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(54) **Household laundry dryer**

(57) A household laundry dryer (1) comprising a cabinet (2-5), a drying circuit (9-13, 17, 18), motor means (14), and a laundry drum (7) having at least one inlet (7e) and one outlet (17) for passage of drying air. The drum (7) is mounted within the cabinet (2-5) and has at least one member for agitating the laundry (8a, 8b). The drum (7) has a structure comprising a front wall (7a), a rear wall (7b) and a peripheral wall (7c) that extends between the front wall (7a) and the rear wall (7b) for defining a volume for containing the laundry. A first part (20) of the structure of the drum, including at least one between the front wall (7a) and the rear wall (7b), as well as at least one respective substantially cylindrical portion (7c₁, 7c₂) of the peripheral wall (7c), is mounted in a stationary position within the cabinet (2-5). A second part (30) of the structure of the drum, including at least one respective substantially cylindrical portion (7c₃) of the peripheral wall (7c) is rotatably mounted within the cabinet (2-5) for rotating about a substantially horizontal axis of rotation (X). The first part (20) and the second part (30) of the structure of the drum are substantially coaxial, and fixed with respect to the second part (30) of the structure of the drum is the at least one member (8a, 8b) for agitating the laundry. The motor means (14) are operatively coupled to the second part (30) of the structure of the drum for causing rotation thereof.

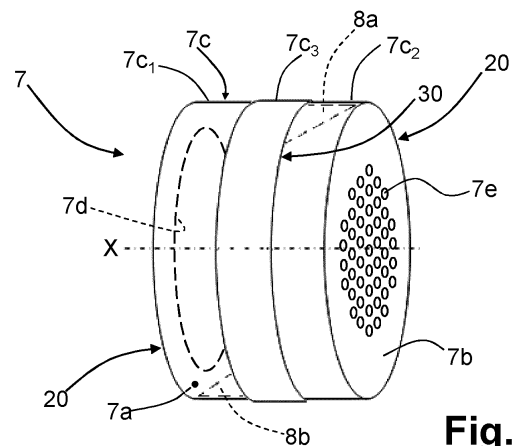


Fig. 3

Description

Field of the invention

[0001] The present invention relates to a household laundry dryer of the type indicated in the preamble of Claim 1.

Background of the invention

[0002] Laundry dryers typically have a load-bearing structure or cabinet, mounted within which is a laundry drum, rotatable about a substantially horizontal axis. The drum is driven by means of an electric motor, usually via a transmission belt, and is rotatably supported in its front and rear areas via pairs of rollers or runners. In some solutions, the drum is supported in its front part by means of an aforesaid pair of wheels and in the rear part by a shaft, coaxial to the axis of rotation of the drum and associated to its rear wall.

[0003] The laundry dryer has a circuit for conveying a flow of drying air, which includes a channel along which a fan operates and means for heating the air. The fan forces the air into the drum, via a delivery branch of the system, after the air itself has been heated by the resistance. The hot air traverses the inside of the drum and is saturated with the humidity yielded by the laundry contained therein, the laundry thus progressively drying. In the majority of known solutions, the heating means comprise at least one electrical resistance, but in recent times the use of heat pumps has spread, mainly for reasons of energy efficiency.

[0004] The hot air is generally introduced into the drum through a central region of its rear wall, which is provided with a plurality of holes. This region of the drum faces a region of a rear wall of the cabinet, which is also provided with one or more holes. The channel that conveys the heated air downstream of the fan usually includes a terminal component, which, together with the aforesaid region of the rear wall of the cabinet, forms a chamber, having in general an approximately circular profile so as to circumscribe a region of diffusion of the air. The drying air spreads within the aforesaid chamber and then penetrates into the drum, through the holes of the corresponding rear wall. Operative between the aforesaid regions provided with holes of the rear wall of the drum and of the cabinet are sealing means, usually constituted by a low-friction annular gasket in order to prevent any dispersion of the flow of hot air into the cabinet.

[0005] The moist air exits from the drum through its front wall, which is provided with a central opening, used - in the case of a front-loading machine - also for the purposes loading and unloading the laundry, associated to which are corresponding sealing means and means for conveying the air. Generally, mounted at this central opening is a duct for intake of the drying air (the so-called "air duct"), which typically girds the central opening and is set between the front wall of the drum and the hatch.

In the case of so-called "condensation" dryers, the front opening of the drum is in fluid communication with the aforesaid air duct, and hence with the intake branch of the circuit of the drying air, upstream of the fan, along which there is a heat exchanger, such as a condenser, designed to subtract humidity from the air taken in from the drum, the dehumidified air being then again heated and re-introduced into the drum via the delivery branch of the circuit.

[0006] In the case of so-called "evacuation" dryers, when the door is closed, the air leaving the front opening of the drum is directed towards the external environment, directly through the door itself or else through a corresponding evacuation channel. In these machines, in fact, the system for conveying the air is provided in such a way that the fan will take in fresh air coming from inside the laundry dryer and/or from the environment where it is installed and will force the air into the drum, after corresponding heating, with the humid air leaving the drum which is instead expelled directly from the appliance.

[0007] In laundry dryers, the drum has a structure traditionally made of sheet metal, usually stainless steel, and comprising a peripheral wall, which is substantially cylindrical, as well as a front wall and a rear wall that are flange-shaped.

[0008] In some known solutions, the front and rear walls of the drum are configured as distinct pieces with respect to the peripheral wall, and are rigidly fixed thereto via welding or clinching. In other solutions the front and rear walls are, instead, formed integrally with the peripheral wall. In the former case, the front and rear walls are obtained via shearing and deformation of a respective sheet of metal. In the latter case, obtaining the front and rear walls of the drum integrally with the peripheral wall involves operations of deformation and stretch-forming of a single starting sheet of metal. In this case, also the rear wall of the drum inevitably has a relatively wide central opening, which must be closed to prevent linen garments from penetrating therein during rotation of the drum. For this purpose, usually fixed to the rear wall of the drum is an additional closing component, provided with an array of holes for passage of the air. In view of the need to guarantee an efficient conveyance of the drying air, fixed to the rear wall of the cabinet is an additional component, having a cylindrical shape, projecting towards the inside of the cabinet and coupled, with interposition of sealing means, to the opening of the rear wall of the drum. In order to guarantee passage of the drying air, this additional component is provided with one or more openings.

Summary of the invention

[0009] The object of the present invention is basically to provide a laundry dryer having a structure that is improved, simpler, and more economically advantageous to produce as compared to the known art, and such as to guarantee efficient operation.

[0010] The above object is achieved, according to the present invention, by a laundry dryer presenting the characteristics indicated in Claim 1. Preferred characteristics of the invention are indicated in the independent claims. The claims form an integral part of the technical teaching provided herein in relation to the invention.

Brief description of the drawings

[0011] Further characteristics and advantages of the present invention will emerge clearly from the ensuing description, with reference to the annexed drawings, which are provided purely by way of non-limiting example, and in which:

- Figure 1 is a schematic front elevation of a laundry dryer according to a first embodiment of the invention;
- Figure 2 is a partial and schematic view, in side elevation, of the laundry dryer of Figure 1;
- Figure 3 is a schematic perspective view of a possible embodiment of a structure of a laundry drum of the dryer of Figures 1 and 2;
- Figure 4 is a partial and schematic view in side elevation, similar to that of Figure 2, of a laundry dryer in according to a second embodiment of the invention;
- Figure 5 is a schematic perspective view of a possible embodiment of a structure of a laundry drum of the dryer of Figure 4;
- Figure 6 is a partial and schematic view in side elevation, similar to that of Figures 2 and 4, of a laundry dryer according to a third embodiment of the invention;
- Figures 7 and 8 are views, similar to those of Figures 1 and 2, of a laundry dryer according to a fourth embodiment of the invention;
- Figure 9 is an exploded schematic view of the structure of a laundry drum of the dryer of Figures 7-8;
- Figure 10 is a perspective view of a component of the structure of Figure 9, from a different angle;
- Figures 11 and 12 are views, similar to those of Figures 1 and 2, of a laundry dryer according to a fifth embodiment of the invention; and
- Figure 13 is an exploded schematic view of the structure of a laundry drum of the dryer of Figures 11-12.

Description of preferred embodiments of the invention

[0012] Reference to "an embodiment" or "one embodiment" within the framework of the present description is meant to indicate that a particular configuration, structure, or characteristic described in relation to the embodiment is comprised in at least one embodiment. Hence, phrases such as "in an embodiment", "in one embodiment", and the like, that may be present in different points in the framework of the present description do not necessarily all refer to one and the same embodiment. More-

over, the particular configurations, structures, or characteristics may be combined in any adequate way in one or more embodiments. The references used herein are only provided for convenience and do not define the sphere of protection or the scope of the embodiments.

[0013] In the present description, the term "plastic material" and the like is meant to indicate any plastic or synthetic material, or material with a plastic or synthetic base, possibly with the addition of fillers designed to improve the functional characteristics and characteristics of strength thereof, such as mineral fillers, textile fillers, synthetic fillers, and so on.

[0014] It is moreover pointed out that in the sequel of the present description only the elements useful for an understanding of the invention will be described in detail, it being taken for granted that the laundry dryer forming the subject of the invention comprises all the other elements in themselves known for normal operation of a laundry dryer, such as, for example, a control system, a motor for driving the drum in rotation via a belt, a condenser for the drying air (in the case where the invention is applied to a condensation dryer), or a heat pump, and so forth.

[0015] In Figures 1 and 2, designated as a whole by 1 is a household laundry dryer according to a possible embodiment of the present invention.

[0016] The laundry dryer 1 has a load-bearing structure, referred to hereinafter for simplicity as "cabinet", comprising a base 2, a front wall 3, a rear wall 4, an upper surface or top 5, and side walls, not represented. In the case exemplified, the laundry dryer 1 is of a front-loading type so that the wall 3 is provided with a through opening (not visible), mounted in front of which is a hatch 6.

[0017] Mounted within the cabinet is a laundry drum 7, provided inside with at least one member for agitating the laundry, or lifter. In the case exemplified, the drum 7 has two lifters 8a and 8b in substantially opposite diametral positions, but not ruled out from the scope of the invention are solutions that envisage a single lifter, or again more than two lifters variously positioned, for example three paddle lifters set at approximately 120° from one another. As may be seen in Figure 3, the drum 7 has a structure that comprises a front wall 7a, a rear wall 7b, and a peripheral wall 7c, which extends between the front wall 7a and the rear wall 7b, for defining a volume for containing the laundry to be dried.

[0018] The laundry dryer 1 includes a drying circuit of any conception known in the sector. In the example represented, the laundry dryer 1 is of the condensation type, and the aforesaid circuit includes some components housed in the base 2 of the laundry dryer, amongst which an air-air heat exchanger 9, or condenser, a fan 10 for forcing a flow of cooling air to a first section of the heat exchanger 9 (in order to favour condensation of the humidity present in the air leaving the drum 7, which is made to pass in a second section of the heat exchanger), a first duct 11 that connects an outlet of the heat exchanger 9 (for the dehumidified air) to a second duct 12, possibly

partially defined by the rear wall 4, which rises along the back of the cabinet, for conveying the drying air towards the inside of the drum 7. In the example, operative within the duct 12 is a fan 13, for taking in the air leaving the heat exchanger 9 and forcing it along the circuit. Along the circuit there are then provided means for heating the drying air (not represented), which may, for example, include one or more electric resistances housed within the duct 11 or the duct 12.

[0019] Once again with reference to the example of embodiment provided, moreover housed in the base 2 are motor means, comprising, for example, an electric motor 14. In the example, the motor 14 is exploited, via one and the same shaft 14a, for driving both the fan 10 and the fan 13: there is nothing to rule out in principle providing distinct motors for the two fans in question.

[0020] According to the invention, a first part of the structure of the drum, designated as a whole by 20, is mounted in a stationary position within the cabinet of the laundry dryer 1 and includes at least one of the front wall 7a and the rear wall 7b, as well as at least one respective portion 7c₁, 7c₂ of the peripheral wall 7c. A second part of the structure of the drum 7, designated as a whole by 30, is instead rotatably mounted within the cabinet of the laundry dryer 1 so as to turn about a substantially horizontal axis of rotation - designated by X in Figure 3 -, and said second part of structure 30 includes at least one respective portion 7c₃ of the peripheral wall 7c. The aforesaid portions 7c₁, 7c₂, 7c₃ of the peripheral wall 7c that belong to the first part 20 and to the second part 30 of the structure of the drum 7 are substantially cylindrical at least in a coupling region thereof. The first part 20 and the second part 30 of the structure of the drum 7 are substantially coaxial, and fixed with respect to the second part 30 are the means for agitating the laundry, here represented by the two lifters 8a and 8b.

[0021] Operatively coupled to the second part 30 of the structure of the drum 7 are motor means, for causing rotation thereof about the axis X. In the case exemplified, the aforesaid motor means used for causing rotation of the part 30 of the structure of the drum 7 are represented by the electric motor 14, associated to the shaft 14a of which is a pulley 15 that, together with a belt 16, transmits the movement to the part of structure 30. In the example, hence, the motor 14 actuates both the two fans 10, 13 and the part of structure 30: this measure must not, however, be considered as essential, it being possible for the motor means that drive the part of structure 30 even to be independent of the ones used for driving one or both of the aforesaid fans. Consequently, in the non-limiting example provided, the presence of the fan 10 is dictated by the type of heat exchanger 9: in the case of use of other types of heat exchanger (for example air-water heat exchanger) or of a heat pump, the presence of the fan 10 is not necessary.

[0022] In the specific case of the embodiment of Figures 1-3, the first part 20 of the structure of the drum 7 includes the front wall 7a, the rear wall 7b, as well as a

first portion and a second portion of the peripheral wall 7c, which are substantially cylindrical and are designated by 7c₁ and 7c₂. On the other side, the second part 30 of the structure of the drum 7 includes a third substantially cylindrical portion 7c₃ of the peripheral wall 7c, which is rotatably mounted between the aforesaid first and second portions 7c₁ and 7c₂. Consequently, in this embodiment, the rotatable part of the structure of the drum 7 is basically constituted by a cylindrical intermediate strip of the peripheral wall 7c, which is set between two stationary half-shells 20 and associated to which are the means for agitating the laundry, operative within the drum itself. In one embodiment, such as the one represented, the portion 7c₃ has a diameter slightly greater than that of the portions 7c₁ and 7c₂, but not ruled out from the scope of the invention is the case where the part 30 has a diameter smaller than the part 20, at least in the respective connection areas, or substantially the same diameter. The portion 7c₃ may be rotatably constrained between the portions 7c₁ and 7c₂ with profiles substantially of the shape-fit type, such as channel-section slide guides, and/or with possible interposition of sealing means, for example low-friction gaskets of the type normally used in laundry dryers. Preferably, the couplings of the portion 7c₃ with the portions 7c₁ and 7c₂ are shaped to prevent any risk of pinching of the garments between the rotatable portion and the stationary one.

[0023] In the preferred embodiment of the invention, the at least one member for agitating the laundry or lifter 8a, 8b extends longitudinally from the rotatable part of structure 30 as far as inside the stationary part of structure 20, as is clearly visible, for example, in Figures 2 and 3. This is advantageous in so far as it enables movement of laundry that occupies temporarily a portion of the volume for containing the laundry defined by the stationary part of structure 20. Of course, the shape of the lifter or lifters provided may be various, according to the need. In general, the lifters are mounted at a distance from the portions of wall 7c₁ and 7c₂ such as to reduce the risk of pinching of the laundry during their rotation, and are purposely shaped. The lifter or lifters may be applied to the corresponding part of structure 30 or else be obtained integrally therewith, for example when the part 30, or at least its portion 7c₃, is made at least in part of plastic material.

[0024] In the embodiment exemplified, fixed with respect to the second part 30 of the structure of the drum 7 are at least two lifters 8a, 8b, which extend substantially in opposite directions starting from the rotatable intermediate portion 7c₃ of the peripheral wall 7c, i.e., with the lifter 8a that extends longitudinally as far as inside the portion of the containment volume defined by the front wall 7a and by the portion 7c₁ of the peripheral wall 7c, and with the lifter 8b that extends longitudinally as far as inside the portion of the containment volume defined by the rear wall 7b and by the portion 7c₂ of the peripheral wall 7c. In possible variant embodiments (not represented), one and the same lifter extends longitudinally from

opposite sides of the portion $7c_3$, i.e., within each of the aforesaid portions of the volume for containing the laundry.

[0025] It will be appreciated that, in the embodiment represented in Figures 1-3, a substantial portion of the containment volume, designed to be effectively occupied by a part of the load of laundry, is defined by the stationary part of structure 20. Given that the laundry dryer 1 is of the front-loading type, this part 20 includes a front wall 7a provided with a single opening - designated by 7d in Figure 3 - for loading and unloading the laundry, which in use is closed by a corresponding rear portion of the hatch 6. It will moreover be appreciated that, since the part 20 is a stationary part of the structure of the drum, the front wall 7a may be variously configured and does not necessarily have to be formed integrally with the respective portion $7c_1$ of the peripheral wall 7c, or constituted by a circular flange body associated to the aforesaid portion $7c_1$: for example, the wall 7a of the drum 7 may be defined by a portion of a stationary front partition with polygonal profile (obviously having dimensions of height and width greater than the diameter of the portion $7c_1$), or again be obtained from a portion of the front wall 3 itself of the cabinet of the laundry dryer 1.

[0026] Of course, similar considerations apply, once again for the case of the embodiment of Figures 1-3, in relation to the rear wall 7b and to the corresponding portion $7c_2$ of the peripheral wall 7c. In the embodiment exemplified (see in particular Figure 3), also the rear wall 7b of the drum belongs to the stationary part 20 and has an array of holes 7e for inlet of the drying air. Given that the part 20 is stationary, coupling between the rear wall 7b and the duct 12 (Figure 2) is extremely simplified, not requiring, for example, low-friction seal gaskets typical of the known art. On the other hand, as has been said in relation to the front wall 7a, the wall 7b of the drum 7 may also be defined by a component of the duct 12 or of the rear wall 4 itself of the cabinet of the laundry dryer. Of course, there is nothing to rule out configuring the rear wall substantially in the form of a flange, for example in a way similar to what has been illustrated for the front wall 7a of Figure 3 or for the rear wall 7b visible in Figure 5.

[0027] It will moreover be appreciated that, although preferable, each of the portions $7c_1$ and/or $7c_2$ of the peripheral wall 7c of the drum does not necessarily have to be completely cylindrical, the cylindrical shape being limited to the regions of connection with the rotatable portion $7c_3$ in order to enable rotation of the latter.

[0028] In the laundry dryer 1 according to the invention, moreover, the inlet and/or outlet for the air of the drum 7 are not necessarily defined in the front wall 7a or rear wall 7b, it being possible for the inlet and/or the outlet to be defined totally or in part also in a portion of the peripheral wall 7c that belongs to the stationary part of structure 20. Very advantageously, moreover, in the stationary part of structure 20 there may be defined channels, such as ducts for conveying the hot drying air according to preferential paths within the drum, and/or functional com-

ponents of the laundry dryer 1, such as a seat for a filter or sensor means. In regard to the latter possibility, in fact, it is emphasized how the solution according to the invention enables, for example, provision, in a very easy way, of temperature-sensor means and/or humidity-sensor means directly inside the drum and in the proximity of the laundry, in particular inside the stationary part of structure, to which said sensor means can be constrained.

[0029] Of course, the shape and dimensions of the lifters, as well as the position and dimensions of the above channels and/or functional components will be provided so as to prevent any interference of the former with the latter.

[0030] For example, in the case of Figures 1 and 2, mounted inside the stationary part 20, or obtained integrally therewith, and in particular between the front wall 7a and the portion $7c_1$ of the peripheral wall 7c, is a channel 17, which provides outlet for the air from the drum 7 and defines at the same time the seat for a removable filter 18 for the fluff set in circulation by the air (such a filter may be rendered accessible following upon opening of the hatch 6 or via a purposely provided access hatch present on the wall 3 of the cabinet or on the front of the base 2).

[0031] Figures 4 and 5 are schematic illustrations of a second possible embodiment of the invention. In these figures the same reference numbers as those of the previous figures are used to designate elements that are technically equivalent to the ones already described above. In this embodiment, the stationary part 20 of the structure of the drum includes the front wall 7a and a respective substantially cylindrical portion $7c_1$ of the peripheral wall 7, whilst the rotatable part 30 of the structure of the drum includes the rear wall 7b, as well as a respective substantially cylindrical portion $7c_3$ of the peripheral wall 7c.

[0032] In this embodiment, as may be appreciated, the lifter 8b extends only within the portion of the volume for containing the laundry defined by the part of structure 30. Consequently, in a way similar to what has been already mentioned, such a lifter could be configured so as to extend also into the portion of the containment volume defined by the part of structure 20.

[0033] In the embodiment exemplified (see Figure 5), the rear wall 7b is shaped substantially like a circular flange, with a projecting cylindrical lip 7f, designed for rotatable coupling with a cylindrical outlet portion (not visible) of the duct 12, with interposition of low-friction sealing means. The aforesaid cylindrical outlet portion of the duct 12 preferably has a terminal wall provided with one or more openings, and/or a closing component, provided with an array of holes for passage of the air, may be mounted on the rear wall 7b of the drum, at the opening delimited by the cylindrical lip 7f. Again, the above embodiment is to be understood merely as example, in so far as the shape of the wall 7b, when belonging to the rotatable part of structure, and its modalities of mechan-

ical and fluidic coupling and coupling to the outlet section of the duct 12 may be various, according to the known technique currently used in the sector. It will be appreciated, for example, that the rear wall 7b of the drum of Figure 5 could present an array of holes 7e as illustrated in Figure 3, with the outlet of the duct 12 and the corresponding sealing means shaped accordingly.

[0034] In general terms, the rotatable part 30 of the structure of the drum 7 may be rotatably supported at least partially by the stationary part 20. With particular reference to the embodiment of Figures 1-3, the part 30 may possibly be completely supported by the part 20, without any need for further rolling or sliding supporting means. On the other hand, in other embodiments, such as for example that of Figures 4 and 5, it is preferable for the part of structure 30 to be rotatably supported at least in part (also) by additional supporting means, associated to the load-bearing structure of the laundry dryer, for example to its base 2. These means may be, for example, of the rolling type, such as wheels, or sliding type, such as runners. In the embodiment exemplified in Figure 4, the additional supporting means comprise two pairs of wheels 31a and 31b, the wheels of each pair being rotatable according to a respective axis substantially parallel to the axis X (the figure shows just one wheel of each pair). The pairs of wheels 31a, 31b are here mounted in a front area and rear area, respectively, of the portion 7c₃ of the peripheral wall 7c. Obviously, it is also possible to provide a single pair of wheels, such as the pair of wheels 31b, with the part of structure 30 that is rotatably supported in its front part by virtue of the rotatable coupling with the part of structure 20.

[0035] The part of structure 20 is supported by the stationary structure of the laundry dryer, for example via corresponding rests or supports, designated by way of example by 21 in Figures 2 and 4.

[0036] The invention may be applied also to the case of a top-loading laundry dryer. Such an embodiment is exemplified in Figure 6, where the same reference numbers as those of the previous figures are used to designate elements that are technically equivalent to the ones already described above.

[0037] The structure of the drum 7 is to a large extent similar to that of Figures 4 and 5. In this solution, however, defined in the portion 7c₁ of the peripheral wall 7c of the drum is, in a upper area thereof, an opening provided with a hatch 6' having sealing means, suitable to prevent any dispersion of the drying air, and associated to the upper wall 5 of the cabinet is a respective hatch 6'' to enable access to the hatch 6' and hence to the inside of the drum 7.

[0038] In a top-loading laundry dryer the stationary part 20 of the structure of the drum may be configured in a way similar to what has been illustrated in Figure 4, it being understood that, in this case, the front wall 7a of the drum does not require an opening of a large diameter for loading and unloading the laundry. Alternatively, the part 20 may be of the type illustrated in Figure 6, where

the front wall 7a may present a single central opening, or an array of holes (in a way similar to the wall 7b of Figure 3), or again a flange (in a way similar to the wall 7b of Figure 4). Once again with reference to the case exemplified in Figure 6, provided in the front part of the laundry dryer is a duct 21, which may be of a general conception similar to the duct 12, for conveying the moist air leaving the drum 7 towards the condenser 9. Once again with reference to the case illustrated, the seat for the filter 18 may in this case be defined within the duct 21 in order to be accessible from the front of the laundry dryer 1, via a suitable access (not represented).

[0039] The structure of the drum 7 of the laundry dryer according to the invention may be entirely made of metal material, for example stainless steel, but major advantages in terms of simplification and reduction of the costs may be achieved using at least in part plastic materials. In this perspective, the structure of the drum 7 may be of a hybrid type, i.e., made in part of metal material and in part of one or more plastic materials. For example, as already mentioned, the front wall 7a and/or rear wall 7b of the drum may be defined by stationary components of the laundry dryer 1, such as parts of the walls 3 or 4 of the cabinet or parts of the ducts 12 or 21, that may be conveniently made of plastic materials. Each of the portions 7c₁ and 7c₂ may be made of plastic material, and a plastic material or combination of plastic materials may possibly be used to obtain the entire stationary part of structure 20. Use of plastic materials is particularly advantageous when integrated in the stationary part of structure are ducts for the air or housings for functional components of the laundry dryer 1. Of course, considerations similar to those set forth above apply also to the case of the rotatable part of structure 30, which may thus be entirely or partially made of metal material, or plastic material, or again a combination of metal material and plastic material.

[0040] Advantageously, at least a portion of the stationary part 20 of the structure of the drum 7 may be shaped so as to enable housing or positioning on the outside of the drum itself of one or more functional components of the laundry dryer 1. For example, as already mentioned previously, the portion 7c₁ or portions 7c₁ and 7c₂ of the peripheral wall 7c of the drum 7 do not necessarily have to be perfectly cylindrical or completely cylindrical, by virtue of the fact that these portions are stationary. Of course, these portions 7c₁ or 7c₁ and 7c₂ will be substantially cylindrical at least at their region of coupling to the rotatable part 30.

[0041] For this reason, in possible embodiments of the invention, a stationary portion of the peripheral wall 7 may be shaped so as to present recesses aimed at facilitating positioning of components of the laundry dryer external to the drum. Of course, also in this case, the shape and dimensions of the lifters, as well as the dimensions and position of the aforesaid recesses will be provided so as to prevent any interference of the former with the latter.

[0042] For example, one of the practical problems that are encountered in installation of a heat pump within a laundry dryer derives from the encumbrance in height of its components, and in particular of its compressor. The consequence of this is that frequently the diameter of the drum must be contained in order to prevent risks of interference during its rotation with the aforesaid cumbersome components. In the case of the present invention, the compressor of a heat pump may be mounted in a region corresponding to the stationary part of structure 20, for example by defining a recess in the portion of wall 7c₁ or 7c₂ in a position corresponding to that where the compressor (but it could be any other component, for example, a motor or a condenser) will be installed, thus enabling an easier installation of the component in question but without reducing appreciably the laundry-containment capacity of the drum 7. A similar reasoning, in relation to the possibility of defining recesses in a portion of wall 7c₁ or 7c₂ - or also in the front wall 7a and rear wall 7b when one or both of them belong to the stationary part of structure 20 - applies in the case of possible components mounted in the upper part or side parts of the cabinet of the laundry dryer (for example, an electronic control board, components of the control panel of the laundry dryer, a drawer for collection of the condensation water, etc.).

[0043] In other embodiments, a stationary portion of the peripheral wall 7c may also be shaped so as to present one or more projections outwards in order to increase the internal volume of the drum 7, for example in order to provide therein or house therein functional elements of the laundry dryer 1. In these embodiments, for example, a lower part or a half part of the stationary portion 7c₁ and/or 7c₂ of the peripheral wall 7 has a shape that can be substantially superimposed on an imaginary cylindrical surface, whilst an upper part or an upper half of the stationary portion 7c₁ and/or 7c₂ itself is shaped so as to expand outwards more than the aforesaid imaginary cylindrical surface. It should be noted that, preferably, a similar expanded shaping is not provided in the lower part of the stationary portion of interest of the peripheral wall 7c, since there could be created areas of accumulation of laundry that cannot be reached by the lifters: instead, in the upper part of the drum mixing of the laundry is always guaranteed by gravity.

[0044] An embodiment provided by way of example in this sense is exemplified in Figures 7-10, where the same reference numbers as those of the previous figures are used to designate elements that are technically equivalent to the ones described previously. In the example considered, the laundry dryer 1 has a structure generally similar to that of Figures 1-3, but in this case the rear portion of the stationary part of the drum, here designated by 20', includes at least one upper extension, which in the example projects from the corresponding portion of wall 7c₂. More precisely, in the example, two upper and lateral extensions, designated by 40, are provided, which here involve also the rear wall 7b of the drum, as may be

appreciated in particular from Figures 9 and 10. The portion of wall 7c₂ has in any case a substantially cylindrical front part, here designated by 41, for coupling with the rotatable part 30 of the structure of the drum 7. It should be noted that the part 41, or more in general, the cylindrical part of the portion or portions 20, 20' (or 30) that is provided for coupling with the rotatable part 30 (or with a respective stationary part 20, 20', respectively), according to the various embodiments of the invention, does not necessarily have to consist of a continuous cylindrical wall: this coupling part could also present one or more interruptions (consider, for example, a series of teeth projecting at the front and set according to a circumference, for engagement to the part 30 or 20 or 20', respectively), it remaining understood that the coupling between a stationary part and the rotatable part of the structure of the drum will be preferably provided with sealing means to prevent any dispersion of the flow of drying air.

[0045] In the at least one upper extension 40 there may be integrated or mounted functional elements of the laundry dryer, such as for example ducts for conveying the flow of forced air in preferential directions. For instance, as emerges, for example, from Figures 7 and 8, in the embodiment exemplified the extensions 40 are provided with channels 42 with outlet openings designed to direct the flow of the drying air at inlet - represented schematically by the black arrows - in radial directions towards the axis of rotation of the rotatable part of structure 30. In this embodiment, then, the rear duct 12 extends further upwards with respect to the case of Figures 1-2, and may comprise two branches that terminate at the extensions 40, i.e., at the inlets of the ducts 42 provided in these extensions (these inlets are represented schematically in Figure 9). It is of course also possible to provide in addition an axial inlet, for example including a single hole or a plurality of holes in the rear wall 7b.

[0046] The part 20' may include a single extension 40, that may also be shaped differently from the example illustrated, and it is likewise clear that also the front part 20 of the stationary structure of the drum 7 may include one or more upper extensions, not necessarily of a shape similar to those of the extensions 40, according to the need. Consider, for example, the case where the direction of the flow of drying air is opposite to the one exemplified in Figures 7-8, in which case one or more ducts 42 could be provided at corresponding extensions 40 provided in the stationary part of structure 20. In an embodiment of this type, in a region corresponding to such an extension 40, there could be provided the seat for the fluff filter.

[0047] Of course, one or more extensions of the volume of the drum according to the concept described with reference to Figures 7-10 may be provided also in the case of a machine the drum 7 of which includes only a stationary part of structure (front or rear) and a rotatable part of structure 30 (rear or front, respectively), in a way similar to the case illustrated in Figures 4-5.

[0048] Figures 11-13 illustrate another example of

laundry dryer 1 having a drum 7 with a stationary front part, here designated by 20", the portion of peripheral wall 7c₁ of which is provided with an upper extension. The laundry dryer 1 of Figures 11-12 is of the top-loading type, having a general structure similar to that of the embodiment of Figure 6. In this case, the stationary front part 20" includes an upper extension 43 of the portion of wall 7c₁, substantially central and open at the top, which replaces the hatch 6" of Figure 6 and extends substantially as far as the hatch 6" provided in the upper wall 5 of the cabinet of the laundry dryer 1. In such an embodiment, suitable sealing means will be operative between the upper edge of the extension 43 and the aforesaid hatch 6".

[0049] From the foregoing description, the characteristics of the present invention, as likewise its advantages, emerge clearly. Amongst the advantages, the following may be emphasized:

- the drum can have an improved loading capacity by virtue of the fact that a substantial portion of its containment volume is stationary; the fact that a significant part of the structure of the drum is stationary prevents the need to provide around it a space sufficient to enable rotation thereof: consequently, the aforesaid stationary part may, without any problem, be in contact with other internal parts of the laundry dryer, thus enabling an increase of its dimensions;
- the structure of the laundry dryer is as a whole simplified as compared to the known art; in particular, the presence of a stationary front part of the structure of the drum enables elimination of the usual duct for intake of the drying air (the aforementioned air duct), thus enabling increase of the containment volume of the drum: the intake of the air may be obtained, as may be seen, through a perforated portion of the stationary front part, or by providing therein an outlet channel; the presence of a stationary rear part of the structure of the drum enables improvement of the coupling and passage of the forced flow between the duct for delivery of the drying air and the drum, precisely by virtue of the fact that the aforesaid rear part is stationary;
- there is no longer the need to provide sliding gaskets both at the front and at the back of the drum, thereby reducing the losses of thermal power;
- the presence of a stationary part of structure of the drum enables integration therein of channels for the air, for example for conveying the hot drying air according to preferential paths within the drum;
- the possibility of integrating the seat for the fluff filter or other fluidic components directly in the stationary part of structure of the drum simplifies production of the laundry dryer and improves the overall fluid-dynamic efficiency thereof;
- the possibility of integrating, in a very easy way, sensor means - in particular temperature-sensor means

and/or humidity-sensor means - directly within the drum and in the proximity of the laundry, in particular within the stationary part of structure;

- the possibility of obtaining seats and/or recesses in the stationary part of structure enables an easier positioning of possible cumbersome functional components of the laundry dryer external to the drum.

[0050] It is clear that numerous variants may be made by the person skilled in the art to the laundry dryer described by way of example, without thereby departing from the scope of the invention as defined in the ensuing claims. For example, with reference to the various embodiments illustrated, the drying circuit may be provided in such a way that the direction of the flow of forced air is opposite to the one indicated in the attached figures. Likewise, with reference to a variant of the type illustrated in Figure 4, the positions of the stationary part 20 and of the rotatable part 30 could be reversed (i.e., with the stationary part 20 closer to the rear wall 4 of the cabinet and the rotatable part 30 closer to the front wall 3 of the cabinet). The rotatable part of structure of the drum 7 may comprise only a respective portion of the peripheral wall 7c, with the stationary part of structure that hence includes the front wall 7a, the rear wall 7b, and a remaining portion of peripheral wall 7c. The means used for causing rotation of the part of structure 30 must not necessarily be of the pulley-belt type, it being possible to include, for example, a gear arrangement between a motor and the part 30 or again, for example in embodiments of the type of Figures 4, 6 and 11-12, the driving arrangement could include a rear motor, rotor of which is fixed with respect to the rotatable part of structure 30.

Claims

1. A household laundry dryer comprising a cabinet (2-5), a drying circuit (9-13, 17, 18; 9-13, 17, 18, 21), motor means (14), and a laundry drum (7) having at least one inlet (7e; 7f) and one outlet (17; 7d) for the passage of drying air, the drum (7) being mounted within the cabinet (2-5) and having at least one member for agitating the laundry (8a, 8b), wherein the drum (7) has a structure comprising a front wall (7a), a rear wall (7b), and a peripheral wall (7c) that extends between the front wall (7a) and the rear wall (7b) for defining a volume for containing the laundry; said laundry dryer being **characterized in that:**

- a first part (20; 20', 20'') of the structure of the drum, including at least one of the front wall (7a) and the rear wall (7b), as well as at least one respective portion (7c₁, 7c₂) of the peripheral wall (7c), is mounted in a stationary position within the cabinet (2-5);
- a second part (30) of the structure of the drum, including at least one respective portion (7c₃) of

- the peripheral wall (7c) is rotatably mounted within the cabinet (2-5), for rotating about a substantially horizontal axis of rotation (X), the first part (20; 20', 20'') and the second part (30) of the structure of the drum being substantially coaxial and there being associated to the second part (30) of the structure of the drum the at least one member (8a, 8b) for agitating the laundry;
- said portions (7c₁, 7c₂, 7c₃) of the peripheral wall (7c) belonging to the first part (20; 20', 20'') and to the second part (30) of the structure of the drum are substantially cylindrical at least in a coupling region thereof; and
 - the motor means (14) are operatively coupled to the second part (30) of the structure of the drum for causing rotation thereof.
2. The laundry dryer according to Claim 1, wherein the at least one agitating member (8a, 8b) extends longitudinally from the second part (30) of the structure of the drum into the first part (20; 20', 20'') of the structure of the drum.
 3. The laundry dryer according to Claim 1 or Claim 2, wherein:
 - the first part (20; 20', 20'') of the structure of the drum includes the front wall (7a), the rear wall (7b), a first portion (7c₁) of the peripheral wall (7c), and a second portion (7c₂) of the peripheral wall (7c); and
 - the second part (30) of the structure of the drum includes a third portion (7c₃) of the peripheral wall (7c) that is rotatably mounted between the aforesaid first and second portions (7c₁, 7c₂) of the peripheral wall (7c).
 4. The laundry dryer according to Claims 2 and 3, wherein associated to the second part (30) of the structure of the drum are at least one first agitating member (8a) and one second agitating member (8b), the first agitating member (8a) extending longitudinally from the second part (30) of the structure of the drum into a part of said volume for containing defined by the front wall (7a) and by the first portion (7c₁) of the peripheral wall (7c), and the second agitating member (8b) extending longitudinally from the second part (30) of the structure of the drum into a part of said volume for containing defined by the rear wall (7b) and by the second portion (7c₂) of the peripheral wall (7c).
 5. The laundry dryer according to Claim 1 or Claim 2, wherein:
 - the first part (20; 20'') of the structure of the drum includes one of the front wall (7a) and the rear wall (7b), as well as a respective portion (7c₁) of the peripheral wall (7c); and
 - the second part (30) of the structure of the drum includes the other of the front wall (7a) and the rear wall (7b), as well as a respective portion (7c₃) of the peripheral wall (7c).
 6. The laundry dryer according to any one of the preceding claims, wherein the second part (30) of the structure of the drum is rotatably supported at least in part by the first part (20; 20', 20'') of the structure of the drum.
 7. The laundry dryer according to any one of the preceding claims, comprising means (31a, 31b) for rotatably supporting the second part (30) of the structure of the drum.
 8. The laundry dryer according to any one of the preceding claims, wherein one of the inlet (7e; 7f) and the outlet (17; 7d) for the drying air is defined at least in part in one from among the front wall (7a), the rear wall (7b), and a portion (7c₁) of the peripheral wall (7c) that belongs to the first part (20; 20', 20'') of the structure of the drum.
 9. The laundry dryer Claim 6, wherein at least one of the inlet (7e; 7f) and the outlet (17; 7d) for the drying air comprises one of a single opening (7d; 7f) and a plurality of holes (7e) of the front wall (7a) or of the rear wall (7b).
 10. The laundry dryer according to any one of the preceding claims, wherein at least one of the front wall (7a) and the rear wall (7b) is substantially flange-shaped.
 11. The laundry dryer according to Claim 1, wherein at least one portion (40; 43) of the first part (20'; 20'') of the structure of the drum is shaped for the purposes of housing or positioning one or more functional elements (17, 18; 42) of the laundry dryer (1) inside the drum (7).
 12. The laundry dryer according to Claim 1, wherein at least one portion of the first part (20; 20', 20'') of the structure of the drum is shaped for the purposes of housing or positioning one or more functional elements of the laundry dryer (1) outside the drum (7).
 13. The laundry dryer according to Claim 11 or Claim 12, wherein said at least one shaped portion of the first part (20) of the structure of the drum belongs to a said portion (7c₁, 7c₂) of the peripheral wall (7c).
 14. The laundry dryer according to any one of the preceding claims, wherein in the first part (20) of the structure of the drum there are defined at least in

part one or more ducts for passage of the air and/or there are mounted sensor means.

15. The laundry dryer according to any one of the preceding claims, wherein operative between the first part (20) and the second part (30) of the structure of the drum are sealing means.

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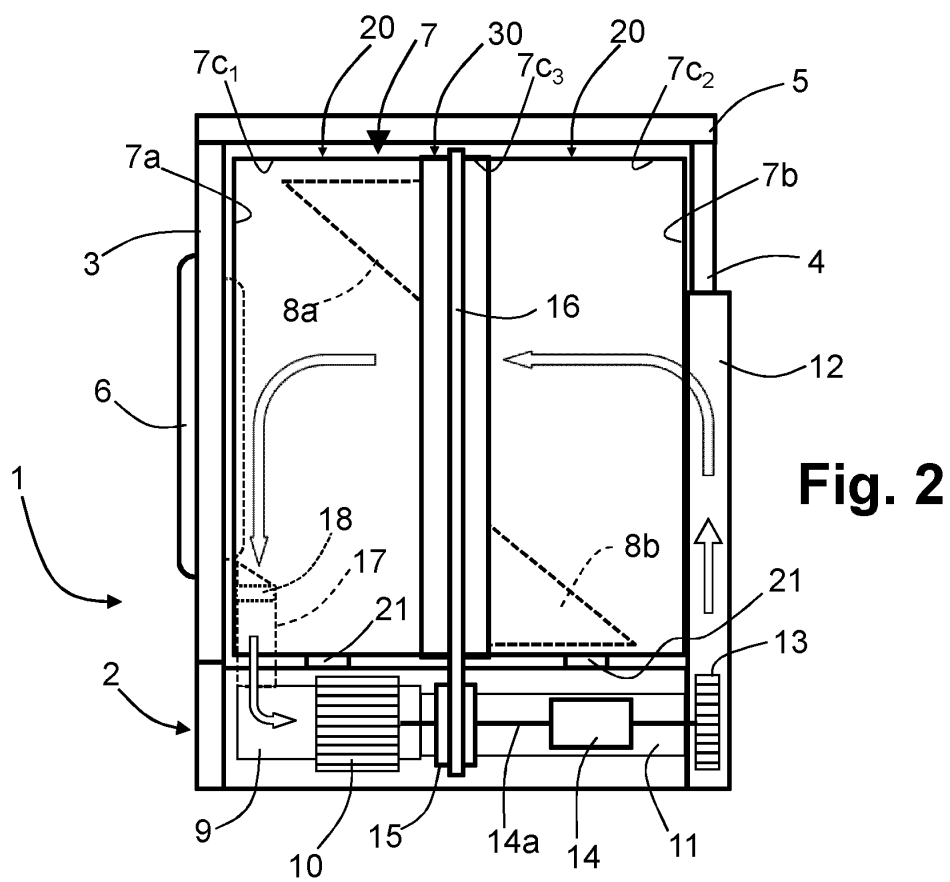
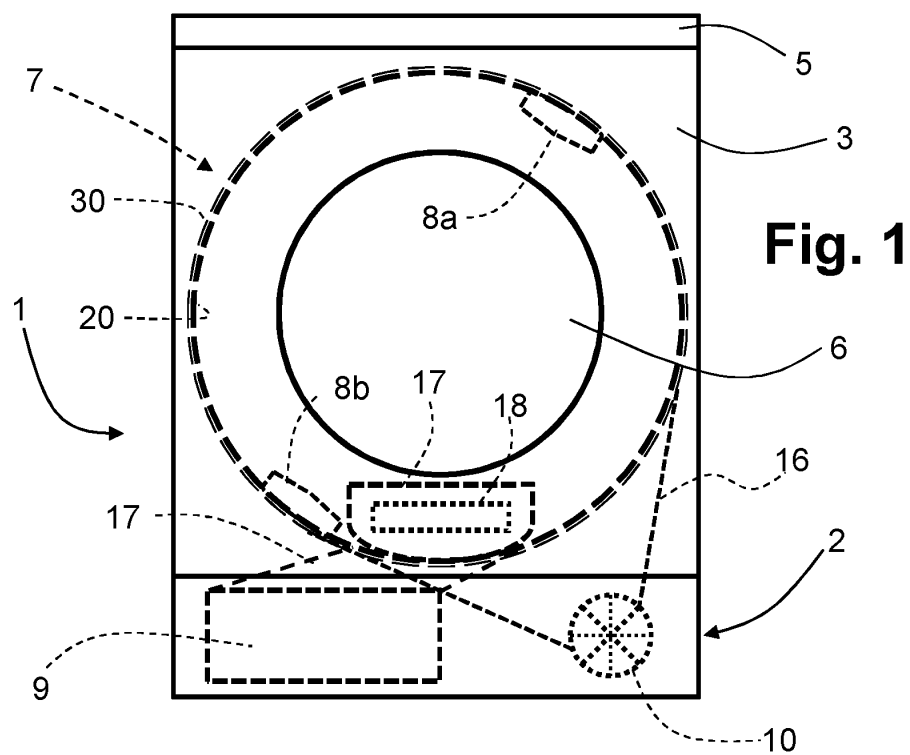
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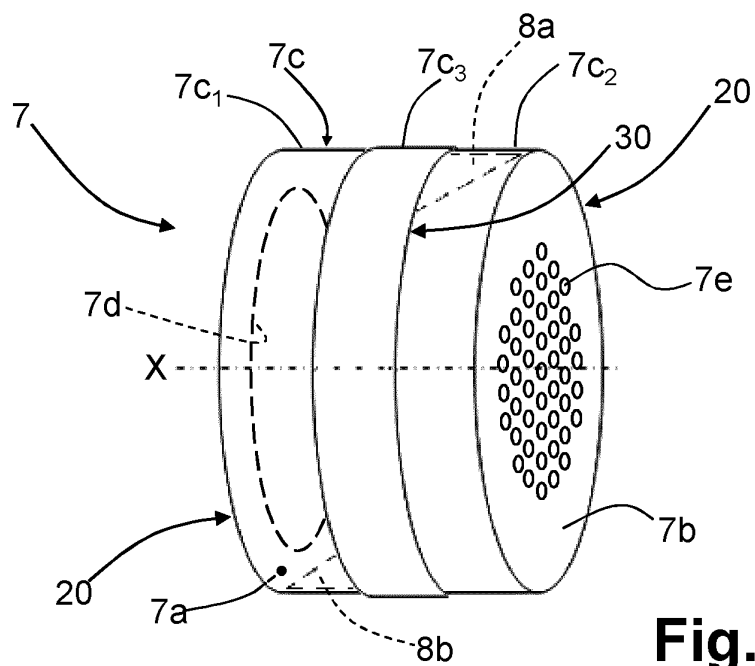


Fig. 3

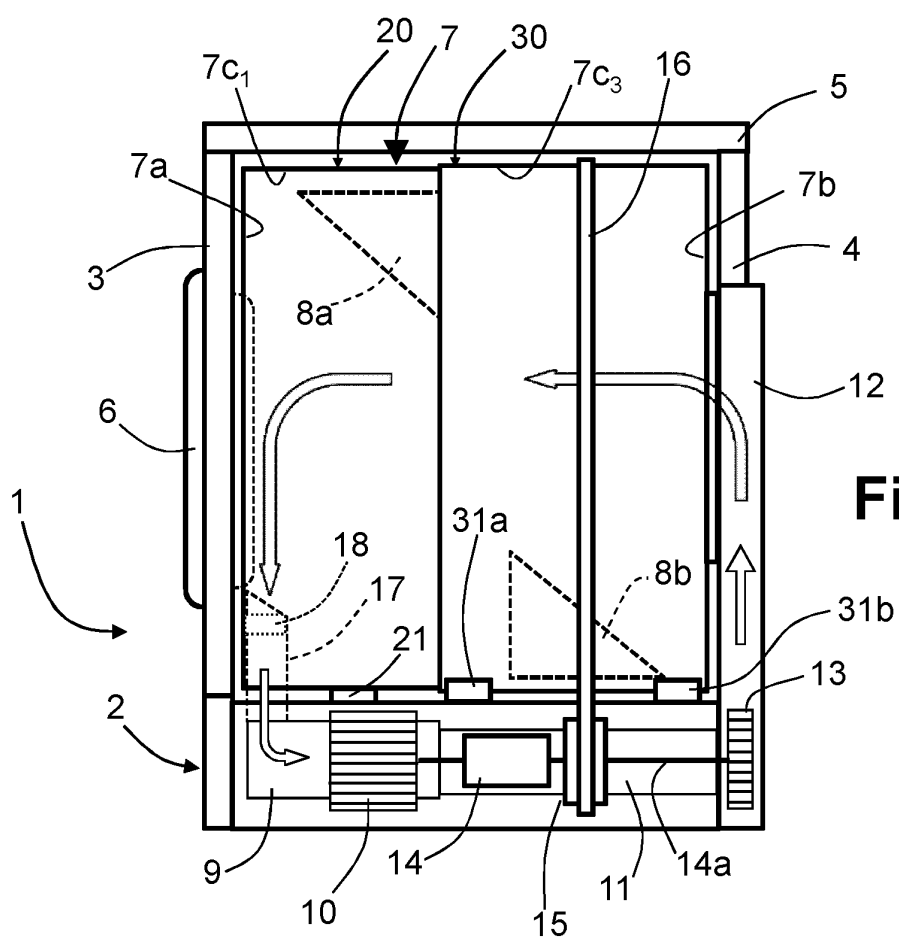


Fig. 4

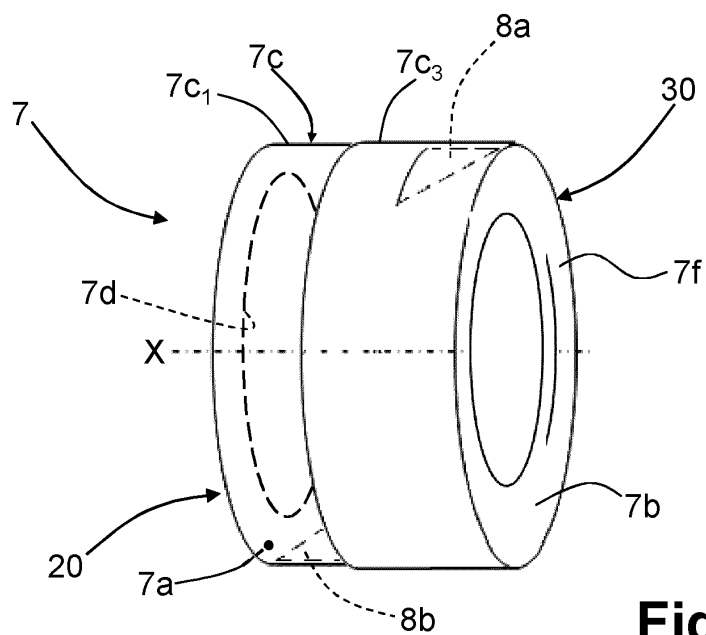


Fig. 5

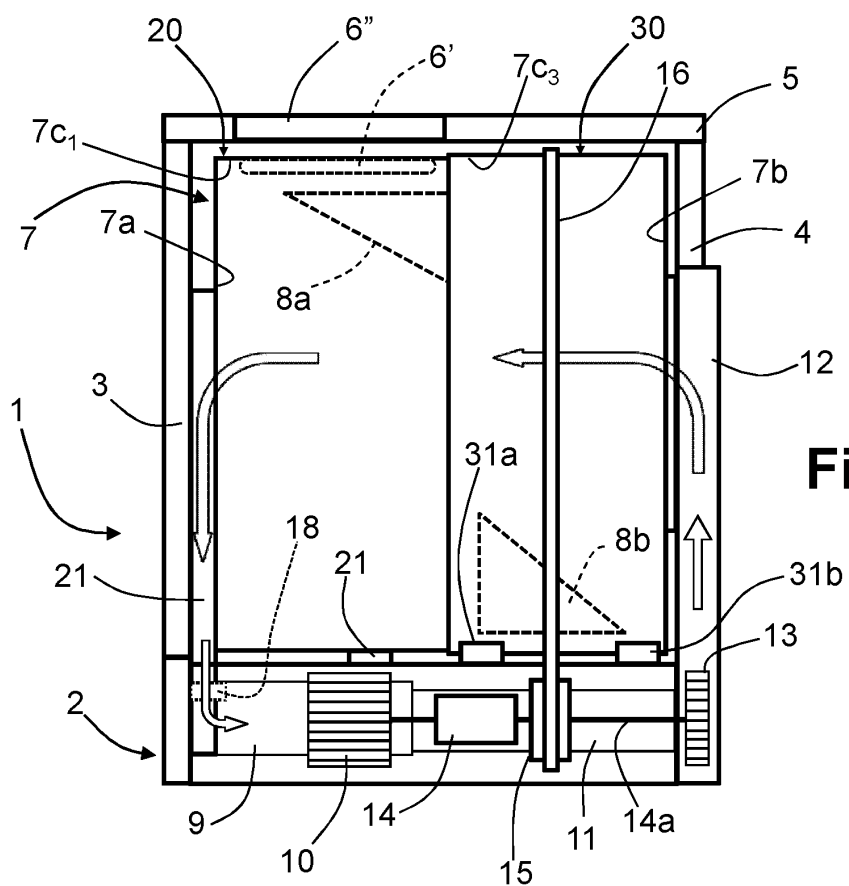


Fig. 6

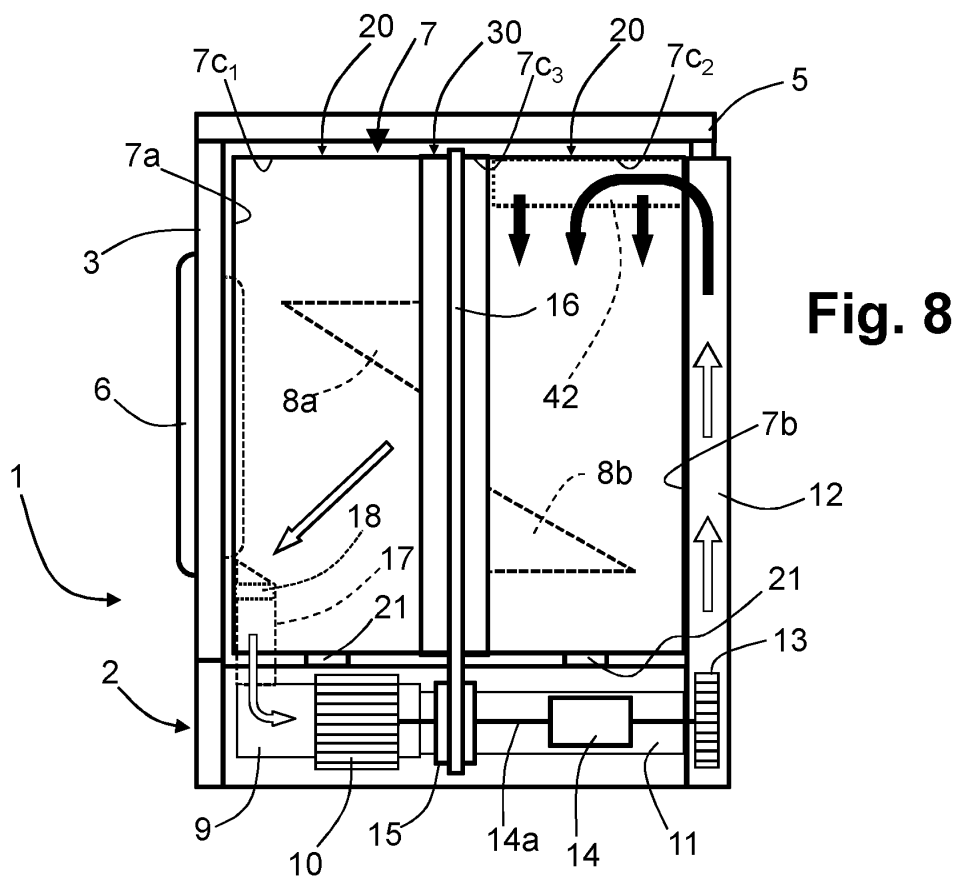
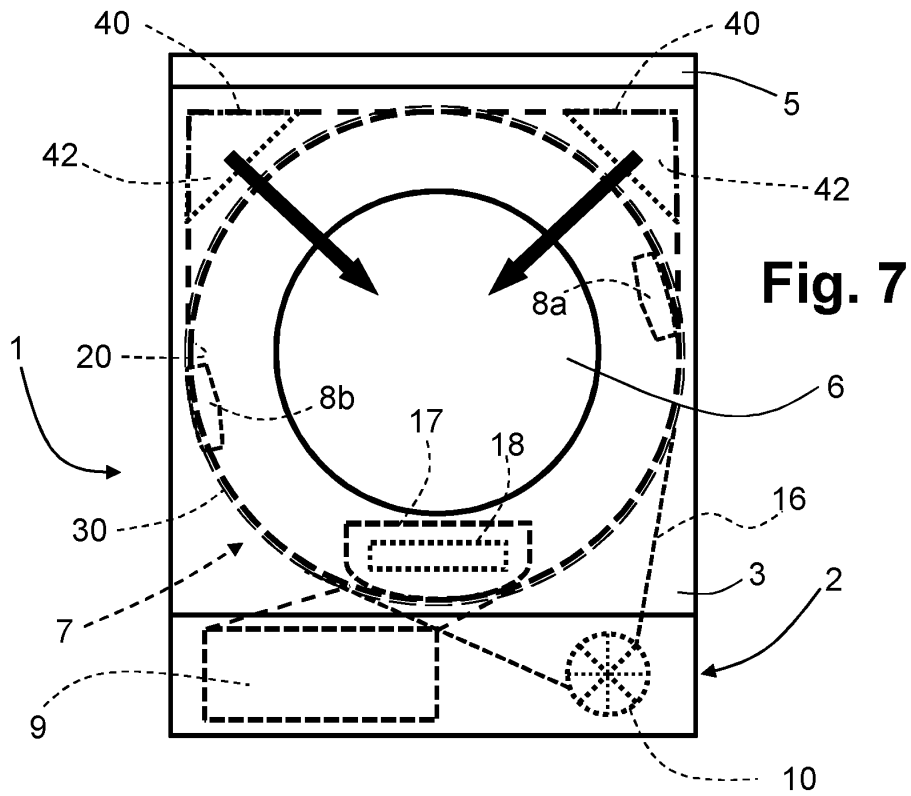


Fig. 9

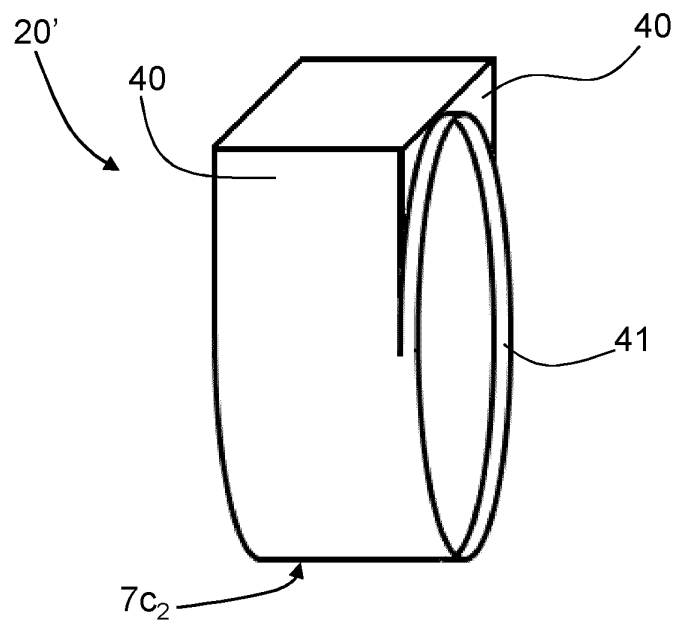
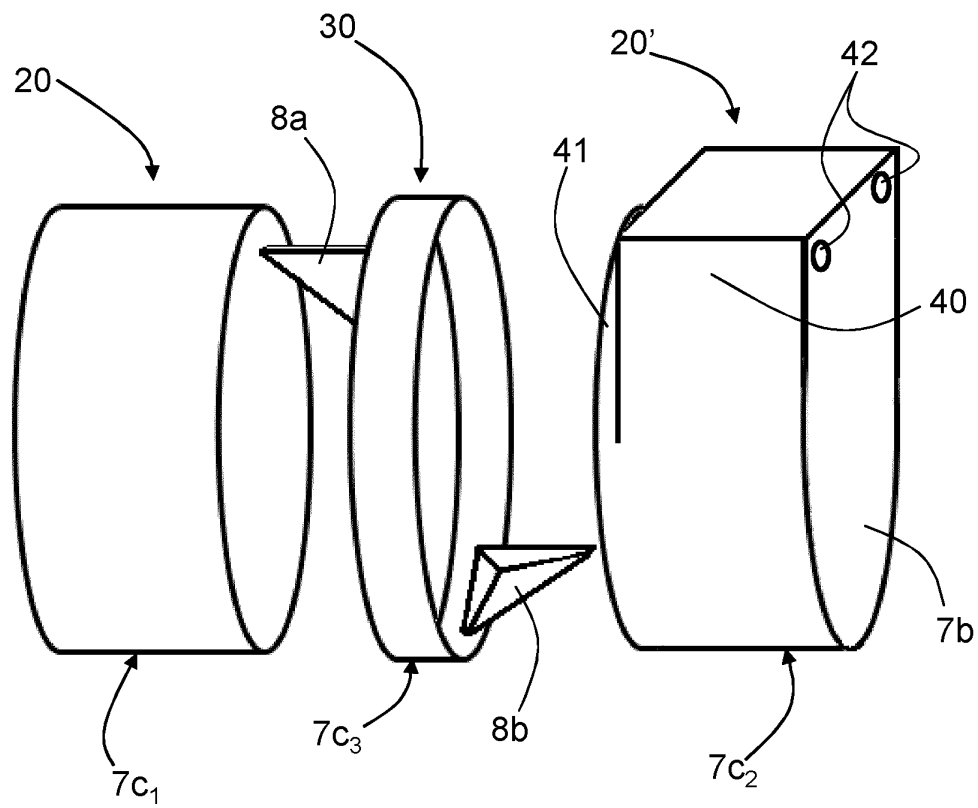


Fig. 10

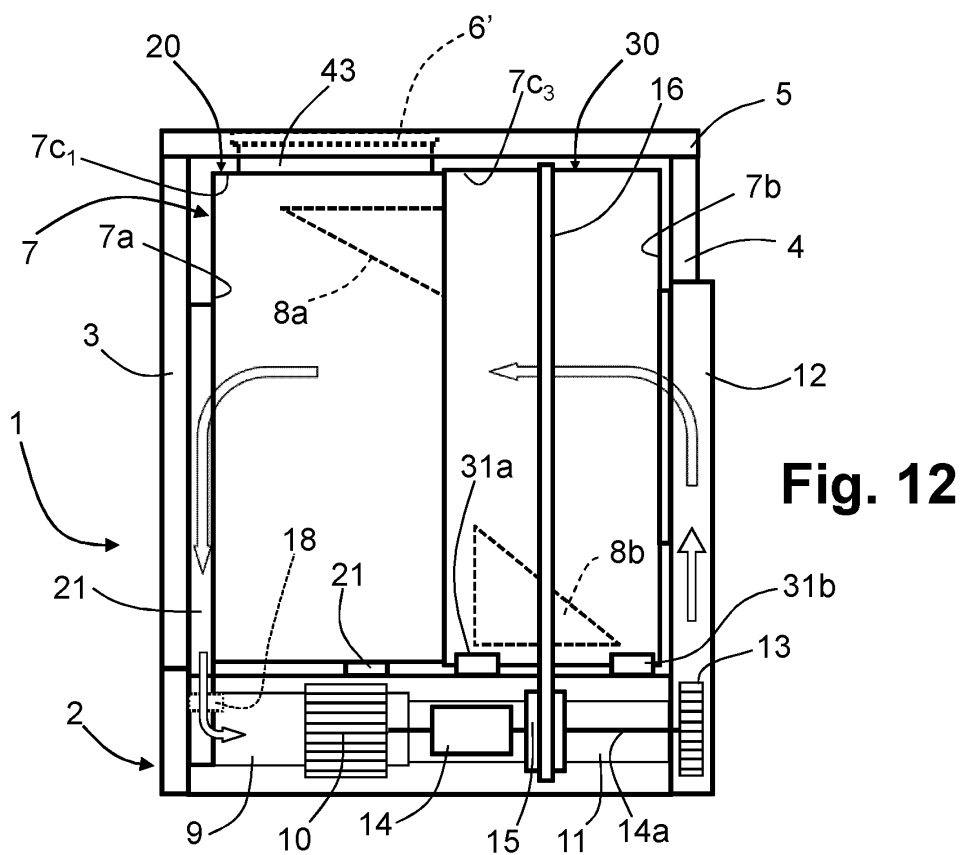
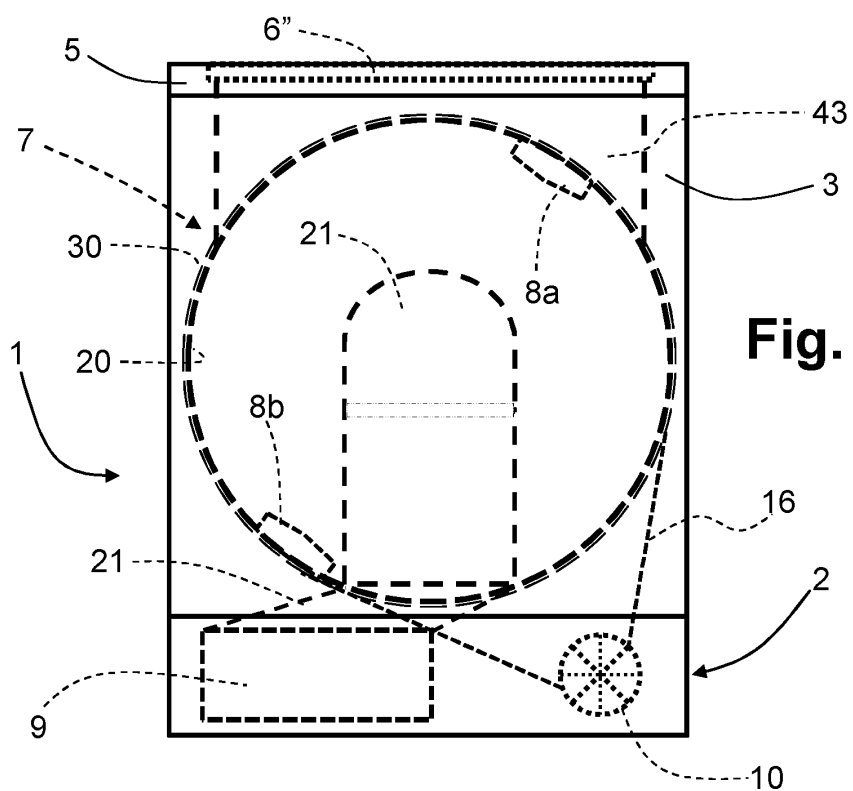
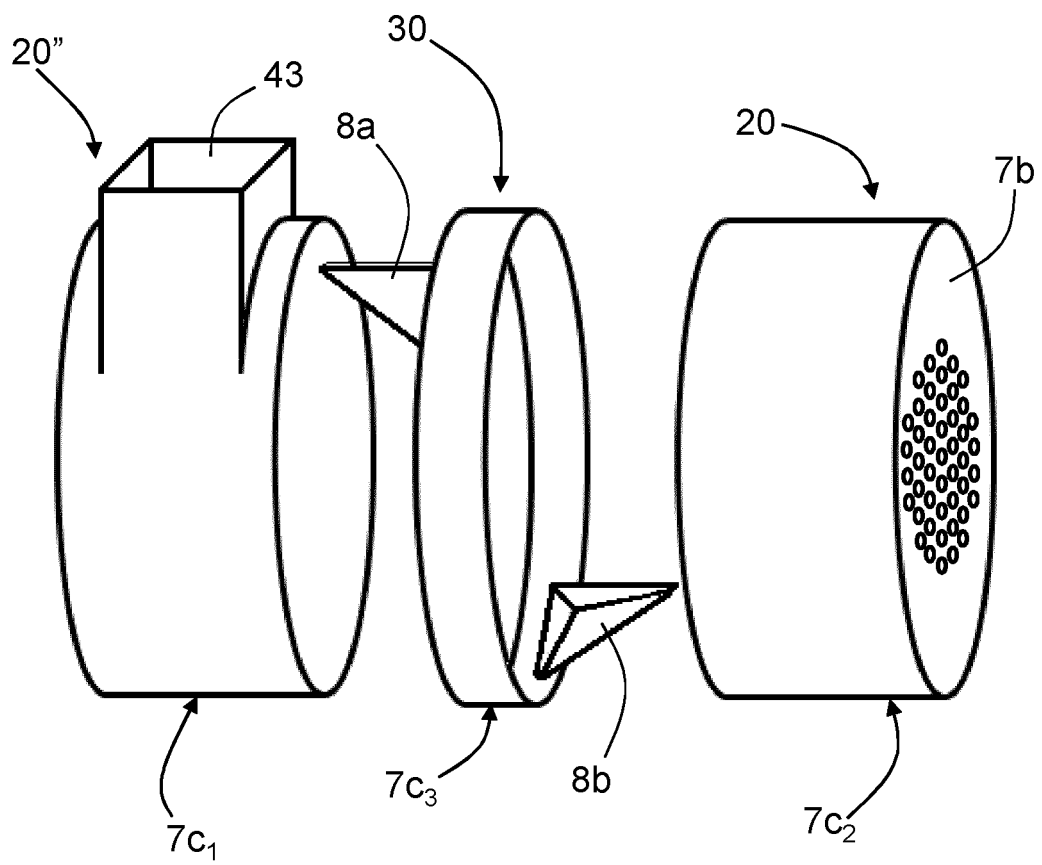


Fig. 13





EUROPEAN SEARCH REPORT

Application Number
EP 13 18 7844

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 3 321 846 A (HEINICKE JOHN B) 30 May 1967 (1967-05-30) * column 2, line 47 - column 4, line 74; figures *	1-15	INV. D06F58/02 D06F58/04
A	----- EP 0 273 580 A2 (JORDAN CHRISTOPHER WILLIAM) 6 July 1988 (1988-07-06) * figures * -----	1-15	
			TECHNICAL FIELDS SEARCHED (IPC)
			D06F
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 29 November 2013	Examiner Stroppa, Giovanni
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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

EP 13 18 7844

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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29-11-2013

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