). In the latter case, preferably condenser 31 of heat pump 30 is located upstream the heater. Appropriate measures should be provided to avoid the electric heater to fuse plastic components of the dryer 1.

[0074] With reference to Figures 2 and 4, the front rim 3f of drum 3, e.g. the circular front rim of the substantially cylindrical mantle 3c, is furthermore coupled in preferably substantially airtight and axially rotating manner to the front wall 20 of cabinet 2, preferably with the interposition of a first circular sealing gasket (not depicted). Front wall 20 is preferably coupled to basement 24. Front wall 20 includes a front bulkhead 70 where the opening 4a for the door 4 is realized and to which the drum 3 is coupled for rotation. The front bulkhead 70 is then preferably covered by a panel 20a extending around the opening 4a and defining the external front surface of the front wall 20 of cabinet 2. The front bulkhead 70 is preferably made of a plastic, i.e. polymeric, material, as an integral, i.e. single, unitary piece. Advantageously, a portion of the process air conduit 18 is formed integrally with the front bulkhead. Process air exits the drum through an air-vent 14 formed in the front bulkhead 70. Such air-vent 14 is preferably shaped so as to receive an air filter therein.

[0075] With reference to Figs. 5 to 9, the rear wall 21 of the cabinet 2 includes a supporting panel or rear bulkhead 60. The back wall 8 of drum 3 substantially faces the rear bulkhead 60 and is coupled in substantially airtight and axially rotating manner to it with the interposition of a second circular sealing gasket 62. Front circular gasket (not shown) and rear circular sealing gasket 62 are preferably substantially coaxial to the longitudinal rotational axis R of the drum 3.

The rear bulkhead 60 is made in a plastic, for instance polymeric, material by means, for instance, of an injection molding process.

[0076] A power cord (not shown in the drawings), provided with a plug, exits from the rear wall of the cabinet through a passage 45 and serves for powering the laundry dryer when connected to power mains.

In a preferred embodiment of the invention, the rear wall 21 of the cabinet 2 includes only two elements, the rear

bulkhead 60 and a cover 61 or a lid 610, simplifying the construction of the back wall 21 of the cabinet 2. In particular, the rear bulkhead 60 includes a first surface 60a facing the interior of the cabinet 2, such as the back wall 8 of the drum 3, and a second surface 60b facing the exterior or the outside of the cabinet 2. Optionally, the rear bulkhead 60 includes at least a portion of a, more preferably a whole, fan housing 150 to house an impeller (not depicted) of the fan 12 (shown in Fig. 3) of the process air circuit.

Two possible embodiments of the rear wall 21 of the cabinet 2 of the dryer 1 are envisaged.

A first embodiment is now described with reference to Figs. 5 to 7. In the depicted laundry dryer 1, the rear wall 21 of the cabinet 2 forms a rear bulkhead 60 which faces the whole back wall 8 of the drum 3, and it is realized as a single, unitary, piece. Preferably, the rear wall 21 of the cabinet 2 includes also a fan housing 150, covered by a lid 610 which is attached, in a detachable manner, to the rear bulkhead 60. Thus a fan aperture 61a is formed in the bulkhead 60 which is closed by the lid 610, fan aperture used to access the fan 12, and in particular an impeller of the same (not visible in the appended drawings shown in Figs 5 to 7). The aperture 61a is located substantially below the location of the back wall 8 and faces the interior of the cabinet 2, in this example, the basement 24 and more preferably an outlet 19 of the air from the basement 24. The rear bulkhead 60 further includes a portion facing the back wall 8 of the drum 3 having preferably a substantially circular central bulge 141 which protrudes outwardly (when assembled within the cabinet 2).

As can be seen clearly in Figs. 6 and 7, in this embodiment, the aperture 61a, when the rear wall 21 of the cabinet 2 is assembled, is closed by the lid 610.

Furthermore, as illustrated in the above example, the whole fan housing 150 is realized within the rear wall 21 and it is composed by a first cup-shaped portion 142 (which belongs to the rear bulkhead 60) and the lid 610. The first cup-shaped portion 142 is provided with a through opening 142a, in the example shown circular, for housing the relevant shaft (not shown) of the fan 12 having an impeller (not shown). Of course, the impeller is housed in the housing 150. The same opening 142a is also used for the inlet process air to enter the fan 12. Therefore, in the process air conduit 18, air exits the basement, where it has been heated and/or dried by the drying air generator - heat pump 30 -, from outlet 19, and enters into the fan housing 150. From the fan housing 150, which is a closed element being the fan aperture 61a closed by lid 610, a conduit portion formed by the rear bulkhead 60 and the lid 610 channels air to the central bulge 141 from where air enters into the drum 3 via the back wall 8.

Coming back to Figure 5, a groove 144 is preferably provided outside an outline of the central bulge 141. The groove 144 is preferably apt to house the aforementioned second sealing gasket 62 (see above). It is obvious for

the man skilled in the art that the groove 144 could be replaced by a gasket supporting collar which protrudes from the inner face of the rear bulkhead 60.

The sealing gasket 62 is preferably encircled and fitted/recessed into the groove 144, and is suitably shaped/dimensioned so as to permanently come in abutment against the rear rim 3e of the rotatable drum 3 without interruption all around the perimeter of the latter, so as to avoid any air leakage between the rear rim 3e of rotatable drum 3 and the supporting rear bulkhead 60.

In the example shown, the drum 3 is preferably structured for being rotatably supported by a drum support assembly, including a plurality of rollers 10 which are arranged - off-axis with respect to the general rotational axis R of the drum 3 - approximately at the two axial ends 3a, 3b of the drum 3, with their rotation axis substantially parallel to the general rotational axis R of the drum 3, so as to allow the tubular body of the drum 3 to rotate about the longitudinal reference or general rotational axis R inside the cabinet 2. Preferably, two of such rollers 10 are located at the front end 3a of the drum 3 and two other of such rollers 10 are located at the back end 3b of the drum 3. Advantageously, rollers 10 comprise a plastic, i.e. polymeric, material.

Two rollers (or more) are fixed to the rear bulkhead 60. Further, the drum support assembly includes, bosses or pins or brackets 101 by means of which the rollers are attached to the rear bulkhead and are fixed therein by means of screws or snap-fitting connections (not depicted in the present drawings). The bosses or brackets are preferably formed as a single unitary piece with the rear bulkhead.

The rear bulkhead 60 thus includes a supporting boss 101 of the corresponding supporting roller 10, which is preferably built also in one piece (preferably via an injection molding process) with the rear bulkhead 60 (see for example figures 5 and 7). More preferably, all supporting bosses of the rollers 10 located in proximity of the rear end 3b of drum 3 are located at, and more preferably integral to, the rear bulkhead 60. Each supporting boss 101 protrudes inwardly from the rear bulkhead 60, i.e. protrudes towards the rotatable drum 3 when the rear bulkhead 60 is mounted on the cabinet 2.

In an advantageous embodiment, the bosses 101 could be conically shaped, tapered outwardly and provided with a central bore 102. The idle supporting roller 10 in turn may comprise a bearing which is mounted on the supporting boss 101 by means of a screw (bearing and screws not shown in the drawings).

The rollers 10 located at the front of the drum 3 may be either connected to the front bulkhead 70 or they might be connected to one of the two shells 24a or 24b of the basement 24. For example, Fig. 2 shows a roller 10 connected to the upper shell 24a of the basement via a bracket 101a. A front bulkhead 70 made of a plastic, i.e. polymeric, material allows forming, if desired, a roller support as an integral piece of the front bulkhead.

[0077] A second embodiment is now described with

reference to Figs. 8 and 9. Elements which are identical in the first and second embodiment will not be further described. In this second embodiment, the rear bulkhead 60 includes a through drum aperture 64 located in front of the back wall 8 of the drum 3, thus from this drum aperture 64 the back wall 8 is visible. Further, the rear wall 21 includes a cover 61 which is coupled to the rear bulkhead 60 in order to close aperture 64. In this embodiment, the rear wall 31 further includes the fan housing 150 having a similar shape as in the first embodiment. As in the precedent embodiment, preferably the rear bulkhead 60 includes a portion of the fan housing 150, for example the first cup-shaped portion 142 defining aperture 61a. However in this embodiment, the cover 61, by means of one of its portions 143, closes both through drum aperture 64 and fan aperture 61a, therefore forming, together with the first portion 142, the housing for the fan 150. In this case, the rear bulkhead 60 does not include, or includes a limited, central bulge 141. The bulge, in turn, is formed in the cover 61 which comprises a central bulge 146.

A power cord (not shown in the drawings), provided with a plug, exits from the rear wall of the cabinet through a passage 45 and serves for powering the laundry dryer when connected to power mains.

[0078] In a different embodiment, not depicted, the rear wall 21 includes both cover 61 and lid 610 as two separate pieces covering drum aperture 64 and fan aperture 61a respectively.

Also in the second embodiment, the groove 144 is formed so as preferably to house the aforementioned sealing gasket 62.

In this embodiment, in the process air conduit 18, air exits the basement from outlet 19 and enters into the fan housing 150. From the fan housing 150, closed by cover 61, a conduit portion channels air to the central bulge 146 from where air enters into the drum 3 via the back wall 8. The conduit portion is thus formed by the rear bulkhead 60 and the cover 61.

[0079] In the embodiment of fig. 8, the drum 3 is preferably structured for being rotatably supported by a drum support assembly which includes a plurality of rollers 10 which are arranged in an analogous manner as in the first embodiment of Figs. 5-7.

Two rollers (or more) are fixed to the rear bulkhead 60, for example they are attached via bosses or pins or brackets 101 to the rear bulkhead and are fixed therein by means of screws or snap-fitting connections (not depicted in the present drawings). The bosses or brackets are preferably formed as a single unitary piece with the rear bulkhead.

The rollers 10 located at the front of the drum may be either connected to the front bulkhead 70 or they might be connected to one of the two shells 24a or 24b of the basement 24. For example, Fig. 2 shows a roller 10 connected to the upper shell 24a of the basement via a bracket 101a. A front bulkhead 70 made of a plastic, i.e. polymeric, material allows forming, if desired, a roller sup-

port as an integral piece of the front bulkhead. Said roller support is designed to rotatably receive the roller.

[0080] Fig. 9 shows a variant of the second embodiment of fig. 8. The bulkhead 60 is analogous to the embodiment of fig. 8 with the exception of the drum support assembly for the drum 3, as detailed below. In this variant of Fig. 9, the drum 3 is supported in rotation by a drum support assembly including a shaft 41 connected to the back wall 8 of the drum 3. The shaft 41 is supported in turn by a bearing 40 which is located at the rear bulkhead 60. Thus the bulkhead includes a portion of the drum support assembly including the bearing 40. The bearing 40 is located inside a plastic ring 67 positioned at the center of aperture 64 and supported by ribs 68. The shaft 41 is preferably coaxial with the general rotational axis R of drum 3.

The ring 67 is located substantially coaxially with shaft 41 so that the latter can be inserted in, and thereby supported by the ring 67. Preferably, ring 67 and ribs 68 are made of plastic material, more preferably of the same plastic material as the rear bulkhead 60. Further, plastic ring 67 and plastic ribs 68 could be realized integral to the rear bulkhead 60.

[0081] It is to be understood that also in the first embodiment, where the rear wall 21 is formed by the rear bulkhead 60 and the lid 610, the drum 3 can be supported by a shaft (this variant of the first embodiment is not shown in the appended drawings), the construction of the drum support assembly including a shaft being the same as in the variant depicted in Fig. 9 with the exception of cover 61 which is substituted by lid 610 and an integral bulge 141 is formed on the rear bulkhead 60.

[0082] In all the embodiments shown, the flow of drying air generated by the heat pump 30 is as follows. The humid air from the laundry (processed in the drum 3) exits the drum 3 from its front end 3a. The process air circuit 18 (depicted as arrows in the Figures) communicates with, i.e. is fluidly connected to, the front end 3a of the rotatable drum 3 via a pass-through opening 17 made in the basement 24, for example in the upper shell 24a, which is further in flow communication with air vent 14 provided in the front bulkhead 70 of the cabinet 2. The air comes out of the drum 3 via the escape air-vent 14 incorporated in the preferably funnel-shaped coupling element of the front bulkhead 70 that delimits/surrounds the laundry loading/unloading opening 4a on front wall 20 of the cabinet 2. Furthermore, in the examples shown, in particular in Fig. 3, a central/intermediate section of the process air conduit 18 preferably extends across the basement 24 of cabinet 2, where preferably also the heat exchangers 31, 32 are housed, and the circulated drying process air is dehumidified and heated. Advantageously, the lower and upper shells 24a, 24b are coupled one on top of the other, forming at least a portion of the process air conduit 18 and more preferably also include further cavities or seats adapted to receive therein further operational components of the dryer for operating a drying process. Air exits the basement through the outlet 19.

The process air conduit 18 includes a further portion realized in the back wall 21 of the cabinet 2 and this portion is formed by the back wall 8 of the drum, by the rear bulkhead 60 and by the cover 61 or by the lid 610. The air from the basement outlet 19 enters the fan housing 150 and this conduit portion channels air exiting from the outlet 19 into the drum 3 through the apertures or vents 65 realized in the back wall 8.

In this way, intake air-vents 65 incorporated into the rear wall 8 of drum 3 are in communication with, i.e. are fluidly connected to, the process air conduit 18 so as to receive the stream of hot air produced by the heat pump 30 located in the basement 24.

Preferably the back wall 8 of tubular body (or drum) 3 is located/arranged within the perimeter of the bulge 141 on rear bulkhead 60 (Fig. 5) or, alternatively, on bulge 146 of cover 61 (Figs. 7 or 8).

The bulge (141 in Figs. 5 to 7 or 146 in Figs. 8 and 9) furthermore has advantageously a peripheral diameter lower than the nominal diameter of the mantle 3c of the drum 3 and/or the outer diameter of back wall 8 of the drum 3, and preferably also greater than the peripheral diameter of the perforated portion of back wall 8, so that the perforated portion of back wall 8 is located/arranged approximately at center of the bulge.

Lastly, the bulge 141 of supporting rear bulkhead 60 shown in Fig. 5 preferably communicates with the outlet 19 via a pass-through opening 66 realized on the bottom of the same bulge. The opening 66 and outlet 19 are preferably connected via an air passage formed within, at least for a portion, the fan housing 150.

Indeed, in both embodiments, fan 12 (Fig. 3) is blowing air exiting the heat pump 30 to the drum 3 and it is preferably located in front of the outlet 19. The fan 12 thus blows air inside the rear wall 21 of the dryer 1, i.e. between the rear bulkhead 60 and the cover 61 or between rear bulkhead 60 and lid 610, so that the air can enter the drum 3 via the vents 65 in the back wall 8 of the drum 3. In all depicted embodiments, preferably the cover 61 or the lid 610 is attached to the outer face of supporting rear bulkhead 60, preferably in substantially airtight manner. In case the lid 610 is present, the lid 610 is suitably shaped/structured to fluidly connect the bulge 141 of the supporting rear bulkhead 60 to the outlet 19, so as to channel the stream of hot air produced by heat pump 30 towards the bulge 141.

In case the cover 61 is present, which forms the bulge 146, the rear bulkhead 60 and the cover 61 together form a conduit so that the air from the basement 24 can enter the bulge 146 and flow in the drum 3.

[0083] With reference now to all embodiments, the laundry dryer 1 includes at least a drum support assembly for a support, such as the shaft 41/bearing 40 or the rollers 10/brackets 101a or bosses 101, of the drum 3, a portion of which (e.g. bosses 101, bearing 40) is realized at the rear bulkhead 60 and more preferably integral to the plastic rear bulkhead 60.

[0084] However, additional drum support assembly

can be present which do not include a portion provided at the rear bulkhead. For example, in all embodiments, the drum is supported also by one or more rollers 10, generally two, located at the front of the drum 3.

In this case, each of the rollers located at the front of the drum also includes a holder, which can be placed in different locations. The holder, for example a boss or a bracket realized in an analogue manner as the boss or bracket formed at the rear bulkhead, is provided either:

- in said front bulkhead 70;
- in said upper shell portion 24a of the basement 24; or
- in said lower shell portion 24b of the basement 24.

[0085] In addition, one portion of a drum support assembly is always realized at the rear bulkhead, but also at the rear of the drum other drum support assemblies can be realized as well. Thus, in addition to the shaft or to one roller connected to the rear bulkhead, a further roller can be realized, said roller being connected to the upper shell portion 24a of the basement or to the lower shell portion 24b of the basement.

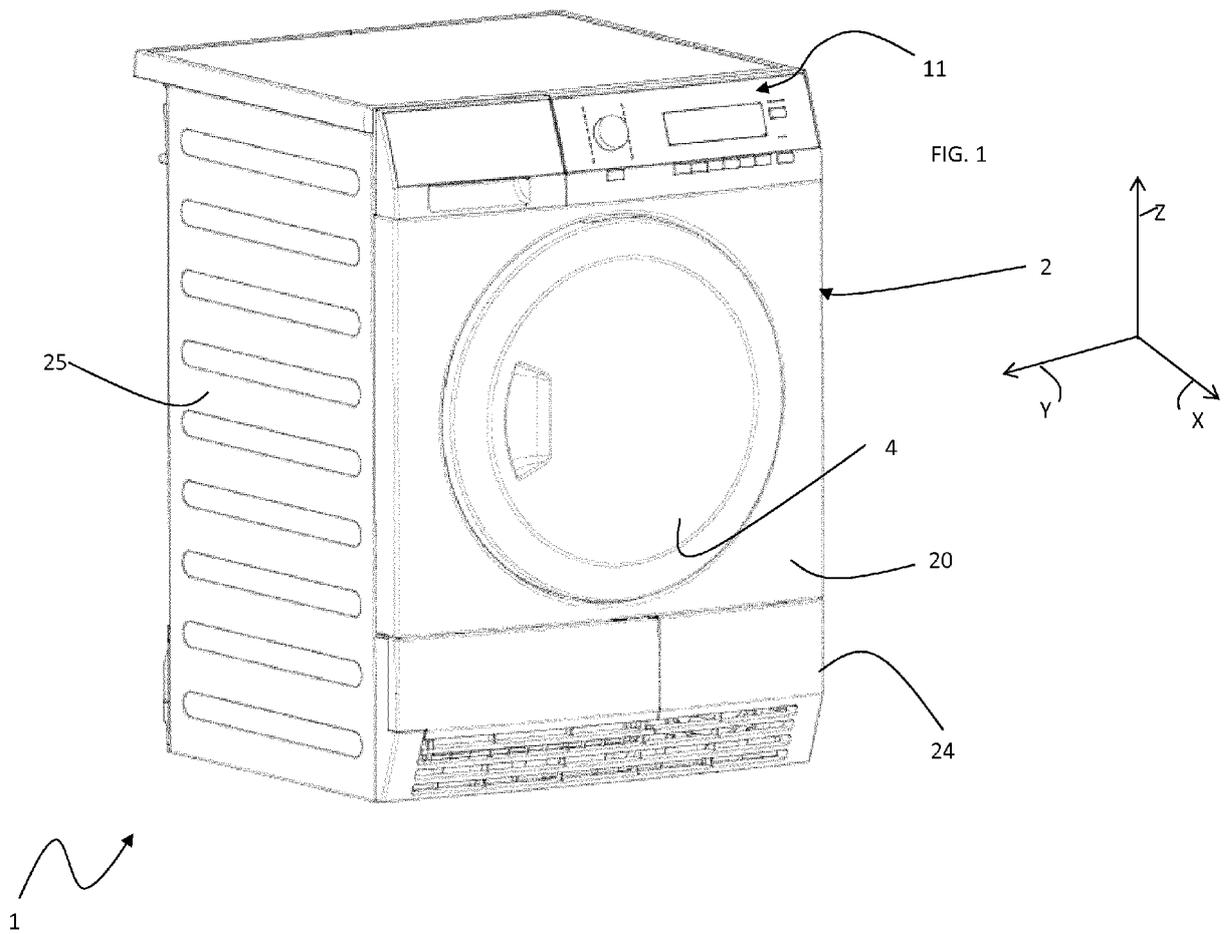
[0086] As depicted in Figs. 10a and 10b, the rear bulkhead 60 may further include other functional elements of the dryer, thanks to its plastic fabrication that makes the integration of additional elements easy. In the mentioned drawing, the rear bulkhead 60 further includes a water collector 200 for the collector of water that may spill from a condensate drawer. Condensate drawer is known in the art and will not be further detailed. As shown, the water collector 200 is integral with the bulkhead forming a single piece. In this embodiment, preferably also the bosses for rollers 10 are integral with the bulkhead, so that an easy assembly of the dryer is achieved.

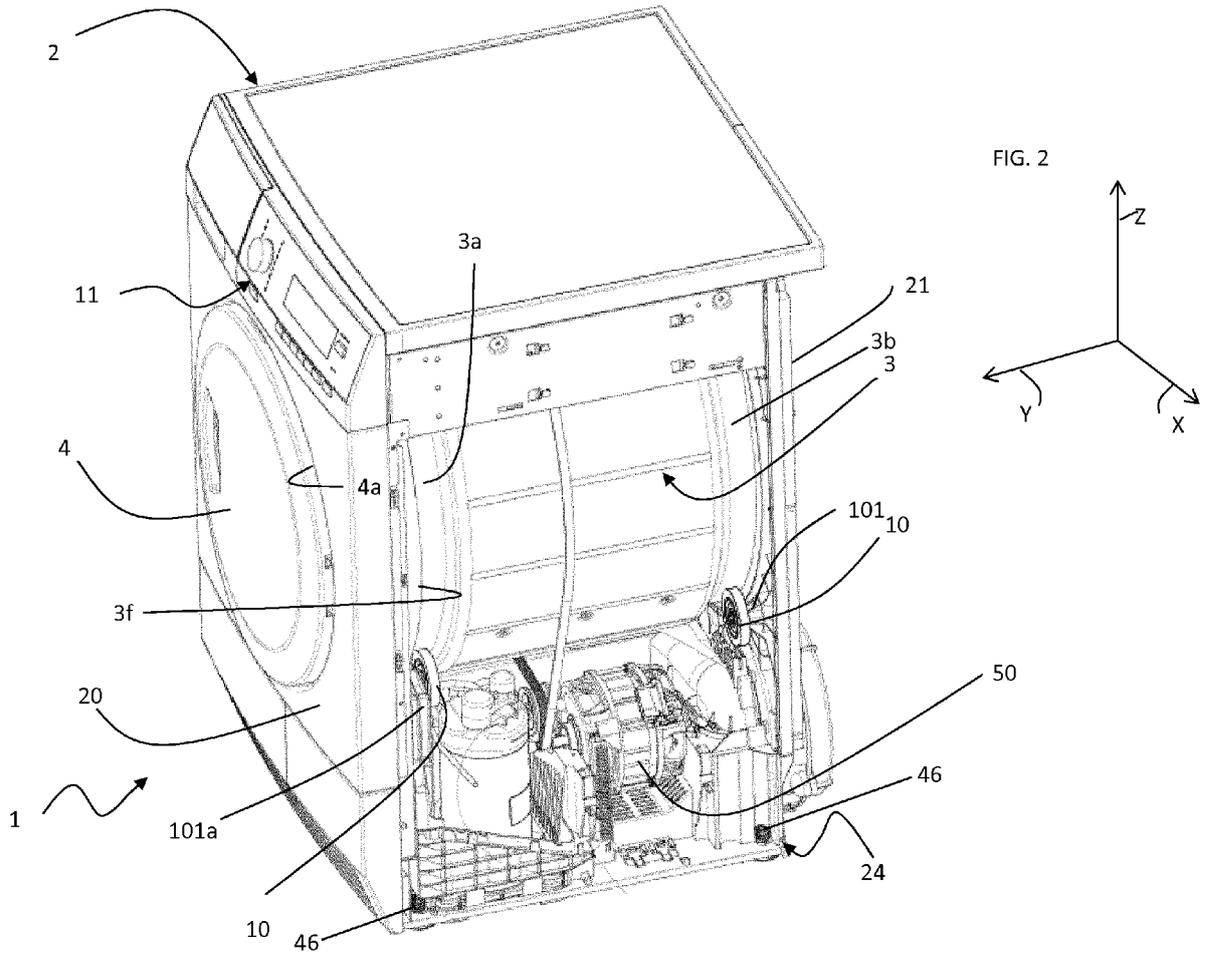
Claims

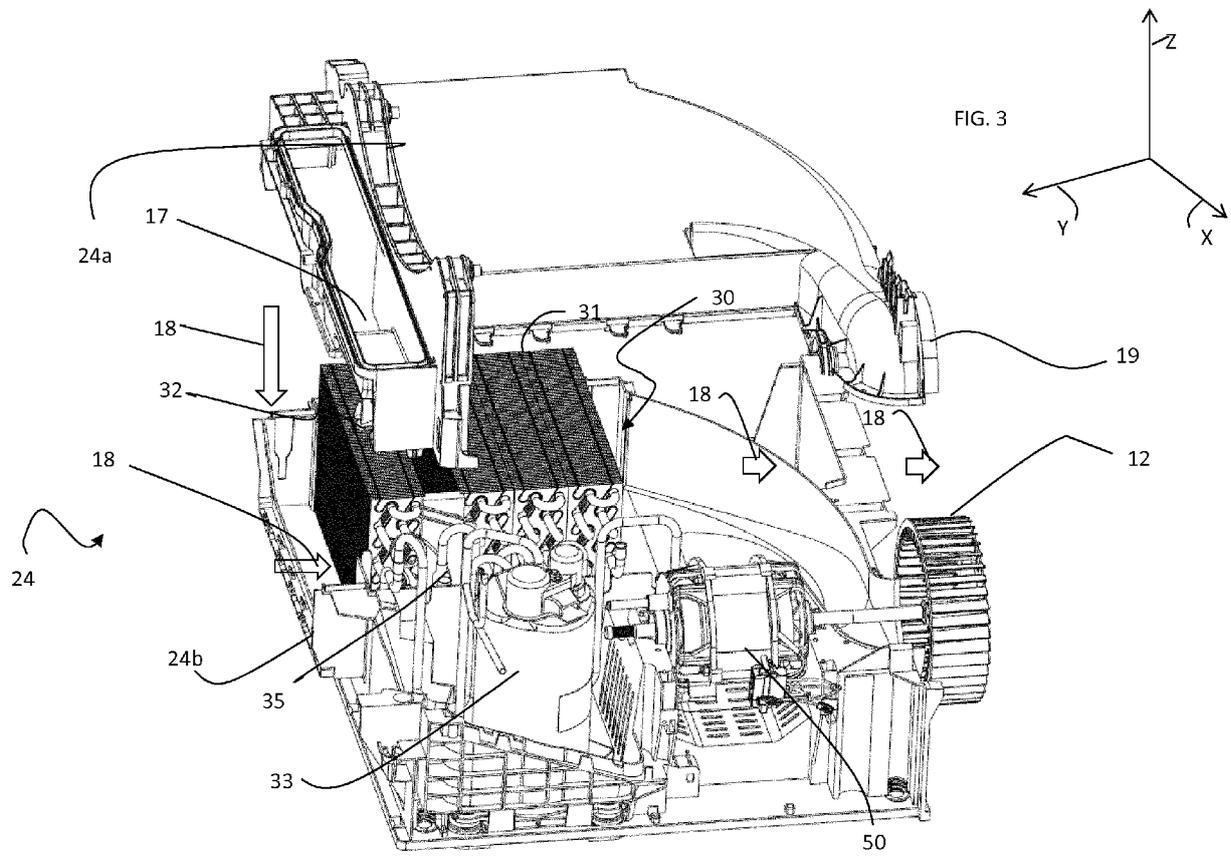
1. A laundry dryer (1) comprising:

- a dryer cabinet (2), comprising a front wall (20) and a rear wall (21);
- a drum (3) rotatably accommodated within said cabinet (2), said drum (3) having a first (3a) and a second end (3b), said second end being fixedly closed by a back wall (8) which rotates unitarily with the drum (3);
- a drying air generator (30), apt to generate a flow of drying air through said drum (3);
- at least one drum support assembly (10; 41; 101; 40) to rotatably support said drum (3) along an axis (R) of rotation within said cabinet (2);
- wherein said front wall (20) comprises a front bulkhead (70) to which the first end (3a) of said drum is coupled in an axially rotating manner, said front bulkhead being realized in plastic material as an integral piece, and said rear wall (21) comprises

- a rear bulkhead (60) to which the second end (3b) of said drum is coupled in an axially rotating manner, said rear bulkhead being realized as an integral piece in plastic material and facing on one side said drum back wall (8) and on the other side the exterior of the cabinet, and including a portion (40; 101) of said at least one drum support assembly (10; 41; 101; 40).
2. The laundry dryer according to claim 1, wherein said drum support assembly (10; 41; 101; 40) includes a holder (40; 101) and a drum support element (41, 10), said holder being provided on said rear bulkhead (60).
 3. The laundry dryer (1) according to claim 1 or 2, wherein said rear bulkhead (60) includes an drum aperture (64) facing the back wall (8) of the drum (3) and a rear cover (61) connected to said rear bulkhead (60) closing said drum aperture, so that said rear bulkhead (60) and said rear cover (61) form an air passage for said drying air flow to said back wall (8) of said drum (3).
 4. The laundry dryer (1) according to any of the preceding claims, including an impeller of a fan (12) and wherein said rear bulkhead (60) includes a fan aperture (61a) for accessing said impeller.
 5. The laundry dryer (1) according to claim 4, wherein said rear bulkhead (60) includes an integrally formed bulge portion (141) facing said back wall (8) of said drum (3), and said rear wall (21) of said cabinet (2) includes a lid (610) connected to said rear bulkhead (60) to cover said fan aperture (61a).
 6. The laundry dryer (1) according to claim 4 when dependent on claim 2, wherein said fan aperture (61a) is covered by said rear cover (61) which extends to cover both said drum aperture (64) and said fan aperture (61a).
 7. The laundry dryer (1) according to any of the preceding claims, wherein said drying air generator (30) includes a condenser (31) of a heat pump system.
 8. The laundry dryer (1) according to any of the preceding claims, wherein said at least one drum support assembly (10; 41; 101; 40) includes a shaft (41), said shaft (41) being connected to said back wall (8) of the drum (3), and said shaft (41) defining said axis of rotation (R) of said drum (3).
 9. The laundry dryer (1) according to claim 8, wherein said shaft (41) is fixed to said back wall (8) and said portion of at least one drum support assembly (40; 101) includes a bearing (40) for said shaft (41).
 10. The laundry dryer (1) according to any of the preceding claims, wherein said at least one drum support assembly (10; 40) includes a roller (10).
 11. The laundry dryer (1) according to claim 10, wherein said at least one drum support assembly includes a boss (101) or a bracket for supporting said roller (10).
 12. The laundry dryer (1) according to any of the preceding claims wherein said portion of said drum support assembly (10; 41; 101; 40) is integral to said rear bulkhead (60).
 13. The laundry dryer (1) according to any of the preceding claims, including a basement (24) having an upper shell (24a) and a lower shell (24b), said basement defining an additional air passage for said drying air flow.
 14. The laundry dryer (1) according to claim 13, wherein said basement (24) is realized in plastic material.
 15. The laundry dryer (1) according to any of the preceding claims, wherein said rear bulkhead (60) includes a water collector (200) for the collection of condensed water, said water collector (20) being integral to said rear bulkhead.







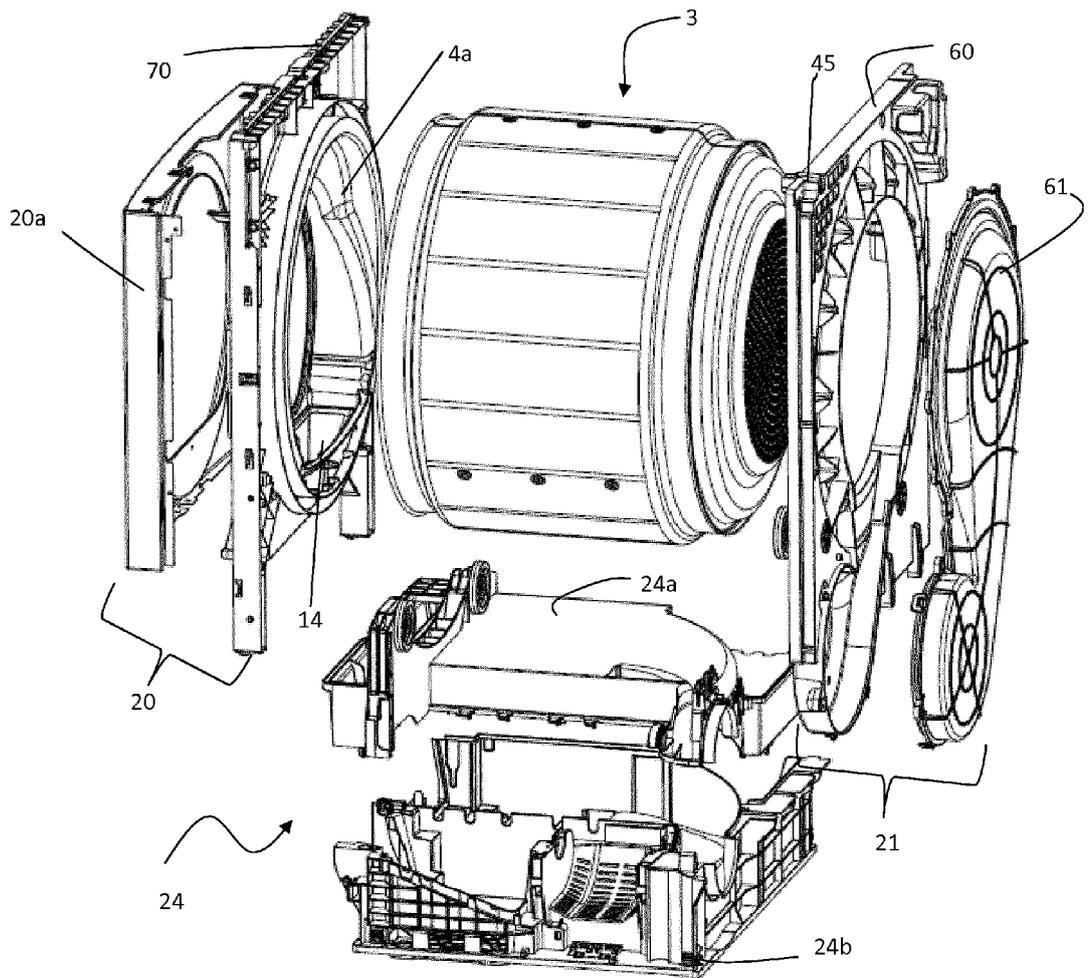
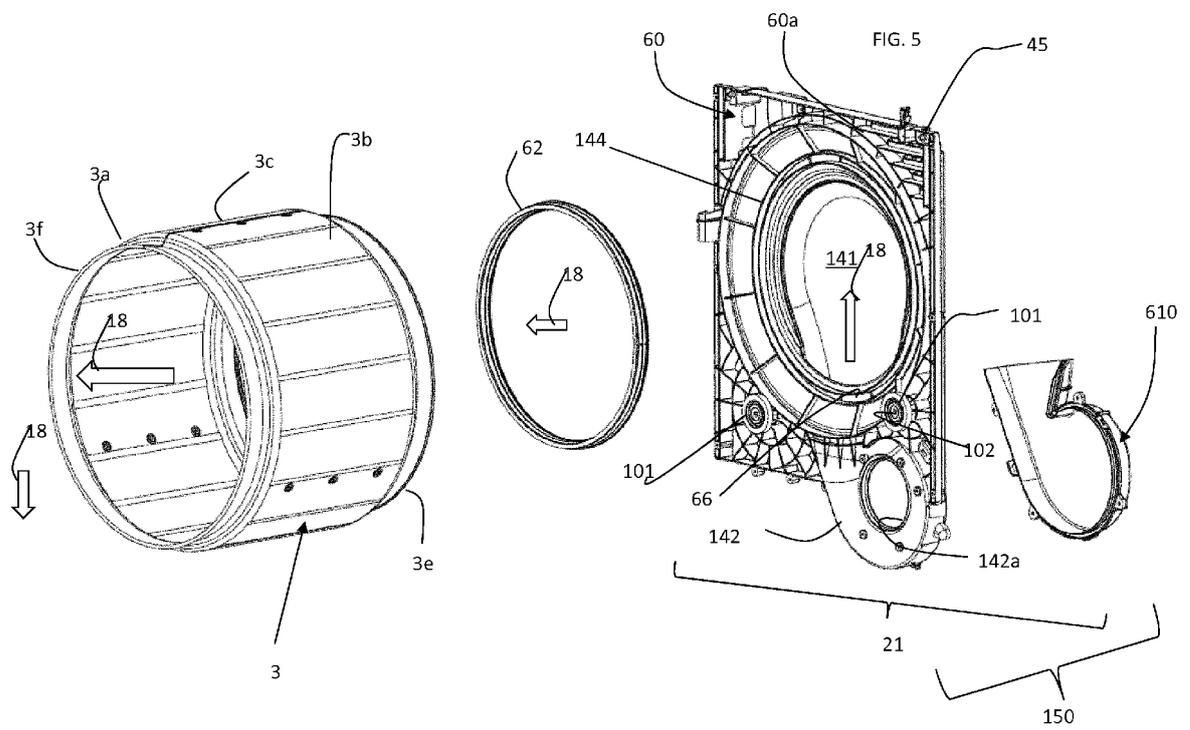
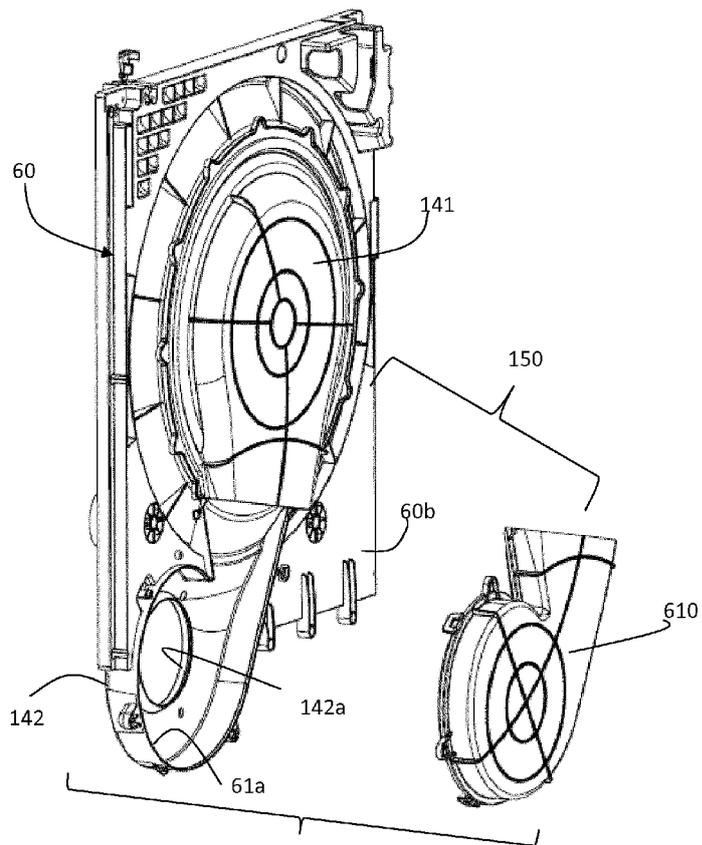


FIG. 4





21
FIG. 6

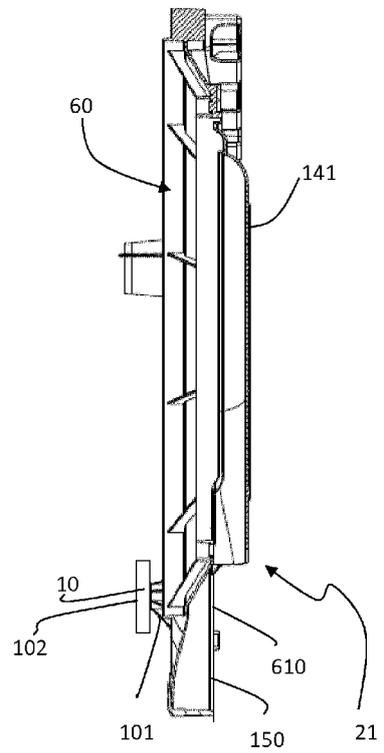
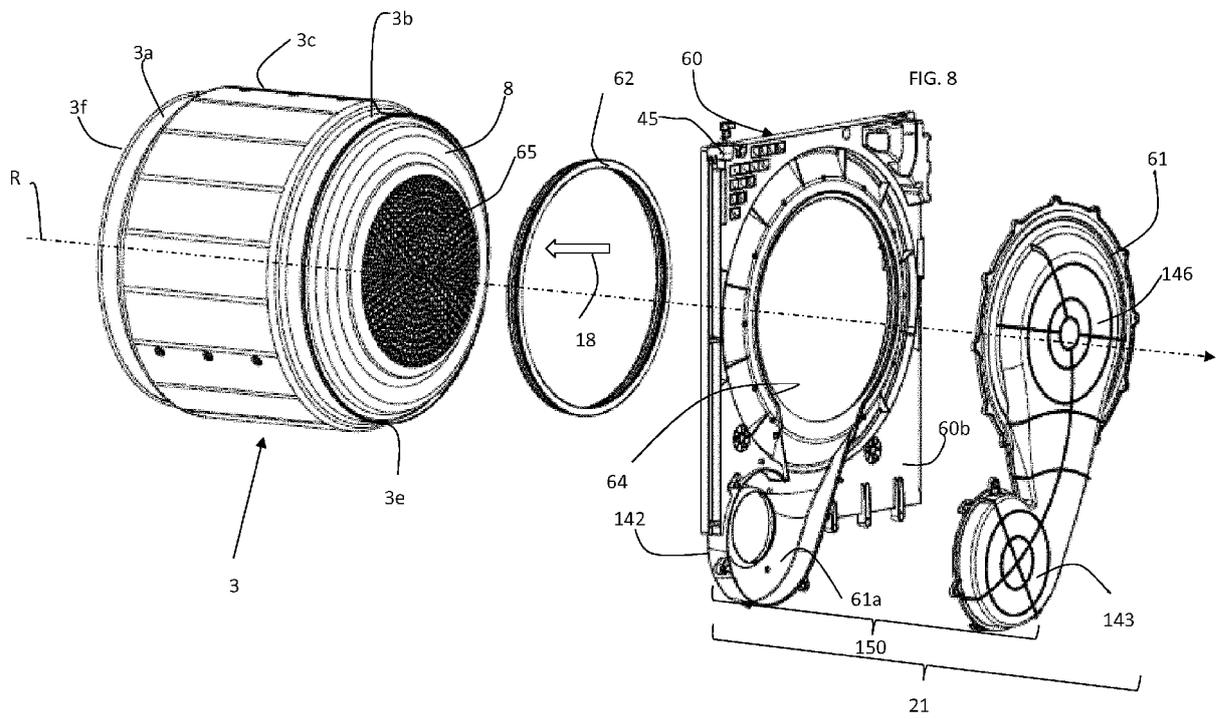
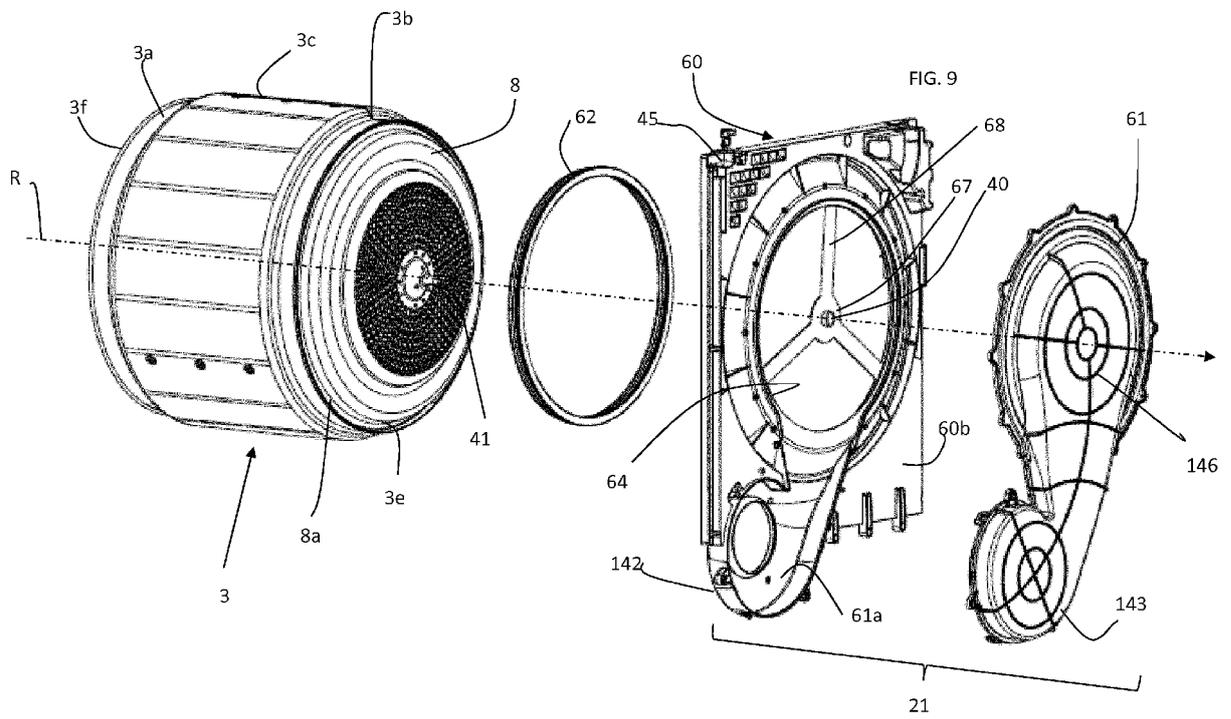


FIG. 7





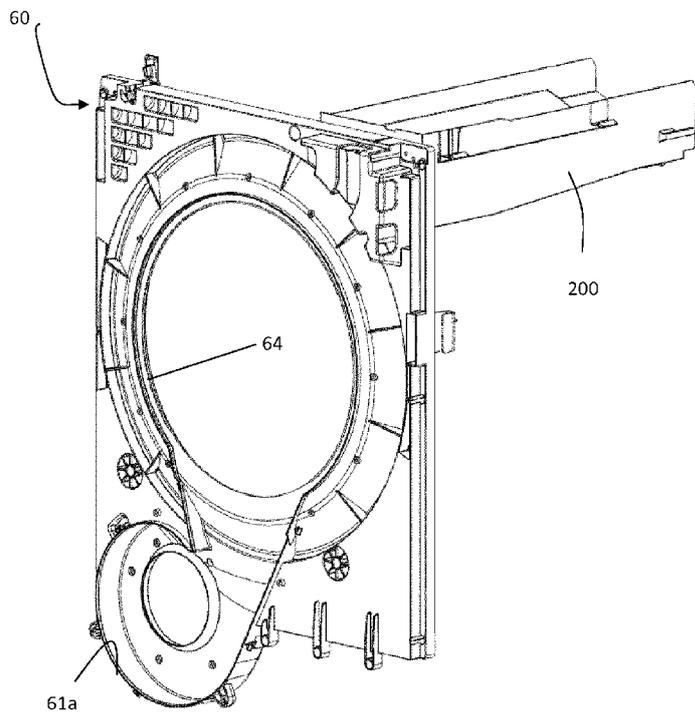


FIG. 10a

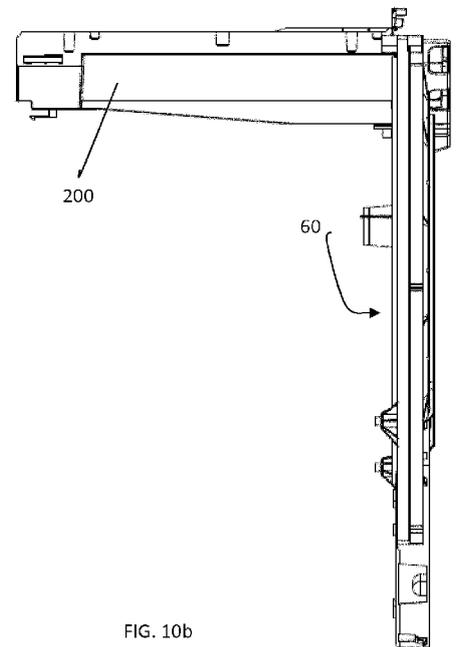


FIG. 10b



EUROPEAN SEARCH REPORT

Application Number
EP 14 18 2918

5

10

15

20

25

30

35

40

45

50

55

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 2 631 356 A1 (ELECTROLUX HOME PROD CORP [BE]) 28 August 2013 (2013-08-28) * paragraph [0009] - paragraph [0024] * * paragraph [0039] - paragraph [0040] * * paragraphs [0046], [0050] * * paragraph [0054] - paragraph [0056] * * paragraphs [0062], [0066] * * paragraph [0073] - paragraph [0081] * * figures 1-6 *	1-14	INV. D06F58/06 D06F58/08 D06F58/20
A, D	EP 2 631 354 A1 (ELECTROLUX HOME PROD CORP [BE]) 28 August 2013 (2013-08-28) * paragraph [0012] * * paragraph [0020] - paragraph [0022] * * paragraph [0028] * * paragraph [0035] - paragraph [0041] * * paragraph [0059] - paragraph [0060] * * paragraph [0066] * * paragraph [0078] - paragraph [0080] * * figures 1, 2, 4 *	1,4-6	
A	EP 2 743 394 A1 (ELECTROLUX HOME PROD CORP [BE]) 18 June 2014 (2014-06-18) * paragraph [0033] - paragraph [0034] * * paragraph [0045] * * paragraph [0049] * * figures 1-3, 8, 9 *	1,2, 10-14	TECHNICAL FIELDS SEARCHED (IPC) D06F
A	US 2013/337205 A1 (ROCKWELL ANTHONY L [US] ET AL) 19 December 2013 (2013-12-19) * paragraph [0004] - paragraph [0005] * * paragraph [0137] - paragraph [0141] * * paragraphs [0143], [0154] * * figures 2a, 3g, 3h, 4 *	1,2,4-6, 10-12	
----- -/--			
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 20 February 2015	Examiner Bermejo Pasetti, M
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	

EPO FORM 1503 03.02 (P04C01)



EUROPEAN SEARCH REPORT

Application Number
EP 14 18 2918

5
10
15
20
25
30
35
40
45
50
55

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 1 541 742 A1 (MIELE & CIE [DE]) 15 June 2005 (2005-06-15) * paragraph [0002] * * paragraph [0009] * * figures 1-6 * -----	1,2, 10-12	
			TECHNICAL FIELDS SEARCHED (IPC)
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 20 February 2015	Examiner Bermejo Pasetti, M
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	

EPO FORM 1503 03.02 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.

EP 14 18 2918

5

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

20-02-2015

10

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 2631356 A1	28-08-2013	EP 2631356 A1 WO 2013127761 A1	28-08-2013 06-09-2013
EP 2631354 A1	28-08-2013	AU 2013225126 A1 CN 104136679 A EP 2631354 A1 WO 2013127767 A2	14-08-2014 05-11-2014 28-08-2013 06-09-2013
EP 2743394 A1	18-06-2014	EP 2743394 A1 WO 2014090778 A1	18-06-2014 19-06-2014
US 2013337205 A1	19-12-2013	NONE	
EP 1541742 A1	15-06-2005	AT 374854 T EP 1541742 A1	15-10-2007 15-06-2005

15

20

25

30

35

40

45

50

55

EPO FORM P0459

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

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP 2631354 A [0006]