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(54) **Laundry dryer apparatus**

(57) The present invention relates to a laundry dryer.

A laundry dryer (1) according to the invention comprises a laundry treating chamber (3), a drying air circulating conduit (12) extending through the laundry treating chamber having a drying air outlet section (36) for exhausting drying air from the chamber (3), wherein the laundry dryer further comprises a drying air-filtering cartridge (5,52,53,54,55) which is fitted in a removable manner into a seat (6) formed in the air outlet section, the drying air-filtering cartridge comprising: two shells (23a, 23b) associated one another, a first air permeable sur-

face (21) extending from one shell towards the other shell for allowing drying air entering the air-filtering cartridge, and a second air permeable surface (22) for allowing exhausting drying air from the air-filtering cartridge, the first and the second surfaces being connected through lateral side walls (24a-d). A laundry dryer according to the invention is characterized in that at least one drying air inlet pass-through opening (9a-d,93a,b,94e,f) is formed in a portion of said lateral walls resting within the seat when the air-filtering cartridge is fitted thereinto.

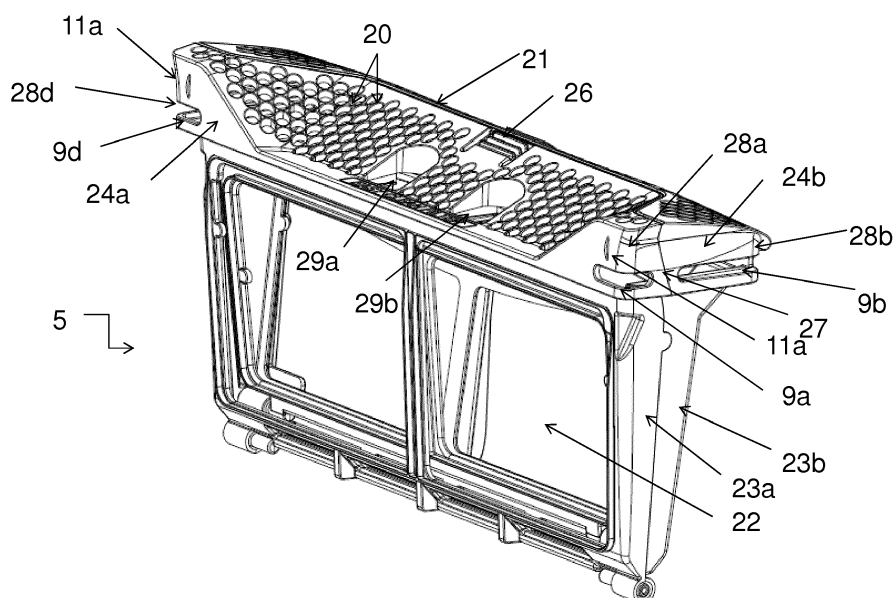


Fig 3

Description

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

[0002] More in particular, the present invention relates to a rotary-drum household laundry dryer to which the following description refers purely by way of example without implying any loss of generality.

[0003] As it is known, rotary-drum household laundry dryers currently on the market generally comprises: a substantially parallelepiped-shaped, outer boxlike casing structured for resting on the floor; a substantially cylindrical rotatable drum which is structured for housing the laundry to be dried and which is housed in axially rotating manner inside the casing so to rotate about a substantially horizontally-oriented longitudinal reference axis, directly facing a laundry loading/unloading opening formed in the front wall of the casing; a hinged to the front wall of the casing to rotate to and from a closing position in which the door rests completely against the front wall of the casing to close the laundry loading/unloading opening and airtight seal the rotatable drum; an electrically-powered motor assembly which is housed inside the casing and is structured for driving into rotation the rotatable drum about its longitudinal reference axis; a closed-circuit, hot-air generator which is housed inside the casing and is structured to circulate inside the rotatable drum a stream of hot air which has a very low moisture content and flows through the rotatable drum and over the laundry inside the drum to rapidly dry the laundry; and finally a control unit which controls the motor assembly and the hot-air generator to perform, on command, one of the user-selectable drying cycles stored in the same control unit.

[0004] In most of the rotary-drum household laundry dryers currently on the market, the rotatable drum further consists in a substantially cylindrical, rigid tubular body which is generally made of metal material and extends substantially horizontally inside the boxlike casing, locally aligned to the laundry loading/unloading opening. This rigid tubular body may be furthermore structured for resting on a number of idle supporting rollers which are arranged at the two axial ends of the tubular body locally parallel to the drum longitudinal reference axis, and are fixed to the boxlike casing in free revolving manner so as to allow the tubular body to freely rotate about its horizontally-oriented longitudinal reference axis. The circular front rim of the tubular body surrounds the laundry loading/unloading opening and is coupled in substantially airtight and axially rotating manner to the front wall of the boxlike casing; whereas the circular rear rim of the tubular body abuts against the rear wall of the boxlike casing and is coupled in substantially airtight and axially rotating manner directly to said rear wall.

[0005] The closed-circuit, hot-air generator in turn comprises: an air recirculating conduit which extends on the bottom of the box-like casing and has a first end directly connected to a first air-vent realized in the rear wall of the boxlike casing, within the perimeter of the rear rim

of the tubular body, and a second end directly connected to a second air-vent realized on the annular frame that delimits the laundry loading/unloading opening on the front wall of the appliance casing; and an electrically-powered centrifugal fan which is located along the air recirculating conduit and is structured to produce an air-flow which flows in closed loop through the air recirculating conduit and the rotatable drum.

[0006] The stream of hot air produced by the hot-air generator generally enters into the tubular body via the first air-vent realized in the rear wall of the boxlike casing, flows inside the tubular body for the entire length of the latter, and finally comes out of the tubular body via the second air-vent realized on the annular frame that delimits the laundry loading/unloading opening on the front wall of the casing.

[0007] The closed-circuit hot-air generator further comprises: an air-cooling device which is located along the air recirculating conduit, and is structured to cool the most air arriving from the rotatable drum, so as to cause the condensation of the surplus moisture inside the air-flow; an air-heating device which is located along the air recirculating conduit, downstream of the air-cooling device, and which is structured for heating the dehumidified airflow arriving from the air-cooling device and directed back to the rotatable drum, so that the airflow directed back into the rotatable drum is heated to a temperature preferably, through not necessarily, higher than or equal to that of the moist air flowing out of the same rotatable drum.

[0008] The closed-circuit hot-air generator is finally provided with an air-filtering member which is arranged along the air recirculating conduit, upstream of the air-cooling device, to prevent the fluff and/or lint particles from reaching and clogging up the air-cooling device, the air-heating and the centrifugal fan.

[0009] In some of the rotary-drum household laundry dryers currently on the market, the air-filtering member consists in a substantially wedge-shaped filtering cartridge which is fitted in removable manner into an air-filtering cartridge seat realized on the annular frame that delimits the laundry loading/unloading opening on the front wall of the casing so as to cover/close the whole seat. When the door is in the wide-opened position, the user is allowed to manually extract the wedge-shaped filtering cartridge from the seat realized on the annular frame that delimits the laundry loading/unloading opening for periodically cleaning.

[0010] Typically, in order to allow a good sealing of the air filtering cartridge to its seat, a gasket is positioned between the air filtering cartridge seat and the air filtering cartridge itself.

[0011] DE8437357U1 discloses a wedge-like air-filtering cartridge for laundry dryers wherein the cartridge is dimensioned for being inserted/plugged into the air-filtering cartridge seat realized on the annular frame that delimits the laundry loading/unloading opening, so as to cover/close the whole seat, and is structured to restrain

the fluff and/or lint particles in suspension into the airflow. This air-filtering cartridge basically consists in a substantially bag- or pocket-shaped air-filtering rigid shell which has a substantially V-shaped cross section and is dimensioned for being inserted/plugged into the seat realized on the annular frame that delimits the laundry loading/unloading opening, so as to cover/close the whole seat.

[0012] The bag-shaped shell is furthermore divided into two complementary valve-like pieces which are laterally hinged to one another at the bottom of the bag- or pocket-shaped air-filtering rigid shell, so that the rigid shell is openable in a book-like manner; and each valve-like piece is provided with a substantially flat, large permeable-to-air sidewall which is structured to restrain the fluff and/or lint particles within the bag-shaped rigid shell.

[0013] To improve the air filtering performances, in DE8437357U1 the wedge-like air-filtering cartridge furthermore comprises two substantially flat, additional permeable-to-air panels, each of which is structured to restrain the fluff and/or lint particles and is hinged to the upper edge of a respective valve-like piece of the bag- or pocket-shaped air-filtering shell, so as to be foldable towards the inside of the bag- or pocket-shaped air-filtering shell for covering the whole permeable-to-air sidewall of the same valve-like piece, thus improving the air-filtering capabilities.

[0014] Despite the double filter structure disclosed by DE8437357U1, typically there is a portion of recirculating drying air that enters the air-filtering cartridge and exits from the coupling interfaces of the air-filtering cartridge component parts, rather than from the filtering surfaces of the air-filtering cartridge, bypassing them. Thus, due to the fact that the main function of the air-filtering cartridge is to filter the recirculating air passing therethrough by collecting therein the fluff and/or lint particles present in the recirculating air, the fluff and/or lint particles present in the recirculating air which by-passes the air-filtering cartridge are not filtered by the cartridge and may fall and then be deposited in the air-circulating conduit rather than on the air-filtering cartridge surfaces. In fact, for example, such a portion of recirculating drying air bypassing the air-filtering cartridge may pass through those gaps necessarily present between the air-filtering cartridge and the relative seat for allowing the air-filtering cartridge to be easily inserted in/removed from the air-filtering cartridge seat. The fluff and/or lint particles are thus deposited within such gaps, and particularly around the outer surface of the air-filtering cartridge.

[0015] Thus, there is the concrete risk that fluff and/or lint particles deposited between the outer surface of the air-filtering cartridge and the air-filtering cartridge seat, enter the air conduit of the laundry dryer, with the result that such fluff and/or lint particles reach the hot-air generator, reducing the drying air flow and/or reducing the thermal heat exchange between the drying air and the air-cooling device, thereby worsening the machine performances.

[0016] This kind of problem is common for all those

kinds of air-filtering cartridges that are removably inserted into the air recirculating conduit and which need a gap for the insertion/removal of the air-filtering cartridge into/from the relative seat.

[0017] Aim of the present invention is to provide a laundry dryer having an air-filtering cartridge which allows the reduction of fluff and/or lint particles accumulation in that portion of air recirculating conduit reached by the recirculating drying air which bypasses the air-filtering cartridge.

SUMMARY OF THE INVENTION

[0018] In one aspect, in compliance with the above aims, according to the present invention there is provided a laundry dryer having an air-filtering cartridge as claimed in Claim 1 and preferably, though not necessarily, in any one of the dependent Claims.

[0019] The laundry dryer of the present invention comprises a laundry treating chamber, a drying air circulating conduit extending through the laundry treating chamber having a drying air outlet section for exhausting drying air from the chamber, and a drying air-filtering cartridge which is fitted in a removable manner into a seat formed in the air outlet section.

[0020] Furthermore, said drying air-filtering cartridge comprises two shells associated one another, a first air permeable surface extending from one of said two shell towards the other one for allowing drying air entering the air-filtering cartridge, and a second air permeable surface for allowing exhausting drying air from the air-filtering cartridge, the first and the second surfaces being connected through lateral side walls.

[0021] The laundry dryer of the present invention is characterized in that at least one drying air inlet pass-through opening is formed in a portion of said lateral walls resting within the seat when the cartridge is fitted therein.

[0022] By the present invention said at least one air inlet pass-through opening prevents the fluff and/or lint particles dispersed in the drying air which by-passes the air-filtering cartridge, from being deposited within the drying air recirculating conduit. In other words, said at least one air inlet pass-through opening allows the fluff and/or lint particles dispersed in the drying air which by-passes the air-filtering cartridge and deposited between the outer surface of the air-filtering cartridge and the air-filtering cartridge seat, to be sucked within the air-filtering cartridge and trapped therein. By this way said fluff and/or lint particles are prevented from depositing onto the air recirculating conduit and clogging up and dirty the air-cooling device that condensates moisture present in the drying air circulating inside the air recirculating conduit.

[0023] Furthermore, by the present invention said at least one opening prevents the fluff and/or lint particles to be accumulated in the surroundings of the air-filtering cartridge during a drying process and the consequent fall into the air recirculating conduit when the air-filtering car-

tridge is removed.

[0024] In the present invention, the term "two shells associated one another" refers to the fact that the first and the second shells may be two separated, i.e. independent, elements forming substantially a single unit when they are joined/assembled one another to form the air-filtering cartridge to be fitted into the air-filtering cartridge seat arranged in the air outlet section. However, the same term may also refer to a first and a second shell having a first portion permanently joined one to the other and a second portion that may be joined and separated to/from the other. As an example, the two shells may comprise a hinge portion that permanently joins the shells and a coupling portion that allows the shells to be removably coupled one onto the other by rotating them about the hinge portion. In this way an air-filtering cartridge is formed that may be opened/closed in a book-like manner..

[0025] In one embodiment of the present invention, said first air permeable surface is formed on one shell only, while the second shell is free of said first air permeable surface. In such an embodiment, the second shell may be coupled to the first shell to form a bag- or pocket-shaped structure for filtering drying air passing there-through.

[0026] In a second preferred embodiment, each shell comprises a first air permeable surface extending towards the other shell. In other words, both the first and the second shell comprise said first air permeable surface allowing said drying air to enter the air-filtering cartridge. The first air permeable surface is generally exposed to the laundry treating chamber.

[0027] By this way, on one hand, when the first and the second shell are joined one to the other to form substantially a single unit, the first air permeable surface of the first shell is adjacent to the first air permeable surface of the second shell to form a substantially single, larger, air permeable surface. On the other hand, when the first and the second shell are spaced apart one each other, each of the first and second shell comprises the corresponding first air permeable surface thereon to form two separated first air permeable surfaces.

[0028] Furthermore and preferably, though not necessarily, said first air permeable surface of the first shell has a shape which is substantially complementary to the shape of said first air permeable surface of the second shell, so as to be joined one to the other.

[0029] Furthermore and preferably, though not necessarily, said first air permeable surfaces of the first and of the second shell are substantially plate like-shaped.

[0030] Furthermore and preferably, though not necessarily, said first air permeable surfaces are provided with a plurality of air passing-through holes and/or apertures, one adjacent the other.

[0031] Furthermore and preferably, though not necessarily, said plurality of air passing-through apertures have rounded edges.

[0032] According to the invention, the air-filtering car-

tridge comprises a second air permeable surface provided for exhausting drying air from the cartridge once fluff and/or lint particles dispersed in the drying air entering the cartridge has been filtered out by means of a filtering mesh. Such second air permeable surface is provided downstream the first air permeable surface considering the drying air flow passing through the cartridge. Filtering mesh is arranged between the first and the second air permeable surfaces or, preferably on the second air permeable surface.

[0033] In the present invention, the term "lateral side walls" refers to any air-filtering cartridge portion that is not part of said first or second air permeable surfaces but that contributes to connect them with each other.

[0034] Furthermore and preferably, though not necessarily, said lateral walls are located in that upper portion of said air-filtering cartridge which rests onto said seat when the air-filtering cartridge is fitted into the seat.

[0035] Furthermore and preferably, though not necessarily, said laundry treating chamber is formed by the inner region of a revolving drum accessible through a loading/unloading opening provided on the laundry dryer cabinet and closable by a door, through which the user is allowed to load/unload laundry articles.

[0036] Furthermore and preferably, though not necessarily, said lateral walls comprise at least a first lateral wall arranged in a position facing the door which closes the laundry treating chamber.

[0037] Furthermore and preferably, though not necessarily, said lateral walls comprise at least a second wall extending transversally with respect to an end open side of the laundry treating chamber.

[0038] Furthermore and preferably, though not necessarily, said lateral walls comprise a consecutive sequence of two couples of said first and second walls to form a perimeter in correspondence of said first air permeable surface, wherein such a perimeter is composed by a sequence of consecutive walls consisting in a first front wall facing the door which closes the laundry treating chamber, a second wall extending transversally with respect to said first front wall, a third rear wall extending preferably substantially parallel to said first front wall and facing the laundry treating chamber, and a fourth wall extending transversally with respect to said first front and third rear wall and extending preferably substantially parallel to said second wall.

[0039] Furthermore and preferably, though not necessarily, the length of said first front wall and of said third rear wall is substantially the same.

[0040] Furthermore and preferably, though not necessarily, the length of said second and of said fourth wall extending transversally with respect to said first front wall and third rear wall is substantially the same.

[0041] Furthermore and preferably, though not necessarily, the length of said first front wall and of said third wall is longer than the width of said second wall and of said fourth wall.

[0042] Furthermore and preferably, though not neces-

sarily, at least said first and second wall forms a corner at their interconnecting area.

[0043] Furthermore and preferably, though not necessarily, each of said couple of consecutive lateral walls forms a corner at their interconnecting area.

[0044] Furthermore and preferably, though not necessarily, said lateral walls forms in total four corners at their interconnecting areas.

[0045] Furthermore and preferably, though not necessarily, said at least one drying air inlet pass-through opening extends on said first front wall and/or on said third rear wall.

[0046] By this way, said at least one drying air inlet pass-through opening extends on said first front wall which substantially extends along the side of the air-filtering cartridge facing the door which closes the laundry treating chamber and/or on said third rear wall which substantially extends along the side of the air-filtering cartridge facing the laundry treating chamber. Thus, said at least one drying air inlet pass-through opening extends along the longer side of said lateral walls.

[0047] Furthermore and preferably, though not necessarily, at least one of said drying air inlet pass-through openings extends on said first front wall and at least one of said drying air inlet pass-through openings extends on said third rear wall.

[0048] Furthermore and preferably, though not necessarily, said at least one drying air inlet pass-through opening extends on said second wall and/or on said fourth wall.

[0049] By this way, said at least one drying air inlet pass-through opening extends on said second wall and/or on said fourth wall which substantially extend along the transversal side of the air-filtering cartridge with respect of the loading/unloading opening. Thus, said at least one drying air inlet pass-through opening extends along the shorter side of said lateral walls.

[0050] Furthermore and preferably, though not necessarily, at least one of said drying air inlet pass-through openings extends on said second wall and at least one of said drying air inlet pass-through openings extends on said fourth wall.

[0051] Furthermore and preferably, though not necessarily, said second wall comprises two drying air inlet pass-through openings and a joining line of the two shells extending between the two openings.

[0052] Furthermore and preferably, though not necessarily, said at least one drying air inlet pass-through opening is formed by joining the two shells along a joining line.

[0053] Furthermore and preferably, though not necessarily, said at least one drying air inlet pass-through opening extends over at least one of said corners formed at the interconnecting area of said first and second walls or said third and fourth walls.

[0054] Furthermore and preferably, though not necessarily, said drying air inlet pass-through openings extend over some of said corners formed at the interconnecting areas of said first, second, third and fourth walls.

[0055] Furthermore and preferably, though not necessarily, said drying air inlet pass-through openings extend over each of said corners formed at the interconnecting areas of said first, second, third and fourth walls.

5 **[0056]** Furthermore and preferably, though not necessarily, the laundry dryer of the present invention further comprises protruding ribs formed on the outer side of said lateral walls for interfering with the seat thereby keeping shells pressed one onto the other when the drying air-filtering cartridge is fitted into the seat.

10 **[0057]** By this way, said protruding ribs allow a good contact between the air-filtering cartridge shells. Thus, the amount of air which otherwise is able to pass through the existing gap of poorly coupled shells of the air-filtering cartridge is reduced or even eliminated and, in consequence of that, it is also reduced or even eliminated the amount of fluff and/or lint particles dispersed in the drying air which may deposit onto the air recirculating conduit clogging up and dirtying the air-cooling device that condenses moisture present in the drying air circulating inside the air recirculating conduit.

15 **[0058]** Furthermore and preferably, though not necessarily, said protruding ribs may have any proper shape which allows them to interfere with the seat thereby keeping shells pressed one onto the other when the drying air-filtering cartridge is fitted into the seat. Furthermore and preferably, though not necessarily, said protruding ribs have a bar shape, rod shape, half moon shape.

20 **[0059]** Furthermore and preferably, though not necessarily, an abutting surface is arranged between said first air permeable surface and said second air permeable surface for keeping the drying air-filtering cartridge in a predetermined position within the seat.

25 **[0060]** Furthermore and preferably, though not necessarily, said protruding ribs are arranged between said abutting surface and said first air permeable surface.

30 **[0061]** Furthermore and preferably, though not necessarily, said two shells enclose two further inner shells.

35 **[0062]** Furthermore and preferably, though not necessarily, said two shells and/or said two further shells are hinged each other on a side of the drying air-filtering cartridge which is opposite to the first air permeable surface.

40 **[0063]** Furthermore and preferably, though not necessarily, said two further inner shells are hinged on one of said two shells.

45 **[0064]** Furthermore and preferably, though not necessarily, said shells are hinged one each other by means of any suitable connecting elements, such as, for example, hinge elements or hooks or coupling elements rotatably coupled one another.

50 **[0065]** Furthermore and preferably, though not necessarily, said shells are hinged one each other along any suitable edge of one shell which is allowed to hinge to a respective edge of the other one shell.

55 **[0066]** Furthermore and preferably, though not necessarily, said shells are slidably coupled one onto the other.

[0067] Furthermore and preferably, though not necessarily, said shells are removably assembled one onto the

other through snap-in fastening elements, preferably comprising one or more resilient tabs or hooks formed on one shell which removably engage a corresponding seat provided on the other shell.

[0068] Furthermore and preferably, though not necessarily, each of said two shell and/or said two further inner shells is provided with a filtering mesh for retaining fluff and/or lint particles dispersed in the drying air, the mesh determining the filtering surfaces.

[0069] Furthermore and preferably, though not necessarily, each of said shells and said two further inner shells form a two valve-like structure which is openable in a book-like manner.

[0070] Furthermore and preferably, though not necessarily, a manually-operated snap-on locking mechanism is structured for selectively anchoring shells to hold such shells coupled one another.

[0071] Furthermore and preferably, though not necessarily, said air-filtering cartridge is provided with at least one recess for allowing a user finger to fit into it for grasping the cartridge and exerting a force sufficient to remove the air-filtering cartridge from the seat when necessary.

[0072] Furthermore and preferably, though not necessarily, said first air permeable surface of the air-filtering cartridge is provided with said at least one recess.

[0073] Furthermore and preferably, though not necessarily, said first air permeable surface of the air-filtering cartridge is provided with at least two of said recesses for allowing fingers of a user to fit into them for grasping the cartridge and exerting a force for removing the air-filtering cartridge from the seat when necessary.

[0074] Furthermore and preferably, though not necessarily, said at least two recesses are opportunely spaced one from the other for equally distributing the force exerted by the user for removing the air-filtering cartridge from the seat when necessary.

[0075] Furthermore and preferably, though not necessarily, the laundry dryer of the present invention further comprises a gasket positioned between an air-filtering cartridge seat portion and said air-filtering cartridge for sealing the air-filtering cartridge to the seat portion.

[0076] By this way, the insertion of the air-filtering cartridge into its seat, sealingly covers the drying air outlet section, thus reducing the amount of drying air that may by-pass the air-filtering cartridge entering the drying air conduit unfiltered..

[0077] Furthermore and preferably, though not necessarily, said gasket extends all around the seat portion of the process air outlet section and is anchored to the perimeter border of the seat portion through a vertical protuberance having one or more couple of lateral projections for each side of the vertical protuberance.

[0078] Furthermore and preferably, though not necessarily, said gasket has an outer edge having an open arched profile that defines a hollow cavity between an upper end region and a lower end region of the arched profile.

[0079] Furthermore and preferably, though not neces-

sarily, the laundry dryer of the present invention further comprises a boxlike cabinet structured for resting on the floor. The cabinet houses the substantially cylindrical, revolving drum for treating laundry using drying air, and which is mounted in axially rotating manner inside the boxlike cabinet. The revolving drum has an open end face which directly faces a laundry loading/unloading through opening formed in the front wall of the cabinet.

[0080] Furthermore and preferably, though not necessarily, the door is hinged to the front wall of the cabinet and rotates about a preferably, though not necessarily, vertically-oriented reference axis, to and from a closing position in which the door rests completely against the front wall to close the laundry loading/unloading opening and substantially airtight seal the revolving drum.

[0081] In one embodiment, the laundry dryer of the present invention is a vented dryer wherein the drying air runs through an open path; in fact, the processed air is sucked from ambient surrounding the laundry dryer, heated up by means of a heater and, after flowing in the drum, said drying air with moisture extracted from wet clothes is conveyed through a vent duct outside the dryer.

[0082] In another embodiment, the laundry dryer of the present invention is a so-called "condense dryer"; typically condense dryers are dryers utilizing an air-to-air exchanger or a heat pump exchanger. In such condense dryers, instead, the processed air flows in a closed circuit, wherein the heated air flow is passed cyclically through a drying chamber and an air-cooling device that removes moisture from the air flow exiting the drying chamber. In fact, the processed air is heated up by a, preferably electric, heater or by the condenser of the heat pump unit before entering the drum and then the air is cooled and dehumidified by an air-to-air exchanger or by the evaporator of the heat pump unit at drum outlet. Moisture removed by the air flow, which operates in said a closed circuit, is recovered in a tank that must be periodically emptied by a user.

[0083] In a second aspect, in compliance with the above aims, according to the present invention there is provided a laundry dryer having an air-filtering cartridge as claimed in Claim 10 and preferably, though not necessarily, in any one of the dependent Claims thereof.

[0084] According to said second aspect, the laundry dryer of the present invention comprises a laundry treating chamber, a drying air circulating conduit extending through the laundry treating chamber having a drying air outlet section for exhausting drying air from the chamber, and a drying air-filtering cartridge which is fitted in a removable manner into a seat formed in the air outlet section. Furthermore, said drying air-filtering cartridge comprises two shells associated one another, a first air permeable surface extending from one of said two shell towards the other one for allowing drying air entering the air-filtering cartridge, and a second air permeable surface for allowing exhausted drying air exiting from the air-filtering cartridge, the first and the second surfaces being connected through lateral side walls.

[0085] According to said second aspect, the laundry dryer of the present invention is characterized in that protruding ribs are formed on the outer side of said lateral walls for interfering with the seat thereby keeping shells pressed one onto the other when the drying air-filtering cartridge is fitted into the seat.

[0086] By this way, said protruding ribs allow a good contact between the air-filtering cartridge shells. Thus, the amount of air which otherwise is able to pass through the existing gap of poorly coupled shells of the air-filtering cartridge is reduced or even eliminated and, in consequence of that, it is also reduced or even eliminated the amount of fluff and/or lint particles dispersed in the drying air which may deposit onto the air recirculating conduit clogging up and dirtying the air-cooling device that condensates moisture present in the drying air circulating inside the air recirculating conduit.

[0087] According to said second aspect, furthermore and preferably, though not necessarily, said protruding ribs may have any proper shape which allows them to interfere with the seat thereby keeping shells pressed one onto the other when the drying air-filtering cartridge is fitted into the seat. Furthermore and preferably, though not necessarily, said protruding ribs may have a bar shape, rod shape, half moon shape.

[0088] According to said second aspect, the term "two shells associated one another" refers to the fact that the first and the second shells may be two separated, i.e. independent, elements forming substantially a single unit when they are joined/assembled one another to form the air-filtering cartridge to be fitted into the air-filtering cartridge said seat arranged in the air outlet section. However, the same term may also refer to a first and a second shell having a first portion permanently joined one to the other and a second portion that may be joined and separated to/from the other. As an example, the two shells may comprise a hinge portion that permanently joins the shells and a coupling portion that allows the shells to be removably coupled one onto the other by rotating them about the hinge portion. In this way an air-filtering cartridge is formed that may be opened/closed in a book-like manner..

[0089] In one embodiment of said second aspect of the present invention, said first air permeable surface is formed on one shell only, while the second shell is free of said first air permeable surface. In such an embodiment, the second shell may be coupled to the first shell to form a bag- or pocket-shaped structure for filtering drying air passing therethrough.

[0090] In a second preferred embodiment of said second aspect of the present invention, each shell comprises a first air permeable surface extending towards the other shell. In other words, both the first and the second shell comprise said first air permeable surface allowing said drying air to enter the air-filtering cartridge. The first air permeable surface is generally exposed to the laundry treating chamber

[0091] By this way, on one hand, when the first and

the second shell are joined one to the other to form substantially a single unit, the first air permeable surface of the first shell is adjacent to the first air permeable surface of the second shell to form a substantially single, larger, air permeable surface. On the other hand, when the first and the second shell are spaced apart one each other, each of the first and second shell comprises the corresponding first air permeable surface thereon to form two separated first air permeable surfaces.

[0092] According to said second aspect, furthermore and preferably, though not necessarily, said first air permeable surface of the first shell has a shape which is substantially complementary to the shape of said first air permeable surface of the second shell, so as to be joined one to the other.

[0093] According to said second aspect, furthermore and preferably, though not necessarily, said first air permeable surfaces of the first and of the second shell are substantially plate like-shaped.

[0094] According to said second aspect, furthermore and preferably, though not necessarily, said first air permeable surfaces are provided with a plurality of air passing-through holes and/or apertures, one adjacent the other.

[0095] According to said second aspect, furthermore and preferably, though not necessarily, said plurality of air passing-through apertures have rounded edges.

[0096] According to the invention, the air-filtering cartridge comprises a second air permeable surface provided for exhausting drying air from the cartridge once fluff and/or lint particles dispersed in the drying air entering the cartridge has been filtered out by means of a filtering mesh. Such second air permeable surface is provided downstream the first air permeable surface considering the drying air flow passing through the cartridge. Filtering mesh is arranged between the first and the second air permeable surfaces or, preferably on the second air permeable surface.

[0097] According to said second aspect, the term "lateral side walls" refers to any air-filtering cartridge portion that is not part of said first or second air permeable surfaces but that contributes to connect them with each other.

[0098] According to said second aspect, furthermore and preferably, though not necessarily, said lateral walls are located in that upper portion of said air-filtering cartridge which rests onto said seat when the air-filtering cartridge is fitted into the seat.

[0099] According to said second aspect, furthermore and preferably, though not necessarily, said laundry treating chamber is formed by the inner region of a revolving drum accessible through a loading/unloading opening provided on the laundry dryer cabinet and closable by a door, through which the user is allowed to load/unload laundry articles.

[0100] According to said second aspect, furthermore and preferably, though not necessarily, said lateral walls comprise at least a first lateral wall arranged in a position

facing the door which closes the laundry treating chamber.

[0101] According to said second aspect, furthermore and preferably, though not necessarily, said lateral walls comprise at least a second wall extending transversally with respect to an end open side of the laundry treating chamber.

[0102] According to said second aspect, furthermore and preferably, though not necessarily, said lateral walls comprise a consecutive sequence of two couples of said first and second walls to form a perimeter in correspondence of said first air permeable surface, wherein such a perimeter is composed by a sequence of consecutive walls consisting in a first front wall facing door which closes the laundry treating chamber, a second wall extending transversally with respect to said first front wall, a third rear wall extending preferably substantially parallel to said first front wall and facing the laundry treating chamber, and a fourth wall extending transversally with respect to said first front and third rear wall and extending preferably substantially parallel to said second wall.

[0103] According to said second aspect, furthermore and preferably, though not necessarily, the length of said first front wall and of said third rear wall is substantially the same.

[0104] According to said second aspect, furthermore and preferably, though not necessarily, the length of said second and of said fourth wall extending transversally with respect to said first front wall and third rear wall is substantially the same.

[0105] According to said second aspect, furthermore and preferably, though not necessarily, the length of said first front wall and of said third wall is longer than the width of said second wall and of said fourth wall.

[0106] According to said second aspect, furthermore and preferably, though not necessarily, at least said first and second wall forms a corner at their interconnecting area.

[0107] According to said second aspect, furthermore and preferably, though not necessarily, each of said couple of consecutive lateral walls forms a corner at their interconnecting area.

[0108] According to said second aspect, furthermore and preferably, though not necessarily, said lateral walls forms in total four corners at their interconnecting areas.

[0109] According to said second aspect, furthermore and preferably, though not necessarily, an abutting surface is arranged between said first air permeable surface and said second air permeable surface for keeping the drying air-filtering cartridge in a predetermined position within the seat.

[0110] According to said second aspect, furthermore and preferably, though not necessarily, said protruding ribs are arranged between said abutting surface and said first air permeable surface.

[0111] According to said second aspect, furthermore and preferably, though not necessarily, said two shells enclose two further inner shells.

[0112] According to said second aspect, furthermore and preferably, though not necessarily, said two shells and/or said two further shells are hinged each other on a side of the drying air-filtering cartridge which is opposite to the first air permeable surface.

[0113] According to said second aspect, furthermore and preferably, though not necessarily, said two further inner shells are hinged on one of said two shells.

[0114] According to said second aspect, furthermore and preferably, though not necessarily, said shells are hinged one each other by means of any suitable connecting elements, such as, for example, hinge elements or hooks or coupling elements rotatably coupled one another.

[0115] According to said second aspect, furthermore and preferably, though not necessarily, said shells are hinged one each other along any suitable edge of one shell which is allowed to hinge to a respective edge of the other one shell.

[0116] Furthermore and preferably, though not necessarily, said shells are slidably coupled one onto the other.

[0117] Furthermore and preferably, though not necessarily, said shells are removably assembled one onto the other through snap-in fastening elements, preferably comprising one or more resilient tabs or hooks formed on one shell which removably engage a corresponding seat provided on the other shell.

[0118] According to said second aspect, furthermore and preferably, though not necessarily, each of said two shell and/or said two further inner shells is provided with a filtering mesh for retaining lint dispersed in the drying air.

[0119] According to said second aspect, furthermore and preferably, though not necessarily, each of said shells and said two further inner shells form a two valve-like structure which is openable in a book-like manner.

[0120] According to said second aspect, furthermore and preferably, though not necessarily, a manually-operated snap-on locking mechanism is structured for selectively anchoring shells to hold such shells coupled one another.

[0121] According to said second aspect, furthermore and preferably, though not necessarily, said air-filtering cartridge is provided with at least one recess for allowing a user finger to fit into it for grasping the cartridge and exerting a force sufficient to remove the air-filtering cartridge from the seat when necessary.

[0122] According to said second aspect, furthermore and preferably, though not necessarily, said first air permeable surface of the air-filtering cartridge is provided with said at least one recess.

[0123] According to said second aspect, furthermore and preferably, though not necessarily, said first air permeable surface of the air-filtering cartridge is provided with at least two of said recesses for allowing fingers of a user to fit into them for grasping the cartridge and exerting a force for removing the air-filtering cartridge from the seat when necessary.

[0124] According to said second aspect, furthermore and preferably, though not necessarily, said at least two recesses are opportunely spaced one from the other for equally distributing the force exerted by the user for removing the air-filtering cartridge from the seat when necessary.

[0125] According to said second aspect, furthermore and preferably, though not necessarily, the laundry dryer of the present invention further comprises a gasket positioned between an air-filtering cartridge seat portion and said air-filtering cartridge for sealing the air-filtering cartridge to the seat portion.

[0126] By this way, the insertion of the air-filtering cartridge into its seat, sealingly covers the drying air outlet section, thus reducing the amount of drying air that may by-pass the air-filtering cartridge entering the drying air conduit unfiltered.

[0127] According to said second aspect, furthermore and preferably, though not necessarily, said gasket extends all around the seat portion of the process air outlet section and is anchored to the perimeter border of the seat portion through a vertical protuberance having one or more couple of lateral projections for each side of the vertical protuberance.

[0128] According to said second aspect, furthermore and preferably, though not necessarily, said gasket has an outer edge having an open arched profile that defines a hollow cavity between an upper end region and a lower end region of the arched profile.

[0129] According to said second aspect, furthermore and preferably, though not necessarily, the laundry dryer of the present invention further comprises a boxlike cabinet structured for resting on the floor. The cabinet houses the substantially cylindrical, revolving drum for treating laundry using drying air, and which is mounted in axially rotating manner inside the boxlike cabinet. The revolving drum has an open end face which directly faces a laundry loading/unloading through opening formed in the front wall of the cabinet.

[0130] According to said second aspect, furthermore and preferably, though not necessarily, the door is hinged to the front wall of the cabinet and rotates about a preferably, though not necessarily, vertically-oriented reference axis, to and from a closing position in which the door rests completely against the front wall to close the laundry loading/unloading opening and substantially airtight seal the revolving drum.

[0131] In one embodiment, the laundry dryer of the present invention is a vented dryer wherein the drying air runs through an open path; in fact, the processed air is sucked from ambient surrounding the laundry dryer, heated up by means of a heater and, after flowing in the drum, said drying air with moisture extracted from wet clothes is conveyed through a vent duct outside the dryer.

[0132] In another second embodiment, the laundry dryer of the present invention is a so-called "condense dryer"; typically condense dryers are dryers utilizing an air-to-air exchanger or a heat pump exchanger. In such

condense dryers, instead, the processed air flows in a closed circuit, wherein the heated air flow is passed cyclically through a drying chamber and an air-cooling device that removes moisture from the air flow exiting the drying chamber. In fact, the processed air is heated up by a, preferably electric, heater or by the condenser of the heat pump unit before entering the drum and then the air is cooled and dehumidified by an air-to-air exchanger or by the evaporator of the heat pump unit at drum outlet. Moisture removed by the air flow, which operates in said a closed circuit, is recovered in a tank that must be periodically emptied by a user.

[0133] A non-limiting embodiment of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

- Figure 1 is a perspective view, with parts removed for clarity, of a rotary-drum household laundry dryer realized in accordance with the teachings of the present invention, an air-filtering cartridge being positioned inside the relative seat;
- Figure 2 is an enlargement view of the Figure 1 laundry dryer, with a first embodiment of the air-filtering cartridge being removed from the relative seat;
- Figure 3 is a perspective view of the air-filtering cartridge of Figure 2 in which the front side of the air-filtering cartridge is shown, i.e. the side facing the laundry loading/unloading pass-through opening closable by the door;
- Figure 4 is a perspective view of the rear side of the Figure 3 air-filtering cartridge, i.e. the side of the air-filtering cartridge facing the laundry treating chamber;
- Figures 5 and 6 show partly-exploded perspective views of the Figures 3, 4 air-filtering cartridge open in a book-like manner;
- Figure 7 is an enlarged view of the Figure 1 laundry dryer showing the air-filtering cartridge according to the first embodiment housed in the relative seat;
- Figure 8 is an enlargement of Figure 7 showing a first protruding rib of the first embodiment of the air-filtering cartridge in engagement with the front side, i.e. the side facing the laundry loading/unloading pass-through opening closable by the door, of the relative seat when the air-filtering cartridge is inserted into the seat;
- Figure 9 is an enlargement of Figure 7 showing a second protruding rib of the first embodiment of the air-filtering cartridge in engagement with the rear side of the relative seat when the air-filtering cartridge is inserted into the seat;

- Figure 10 is a perspective view of a second embodiment of an air-filtering cartridge being removed from the relative seat formed in a laundry dryer as shown in Figure 1, in which the front side of the air-filtering cartridge is shown, i.e. the side facing the laundry loading/unloading pass-through opening closable by the door;
- Figure 11 is a perspective view of a third embodiment of an air-filtering cartridge being removed from the relative seat formed in a laundry dryer as shown in Figure 1, in which the front side of the air-filtering cartridge is shown, i.e. the side facing the laundry loading/unloading pass-through opening closable by the door;
- Figure 12 is a perspective view of a fourth embodiment of an air-filtering cartridge being removed from the relative seat formed in a laundry dryer as shown in Figure 1, in which the front side of the air-filtering cartridge is shown, i.e. the side facing the laundry loading/unloading pass-through opening closable by the door;
- Figure 13 is a perspective view of a fifth embodiment of the air-filtering cartridge of the Figure 1 laundry dryer in which the front side of the filter is shown, i.e. the side facing the laundry loading/unloading pass-through opening closable by the door;
- Figure 14 is a perspective view of the rear side of the Figure 13 air-filtering cartridge;
- Figure 15 shows a schematic view of a heat pump type laundry dryer realized in accordance with a particular embodiment of the present invention.

[0134] With reference to Figures 1 and 2, number 1 indicates as a whole a, preferably household, laundry dryer apparatus which comprises a boxlike cabinet 2 structured for resting on the floor. The cabinet 2 houses a substantially cylindrical, revolving drum 13 for treating laundry using process air in a laundry treating chamber 3, and which is mounted in axially rotating manner inside the boxlike cabinet 2. The revolving drum 13 directly faces a laundry loading/unloading through opening 10 formed in the front wall 8 of the cabinet 2; the user is thus allowed to access laundry in the drum 13 through a door 4 of the laundry dryer 1 arranged at the laundry loading/unloading through opening 10. The door 4 hinged to the front wall 8 of the cabinet 2 rotates about a preferably, though not necessarily, vertically-oriented reference axis, to and from a closing position in which the door 4 rests completely against the front wall 8 to close the laundry loading/unloading opening 10 and substantially airtight seal the revolving drum 13.

[0135] The laundry dryer 1 additionally comprises, inside the boxlike cabinet 2, an electric motor (not shown

in the figures), which is mechanically connected to the revolving drum 13 for driving into rotation the drum 13 about its longitudinal axis; a hot-air generator which is structured to circulate through the revolving drum 13 a stream of hot air having a low moisture level, and which flows over and rapidly dries the laundry located inside drum 13; and finally a control unit (not shown) which controls the electric motor and the hot-air generator to perform one of the user-selectable drying cycles. The hot-air generator comprises an air conduit 12 for supplying drying air to the laundry treating chamber 3 and for exhausting such air, enriched in humidity, from the chamber 3. The hot-air generator is provided with an air-filtering cartridge 5 which is fitted in a removable manner into a seat 6 formed in an air outlet section 36 through which drying air is exhausted from the chamber 3. The air-filtering cartridge 5 is provided for preventing the fluff and/or lint particles dispersed in the drying air leaving the chamber 3 from dirtying the air conduit 12 and all the operational components provided for circulating drying air through the laundry treating chamber 3. A gasket 7 is arranged on a portion of the seat 6 so as to be entrapped between the air-filtering cartridge and the seat 6 when the cartridge 5 is fitted into the seat 6. Gasket 7 allows the air-filtering cartridge 5 to sealingly cover the drying air outlet section 36, thus reducing the amount of drying air that may by-pass the air-filtering cartridge entering the drying air conduit unfiltered.

[0136] With reference to Figures 2-7, a first embodiment of air-filtering cartridge 5 of the laundry dryer 1 of the present invention according to Figure 1 is shown.

[0137] With particular reference to Figures 3 and 4, the front view and the rear view of the first embodiment air-filtering cartridge 5 are shown, i.e., respectively, the side facing the door 4 and the side facing the laundry treating chamber 3 when the air-filtering cartridge 5 is fitted into the seat 6. The air-filtering cartridge 5 shown in Figures 3 and 4 is formed by a first shell 23a and a second shell 23b associated one another in such a way to realize the air-filtering cartridge 5 in a closed configuration, i.e. the working position assumed by the air-filtering cartridge 5 when it is inserted into the seat 6.

[0138] In the air-filtering cartridge 5 shown in Figures 3 and 4, both the first shell 23a and the second shell 23b comprise a respective first air permeable surface 21 extending towards the other shell 23b, 23a and being composed by a plurality of holes 20 for allowing the drying air to enter the air-filtering cartridge 5. Furthermore, the air-filtering cartridge 5 comprises a second air permeable surface 22 for allowing exhausting drying air from the air-filtering cartridge 5.

[0139] As shown in Figures 3 and 4, the first and second surfaces 21, 22 are connected one each other through lateral side walls 24a, 24b, 24c, 24d, positioned in the upper portion of the air-filtering cartridge 5. The first front lateral side wall 24a extends substantially parallel to an end open side of the laundry treating chamber 3 and faces the door 4 when the air-filtering cartridge 5

is inserted into the seat 6 and the door 4 closes the loading/unloading opening 10, the second lateral wall 24b extends transversally with respect to the end open side of the laundry treating chamber 3 of above, the third rear lateral wall 24c extends substantially parallel to such a first front lateral wall 24a and it is opposite thereto and facing the laundry treating chamber 3 when the air-filtering cartridge 5 is inserted into the seat 6, and the fourth lateral wall 24d extends substantially parallel to such a second lateral wall 24b and it is opposite thereto. The first and third lateral walls 24a, 24c, form a corner 28 at each interconnecting area with said second and fourth lateral walls 24b, 24d.

[0140] In the first embodiment of the air-filtering cartridge 5 shown in Figures 2-7, drying air inlet pass-through openings, generally referred as 9, are formed in a portion of the lateral walls, generally referred as 24, which rest within the seat 6 when the air-filtering cartridge 5 is fitted thereinto. Such openings are formed as grooves made in such a portion of the lateral walls 24 allowing an amount of drying air passing through the air-filtering cartridge 5 and its seat 6 to enter the cartridge 5 and being purified from fluff and/or lint particles dispersed in such amount of drying air. Openings 9 allow fluff deposited between the outer surface of the air-filtering cartridge 5 and the seat 6 to be sucked and kept into the cartridge 5.

[0141] In particular, in the first embodiment of air-filtering cartridge 5 shown in Figure 3, the drying air inlet pass-through opening 9a is formed in a portion of the first front lateral wall 24a interconnecting with the second lateral wall 24b, i.e. at the corner 28a. Furthermore, still in the first embodiment of air-filtering cartridge 5 shown in Figure 3, the drying air inlet pass-through opening 9b is formed in a portion of the second lateral wall 24b interconnecting with the third rear lateral wall 24c (visible in Figure 4 only), i.e. at the corner 28b. As shown in Figure 3, the drying air inlet pass-through opening 9b extends towards the drying air inlet pass-through opening 9a, along the second lateral wall 24b; the drying air inlet pass-through opening 9a and the drying air inlet pass-through opening 9b are separated one from the other along a joining line 27 which joins the two shells 23a, 23b.

[0142] In the first embodiment of air-filtering cartridge 5 shown in Figure 3, two protruding ribs 11a are also formed on the outer side of the first front lateral wall 24a, close to the corners 28a, 28d formed by the first front lateral wall 24a with, respectively, the second lateral wall 24b and the forth lateral wall 24d (visible in Figure 4 only). Such protruding ribs 11a, 11b are provided for interfering with the seat 6 thereby keeping shells 23a, 23b pressed one onto the other when the drying air-filtering cartridge 5 is fitted into the seat 6.

[0143] Furthermore, Figure 3 also shows two recesses 29a, 29b positioned in the first air permeable surface 21 for allowing a user to insert his fingers into them for exerting a force sufficient to remove the air-filtering cartridge 5 from the seat 6 when necessary, for example for carrying out cleaning operations.

[0144] In addition, Figures 3 and 4 also shows a manually-operated snap-on locking mechanism 26, structured for selectively anchoring shells 23a, 23b to hold such shells coupled one another. The manually-operated snap-on locking mechanism 26 is positioned in the first air permeable surface 21.

[0145] Similarly, Figure 4 shows the rear view of the first embodiment air-filtering cartridge 5. In particular Figure 4 shows the drying air inlet pass-through opening 9c formed along the fourth lateral wall 24d and also embracing the corner 28c wherein the fourth lateral wall 24d interconnects with the third rear lateral wall 24c. In addition, in Figure 4 it is also visible the drying air inlet pass-through opening 9d formed in that portion of lateral wall wherein the forth lateral wall 24d interconnects with the first front lateral wall 24a (visible in Figure 3 only), i.e. at the corner 28d. As shown in Figure 3, the drying air inlet pass-through opening 9c extends towards the drying air inlet pass-through opening 9d, along the forth lateral wall 24d; the drying air inlet pass-through opening 9c and the drying air inlet pass-through opening 9d are separated one from the other along a joining line 27 which joins the two shells 23a, 23b.

[0146] In the first embodiment of air-filtering cartridge 5 shown in Figure 4, a protruding rib 11b is also formed on the outer side of the third rear lateral wall 24c, close to the corner 28c formed by the third rear lateral wall 24c interconnecting the fourth lateral wall 24d. An additional protruding rib (not shown in Figures 3 and 4) is also formed on the outer side of the third rear lateral wall 24c, close to the corner 28b formed by the third rear lateral wall 24c interconnecting the second lateral wall 24b. Also such protruding ribs 11b allows for interfering with the seat 6 thereby keeping shells 23a, 23b pressed one onto the other when the drying air-filtering cartridge 5 is fitted into the seat 6.

[0147] Figures 5 and 6 show partly-exploded perspective views, with different angulations, of the first embodiment of the air-filtering cartridge 5 depicted in Figures 3 and 4, open in a book-like manner.

[0148] In Figures 5 and 6 it is clearly visible that in such a first embodiment of the air-filtering cartridge 5 both the shells 23a, 23b comprise a first air permeable surface 21 extending towards the other shell 23b, 23a. In Figures 5 and 6 are also visible the four drying air inlet pass-through openings 9a, 9b, 9c, 9d.

[0149] The air-filtering cartridge 5 of Figures 5 and 6 shows that the two shells 23a, 23b enclose two further shells 32a, 32b. The two shells 23a, 23b are hinged each other on the side 25 of the drying air-filtering cartridge 5 which is opposite to the first air permeable surface 21 and the two further inner shells 32a, 32b are hinged each other on the side 25, too. Furthermore, the two further shells 32a, 32b are hinged on one of the two shells 23a, 23b, in particular shell 23a.

[0150] The two shells 23a, 23b and the two further inner shells 32a, 32b are provided with a filtering mesh 40 for retaining fluff and/or lint particles dispersed in the drying

air. The filtering mesh 40 is arranged on the second air permeable surface 22

[0151] Figure 7 is an enlarged sectional view of the Figure 1 laundry dryer and it shows the air-filtering cartridge 5 according to the first embodiment above described with reference to Figures 2 to 6, housed in its seat 6. The drying air inlet pass-through openings 9 formed in the air-filtering cartridge 5 according to the first embodiment are also shown in Figure 7.

[0152] Figures 8 and 9 are enlargements of the portions circled, respectively, on the left side and on the right side of Figure 7.

[0153] Figure 8 better shows a first protruding rib 11a of the first embodiment of the air-filtering cartridge 5 formed on the outer side of the first front lateral wall 24a; the first protruding rib 11a is in engagement with the front side of the seat 6, i.e. the side facing the laundry loading/unloading pass-through opening 10 closable by the door 4, when the air-filtering cartridge 5 is inserted into the seat 6. The first protruding rib 11a by interfering with the seat 6 allows the shell 23a, 23b to be thereby kept pressed one against the other along their joining line 27 when the drying air-filtering cartridge 5 is fitted into the seat 6.

[0154] In Figure 7 is also shown a gasket 7 having a transverse sectional shape extending all around a portion of the seat 6 (abutting surface 30) where the air-filtering cartridge 5 abuts. Gasket 7 is anchored to the perimeter border 33 of the seat 6 through several contact points defined by a vertical protuberance 34 having one or more couple of lateral projections 35 for each side of the vertical protuberance 34.

[0155] Figure 9 better shows a second protruding rib 11b of the first embodiment of the air-filtering cartridge 5 formed on the outer side of the third rear lateral wall 24c; the second protruding rib 11b is in engagement with the rear side of the relative seat 6, i.e. the side facing the laundry treating chamber 3, when the air-filtering cartridge 5 is inserted into the seat 6. The second protruding rib 11b by interfering with the seat 6 allows the shell 23a, 23b to be thereby kept pressed one against the other along their joining line 27 when the drying air-filtering cartridge 5 is fitted into the seat 6.

[0156] Figure 7 also shows the abutting surface 30 arranged between the first air permeable surface 21 and the second air permeable surface 22 for keeping the drying air-filtering cartridge 5 in a predetermined position within the seat 6. The protruding ribs 11a, 11b are arranged between the abutting surface 30 and the first air permeable surface 21.

[0157] The first embodiment of the air-filtering cartridge 5 shown above with reference to Figure 2 to 9 allows the laundry dryer 1 of the present invention to improve the laundry drying performance. In fact, the presence of drying air inlet pass-through openings 9 formed in portions of the lateral walls 24 which connect the first air permeable surface 21 for allowing drying air entering the air-filtering cartridge 5 and the second air permeable

surface 22 for allowing exhausting drying air from the air-filtering cartridge 5, prevents an amount of drying air leaving the laundry treating chamber 3 to bypass the air-filtering cartridge 5 and deposit the fluff and/or lint particles dispersed in such amount of drying air onto the drying air circulating conduit 12. Drying air inlet pass-through openings 9 also allow fluff accumulated

[0158] With reference to Figure 10, a second embodiment of air-filtering cartridge 5 of the laundry dryer 1 of the present invention according to Figure 1 is shown. In Figure 10, like reference figures indicate like parts.

[0159] Such a second embodiment of the air-filtering cartridge 52 shown in Figure 10 differs from the first embodiment of the air-filtering cartridge 5 shown in Figures 2 to 9 only for the fact that in the second embodiment the first and second protruding ribs 11a, 11b disclosed in the first embodiment are not present.

[0160] In such a second embodiment of the air-filtering cartridge 52 shown in Figure 10, the same drying air inlet pass-through opening 9a, 9b, 9c and 9d of the first embodiment of the air-filtering cartridge shown in Figure 3 are also present. The drying air inlet pass-through opening 9c of the first embodiment of the air-filtering cartridge shown in Figure 4 is also present in such a second embodiment 52 of the air-filtering cartridge even if not shown in Figure 10.

[0161] Similarly to the first embodiment, also in such a second embodiment of the air-filtering cartridge 52, the two shells 23a, 23b may enclose two further inner shells 32a, 32b.

[0162] With reference to Figure 11, a third embodiment 53 of the air-filtering cartridge of the laundry dryer 1 of the present invention according to Figure 1 is shown. In Figure 11, like reference figures indicate like parts.

[0163] Such a third embodiment 53 of the air-filtering cartridge shown in Figure 11 is similar to the second embodiment 52 of the air-filtering cartridge shown in Figure 10. In fact, as already described with reference to the second embodiment 52 shown in Figure 10, also in such a third embodiment the first and second protruding ribs 11a, 11b disclosed in the first embodiment are not present. However, such a third embodiment 53 of the air-filtering cartridge shown in Figure 11 differs from the second embodiment 52 of the air-filtering cartridge shown in Figure 10 for the fact that in such a third embodiment 53 the drying air inlet pass-through openings 93a, 93b are formed only on the second lateral wall 24b and/or further drying air inlet pass-through openings are formed only on the fourth lateral wall 24d similarly to openings 93a, 93b, even if such further openings are not shown in Figure 11. In such embodiment, drying air inlet pass-through openings 93a, 93b, and the further openings formed on the fourth lateral wall 24d, do not extend over lateral walls 24a and 24c. In other words drying air inlet pass-through openings 93a, 93b, and the further openings formed on the fourth lateral wall 24d, do not extend over the corners 28a, 28b, 28c, 28d at the opposite ends of the second and fourth lateral walls 24b, 24d. Furthermore, a joining

line 27 of the two shells 23a, 23b extends between the two drying air inlet pass-through openings 93a, 93b formed on the second lateral wall 24b and between two further drying air inlet pass-through openings formed on the fourth lateral wall 24d.

[0164] Similarly to the first embodiment, also in such a third embodiment of the air-filtering cartridge 53, the two shells 23a, 23b may enclose two further inner shells 32a, 32b.

[0165] With reference to Figure 12, a fourth embodiment 54 of the air-filtering cartridge of the laundry dryer 1 of the present invention according to Figure 1 is shown. In Figure 12, like reference figures indicate like parts.

[0166] Such a fourth embodiment 54 of the air-filtering cartridge shown in Figure 12 is similar to the third embodiment 53 of the air-filtering cartridge shown in Figure 11. In fact, as already described with reference to the third embodiment 53 shown in Figure 11, also in such a fourth embodiment 54 the first and second protruding ribs 11a, 11b disclosed in the first embodiment are not present. However, such a fourth embodiment 54 of the air-filtering cartridge shown in Figure 12 differs from the third embodiment 53 of the air-filtering cartridge shown in Figure 11 for the fact that in such a fourth embodiment 54 drying air inlet pass-through openings 94e, 94f are formed only on the first front lateral wall 24a and/or further drying air inlet pass-through openings are formed only on the third rear lateral wall 24c similarly to openings 94e, 94f, even if such openings are not shown in Figure 12. In such embodiment, drying air inlet pass-through openings 94e, 94f, and the further openings formed on the third lateral wall 24c, do not extend over lateral walls 24b and 24d. In other words drying air inlet pass-through openings 94e, 94f, and the further openings formed on the third lateral wall 24c, do not extend over the corners 28a, 28b, 28c, 28d at the opposite ends of the first front and third lateral walls 24a, 24c.

[0167] Similarly to the first embodiment, also in such a fourth embodiment of the air-filtering cartridge 54, the two shells 23a, 23b may enclose two further inner shells 32a, 32b.

[0168] With reference to Figures 13 and 14, a fifth embodiment 55 of the air-filtering cartridge of the laundry dryer 1 of the present invention according to Figure 1 is shown. In Figures 13 and 14, like reference figures indicate like parts.

[0169] Figures 13 and 14 show, respectively, the front view and the rear view of the fifth embodiment of air-filtering cartridge 55, i.e. the side facing the laundry loading/unloading pass-through opening 10 closable by the door 4 and the side facing the laundry treating chamber 3 when the air-filtering cartridge 55 is fitted into the seat 6.

[0170] The air-filtering cartridge 55 shown in Figures 13 and 14 is formed by a first shell 23a and a second shell 23b associated one another in such a way to realize the air-filtering cartridge 55 in a closed configuration, i.e. the working position assumed by the air-filtering cartridge 55 when it is inserted into the seat 6.

[0171] In the air-filtering cartridge 55 shown in Figures 13 and 14, both the first shell 23a and the second shell 23b comprise a respective first air permeable surface 21 extending towards the other shell 23b, 23a and being composed by a plurality of holes 20 for allowing the drying air to enter the air-filtering cartridge 5. Furthermore, the air-filtering cartridge 55 comprises a second air permeable surface 22 for allowing exhausting drying air from the air-filtering cartridge 55.

[0172] As shown in Figures 13 and 14, the first and second surfaces 21, 22 are connected one each other through lateral side walls 24a, 24b, 24c, 24d, positioned in the upper portion of the air-filtering cartridge 55. The first front lateral side wall 24a extends substantially parallel to an end open side of the laundry treating chamber 3 and faces the door 4 when the air-filtering cartridge 55 is inserted into the seat 6 and the door 4 closes the loading/unloading opening 10, the second lateral wall 24b extends transversally with respect to the end open side of the laundry treating chamber 3 of above, the third rear lateral wall 24c extends substantially parallel to such a first front lateral wall 24a and it is opposite thereto and facing the laundry treating chamber 3 when the air-filtering cartridge 55 is inserted into the seat 6, and the fourth lateral wall 24d extends substantially parallel to such a second lateral wall 24b and it is opposite thereto.

[0173] In the front view of the fifth embodiment of air-filtering cartridge 55 shown in Figure 13 two protruding ribs 11a are formed on the outer side of the first front lateral wall 24a, at the opposite end regions thereof. Similarly, in the rear view of the fifth embodiment of air-filtering cartridge 55 shown in Figure 14 two protruding ribs 11b are formed on the outer side of the third rear lateral wall 24c, at the opposite end regions thereof. The two protruding ribs 11a formed on the outer side of the first front lateral wall 24a preferably have a half moon-like shape, while the two protruding ribs 11b formed in relief on the outer side of the third rear lateral wall 24c preferably have a bar-like shape, even if any shape of protruding ribs may be used.

[0174] Such protruding ribs 11a, 11b allows for interfering each of the shells 23a, 23b with the seat 6 thereby keeping such shells 23a, 23b pressed one against the other when the drying air-filtering cartridge 55 is fitted into the seat 6. An abutting surface 30 is arranged between the first air permeable surface 21 and the second air permeable surface 22 for keeping the drying air-filtering cartridge 55 in a predetermined position within the seat 6. The protruding ribs 11a, 11b are arranged between the abutting surface 30 and the first air permeable surface 21.

[0175] With particular reference to the front view of the air-filtering cartridge 55 shown in Figure 13, the air-filtering cartridge 55 is preferably openable in a book-like manner. The air-filtering cartridge 55 of Figures 13 and 14 shows that the two shells 23a, 23b enclose two further inner shells 32a, 32b. The two shells 23a, 23b are hinged each other on the side 25 of the drying air-filtering car-

tridge 55 which is opposite to the first air permeable surface 21 and the two further inner shells 32a, 32b are hinged each other on the side 25, too. Furthermore, the two further shells 32a, 32b are hinged on one of the two shells 23a, 23b, in particular shell 23a.

[0176] The two shells 23a, 23b and the two further inner shells 32a, 32b are provided with a filtering mesh 40 for retaining fluff and/or lint particles dispersed in the drying air. The filtering mesh 40 is arranged on the second air permeable surface 22.

[0177] In addition, Figures 13 and 14 also shows a manually-operated snap-on locking mechanism 26, structured for selectively anchoring shells 23a, 23b to hold such shells coupled one another. The manually-operated snap-on locking mechanism 26 is positioned in the first air permeable surface 21.

[0178] The fifth embodiment of the air-filtering cartridge 55 shown above with reference to Figures 13 and 14 allows the laundry dryer 1 of the present invention to improve the laundry drying performance. In fact, the presence of the protruding ribs 11a, 11b formed on the outer side of lateral walls 24, which connect the first air permeable surface 21 for allowing drying air entering the air-filtering cartridge 55 and the second air permeable surface 22 for allowing exhausting drying air from the air-filtering cartridge 55, and interfering with the seat 6, the shells 23a, 23b are kept pressed one against the other when the drying air-filtering cartridge 55 is fitted into the seat 6. In such a way, the amount of air which otherwise is able to pass through the existing gap of poorly coupled shells of the air-filtering cartridge is reduced or even eliminated and, in consequence of that, it is also reduced or even eliminated the amount of fluff and/or lint particles dispersed in the drying air which may deposit onto the air recirculating conduit 12.

[0179] In a particular embodiment of the laundry dryer of the present invention, the laundry dryer 1 is a heat pump exchanger type condense dryer, as schematically shown in Figure 15, wherein a process air circulating conduit 12 for conveying the process air through the drum 13 and a heat pump assembly 14 are indicated. The process air circulating conduit 12 is usually a closed-circuit air recirculating conduit having its two ends fluidly connected to the revolving drum 13, on opposite sides of the latter; an electric centrifugal fan 31 located along the process air circulating conduit 12 produces, inside the latter, an airflow which flows through the revolving drum 13. An air-filtering cartridge 5 is arranged at an air outlet section 36 exhausting drying air from the drum 13. The air-filtering cartridge 5 filters out fluff and/or lint particles dispersed in the drying air. The arrows in Figure 15 show the direction of the air in the process air circulating conduit 12.

[0180] With particular reference to Figure 15, the heat pump assembly 14 schematically comprises:

- a first air/refrigerant heat exchanger 15 which is located along the process air circulating conduit 12

and is structured for cooling down the airflow arriving from revolving drum 13 to condense and restrain the surplus moisture in the airflow;

- 5 - a second air/refrigerant heat exchanger 16 which is located along the process air circulating conduit 12, downstream of the first heat exchanger 15, and which is structured for heating the airflow arriving from the first heat exchanger 15 and directed back to revolving drum 3, so that the airflow re-entering into revolving drum 13 is heated to a temperature higher than or equal to that of the air flowing out of revolving drum 13;
- 10 - an electrically-powered refrigerant compressing device 17 which is interposed between the refrigerant-outlet of the first heat exchanger 15 and the refrigerant-inlet of the second heat exchanger 16, and which is structured for compressing the gaseous-state refrigerant directed towards the second heat exchanger 16 so that refrigerant pressure and temperature are much higher at the refrigerant-inlet of the second heat exchanger 16 than at the refrigerant-outlet of the first heat exchanger 15; and
- 15 - an expansion valve or similar passive/operated refrigerant expansion device 18 (for example a capillary tube, a thermostatic valve or an electrically-controlled expansion valve) which is interposed between the refrigerant-outlet of the second heat exchanger 16 and the refrigerant-inlet of the first heat exchanger 15, and it is structured so as to cause an expansion of the refrigerant directed towards the first air/refrigerant heat exchanger 15, so that refrigerant pressure and temperature are much higher at the refrigerant-outlet of the second heat exchanger 16 than at the refrigerant-inlet of the first heat exchanger 15;
- 20 - a refrigerant loop 19 for circulating a refrigerant fluid through the members 15, 16, 17, 18 of the heat pump assembly 14.

[0181] The air/refrigerant first heat exchanger 15 is conventionally referred to as the "evaporator" or "gas-heater" of the heat-pump assembly 14, and it is structured so that the airflow arriving from revolving drum 13 and the low-pressure and low temperature refrigerant directed to the suction of the refrigerant compressing device 17 can flow through it simultaneously, allowing the refrigerant having a temperature lower than that of the airflow, to absorb heat from the airflow, thus causing condensation of the surplus moisture in the airflow arriving from revolving drum 13.

[0182] The air/refrigerant second heat exchanger 16, in turn, is conventionally referred to as the "condenser" or "gas-cooler" of the heat-pump assembly 14, and it is structured so that the airflow directed back into revolving drum 13 and the high-pressure and high-temperature re-

frigerant arriving from the delivery of the refrigerant compressing device 17 can flow through it simultaneously, allowing the refrigerant having a temperature greater than that of the airflow to release heat to the airflow, thus heating the airflow directed back into the revolving drum 13.

[0183] Clearly, changes may be made to the laundry dryer 1 as described herein without, however, departing from the scope of the present invention.

[0184] For example, in other particular embodiments of the present invention (not shown in the figures), the laundry dryer may be a vented dryer, wherein the drying air runs through an open path and the drying air with moisture extracted from wet clothes is conveyed through a vent duct to the outside of the laundry dryer. In a further embodiment of the present invention the laundry dryer may be a "condense dryer" type which utilizes an air-to-air exchanger instead of the heat pump exchanger described above.

[0185] Furthermore, the drying air-filtering cartridge 5 of the first embodiment shown with reference to Figures 2 to 9 shows the presence of both protruding ribs 11a formed on the outer side of said first front lateral wall 24a and protruding ribs 11b formed on the outer side of said second rear lateral wall 24b. However, in additional embodiments of the drying air-filtering cartridge, not shown in the Figures, the protruding ribs 11a may be formed only on the outer side of said first front lateral wall 24a, or the protruding ribs 11b may be formed only on the outer side of said second rear lateral wall 24b.

[0186] Furthermore, the drying air-filtering cartridges 52, 53, 54 of the second, third and fourth embodiment shown with reference, respectively, to Figures 10, 11 and 12 show the presence of drying air inlet pass-through openings 9a, 9b, 9c, 9d, 93a, 93b, 94e, 94f formed in a portion of said lateral walls 24a, 24b, 24c, 24d, in the absence of any kind of protruding ribs 11a, 11b formed on the outer side of said lateral walls. However, additional embodiments of the drying air-filtering cartridge, not shown in the Figures, may be similar to said second, third and fourth embodiment, with the difference that protruding ribs 11a are formed on the outer side of said first front lateral wall 24a and/or on the outer side of the third rear lateral wall 24c. According to further embodiments, the drying air-filtering cartridge may be similar to said second, third and fourth embodiment with the difference that the protruding ribs 11b are formed on the outer side of said third rear lateral wall 24c, as described in the first embodiment of the air-filtering cartridge shown in Figures 2 to 9.

[0187] Still furthermore, the drying air-filtering cartridges 5, 52, 53 of the first, second and third embodiment according to the invention may be provided with drying air inlet pass-through openings 9a, 9b, 9c, 9d, 93a, 93b that extend over the joining line 27 of the two shells 23a, 23b. In other words, openings continuously extending along the second and/or the fourth lateral wall 24b, 24d and extending on both shells 23a, 23b may be formed.

[0188] Yet furthermore, a laundry dryer made according to the present invention may include a drying air-filtering cartridge comprising two shells only, without the further inner shells enclosed within the outer shells that are disclosed with reference to the embodiments of the drying air-filtering cartridge shown in Figures 2 to 14

Claims

1. A laundry dryer (1) comprising a laundry treating chamber (3), a drying air circulating conduit (12) extending through the laundry treating chamber (3) having a drying air outlet section (36) for exhausting drying air from the chamber (3), wherein the laundry dryer (1) further comprises a drying air-filtering cartridge (5, 52, 53, 54, 55) which is fitted in a removable manner into a seat (6) formed in the air outlet section (36), the drying air-filtering cartridge (5, 52, 53, 54, 55) comprising: two shells (23a, 23b) associated one another, a first air permeable surface (21) extending from one shell (23a, 23b) towards the other shell (23b, 23a) for allowing drying air entering the air-filtering cartridge (5, 52, 53, 54, 55), and a second air permeable surface (22) for allowing exhausting drying air from the air-filtering cartridge (5, 52, 53, 54, 55), the first and the second surfaces (21, 22) being connected through lateral side walls (24a, 24b, 24c, 24d), **characterized in that**, at least one drying air inlet pass-through opening (9a, 9b, 9c, 9d, 93a, 93b, 94e, 94f) is formed in a portion of said lateral walls (24a, 24b, 24c, 24d) resting within the seat (6) when the air-filtering cartridge (5, 52, 53, 54, 55) is fitted thereinto.
2. A laundry dryer (1) according to claim 1, **characterized in that** each shell (23a, 23b) comprises a first air permeable surface (21) extending towards the other shell (23b, 23a).
3. A laundry dryer (1) according to claim 1 or 2, **characterized in that** said laundry treating chamber (3) is accessible through a loading/unloading opening (10) closable by a door (4) and said lateral walls (24a, 24b, 24c, 24d) comprise a first lateral wall (24a) facing the door (4) and/or a third lateral wall (24c) facing the laundry treating chamber (3), wherein said at least one drying air inlet pass-through opening (9a, 9b, 9c, 9d, 94e, 94f) extends on said first lateral wall (24a) and/or on said third lateral wall (24c).
4. A laundry dryer (1) according to any preceding claim, **characterized in that** said lateral walls (24a, 24b, 24c, 24d) comprise a second lateral wall (24b) and/or a fourth lateral wall (24d) extending transversally with respect to an end open side of the laundry treating chamber (3), wherein said at least one drying air inlet pass-through opening (9a, 9b, 9c, 9d, 93a, 93b)

extends on said second lateral wall (24b) and/or said fourth lateral wall (24d).

5. A laundry dryer (1) according to claim 4, **characterized in that** said second lateral wall (24b) and/or said fourth lateral wall (24d) comprises two drying air inlet pass-through openings (9a, 9b, 9c, 9d, 93a, 93b) and a joining line (27) of the two shells (23a, 23b) extending between the two openings (9a, 9b, 9c, 9d, 93a, 93b).
6. A laundry dryer (1) according to claim 4, **characterized in that** the at least one drying air inlet pass-through openings (9a, 9b, 9c, 9d, 93a, 93b) is formed by joining the two shells (23a, 23b) along a joining line.
7. A laundry dryer (1) according to claim 3 and any claim 4 to 6, **characterized in that** at least one of said first and third lateral walls (24a, 24c) forms a corner (28a, 28b, 28c, 28d) at an interconnecting area with said second and/or fourth lateral wall (24b, 24d) and said at least one drying air inlet pass-through opening (9a, 9b, 9c, 9d) extends over one of said corners (28).
8. A laundry dryer (1) according to any preceding claim **characterized in that** protruding ribs (11a, 11b) are formed on an outer side of said lateral walls (24a, 24c) for interfering with the seat (6) thereby keeping shells (23a, 23b) pressed one onto the other when the drying air-filtering cartridge (5, 55) is fitted into the seat (6).
9. A laundry dryer (1) according to claim 8, wherein an abutting surface (30) is arranged between the first air permeable surface (21) and the second air permeable surface (22) for keeping the drying air-filtering cartridge (5, 55) in a predetermined position within the seat (6) and wherein the protruding ribs (11a, 11b) are arranged between the abutting surface (30) and the first air permeable surface (21).
10. A laundry dryer (1) comprising a laundry treating chamber (3), a drying air circulating conduit (12) extending through the laundry treating chamber (3) having a drying air outlet section (36) for exhausting drying air from the chamber (3), wherein the laundry dryer (1) further comprises a drying air-filtering cartridge (5, 55) which is fitted in a removable manner into a seat (6) formed in the air outlet section (36), the drying air-filtering cartridge (5, 55) comprising: two shells (23a, 23b) associated one another, a first air permeable surface (21) extending from one shell (23a, 23b) towards the other shell (23b, 23a) for allowing drying air entering the cartridge (5, 55), and a second air permeable surface (22) for exhausting drying air from the air-filtering cartridge (5, 55), the first and the second surfaces (21, 22) being connect-

ed through lateral side walls (24a, 24b, 24c, 24d), **characterized in that**, protruding ribs (11a, 11b) are formed on an outer side of lateral walls (24a, 24c) for interfering with the seat (6) thereby keeping shells (23a, 23b) pressed one onto the other when the drying air-filtering cartridge (5, 55) is fitted into the seat (6).

11. A laundry dryer (1) according to any preceding claim **characterized in that** said two shells (23a, 23b) enclose two further inner shells (32a, 32b).
12. A laundry dryer (1) according to any preceding claim **characterized in that** said shells (23a, 23b) and/or further shells (32a, 32b) are hinged each other on a side (25) of the drying air-filtering cartridge (5) which is opposite to the first air permeable surface (21).
13. A laundry dryer (1) according to claim 11 or 12 **characterized in that** said two further inner shells (32a, 32b) are hinged on one of the shells (23a, 23b).
14. A laundry dryer (1) according to any preceding claim **characterized in that** each shell (23a, 23b, 32a, 32b) is provided with a filtering mesh (40) for retaining lint dispersed in the drying air.
15. A laundry dryer (1) according to any preceding claim **characterized in that** a manually-operated snap-on locking mechanism (26) is structured for selectively anchoring shells (23a, 23b) to hold such shells coupled one another.

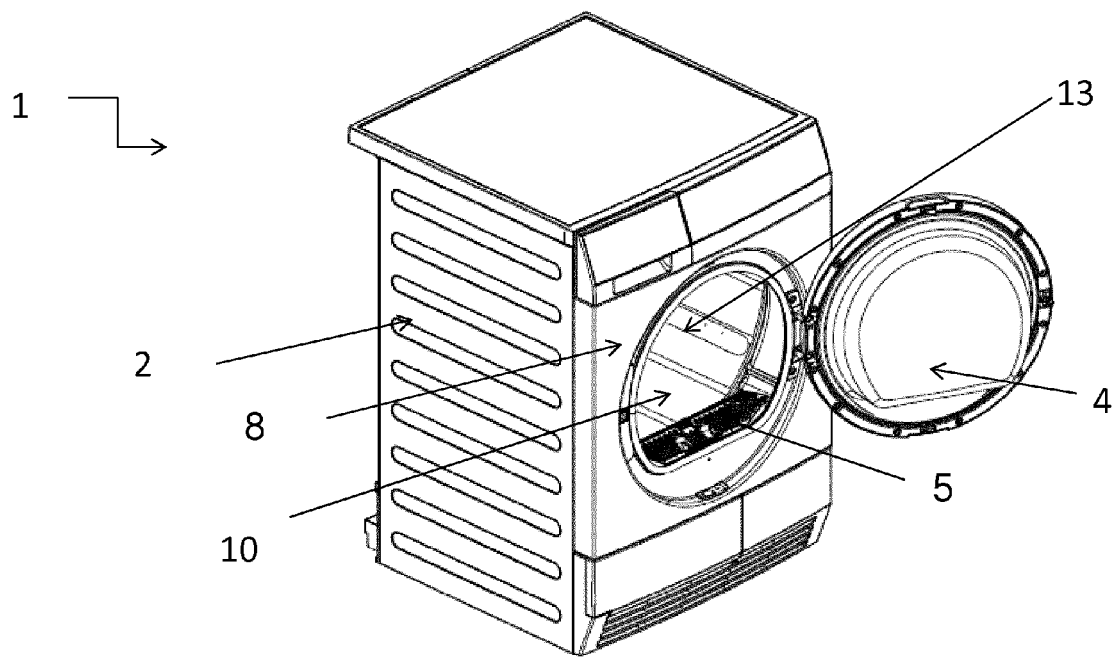


Fig 1

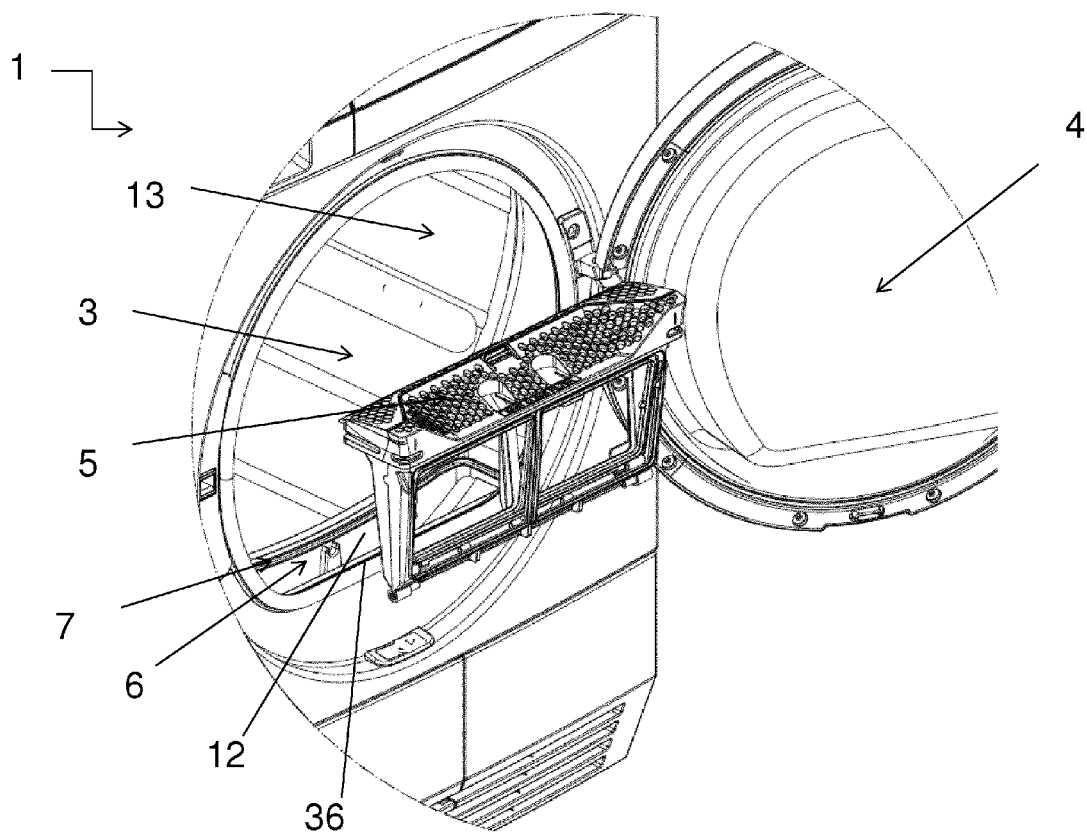


Fig 2

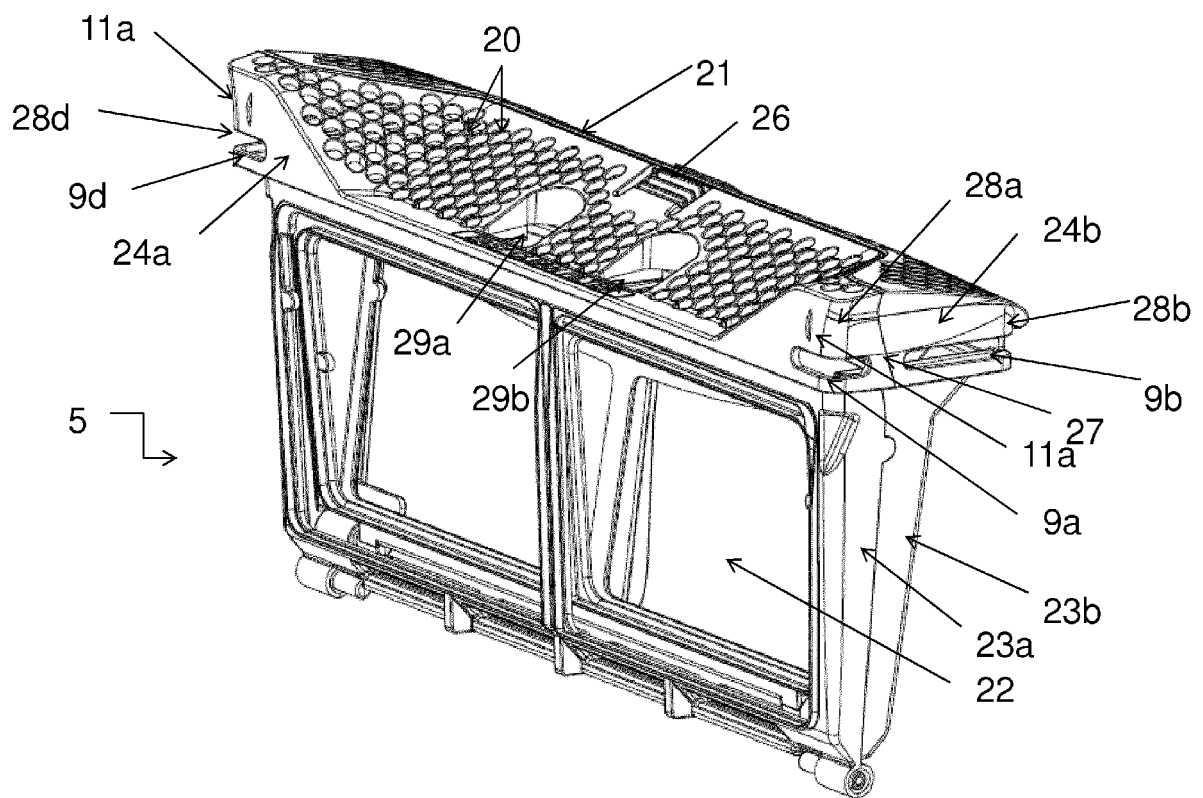


Fig 3

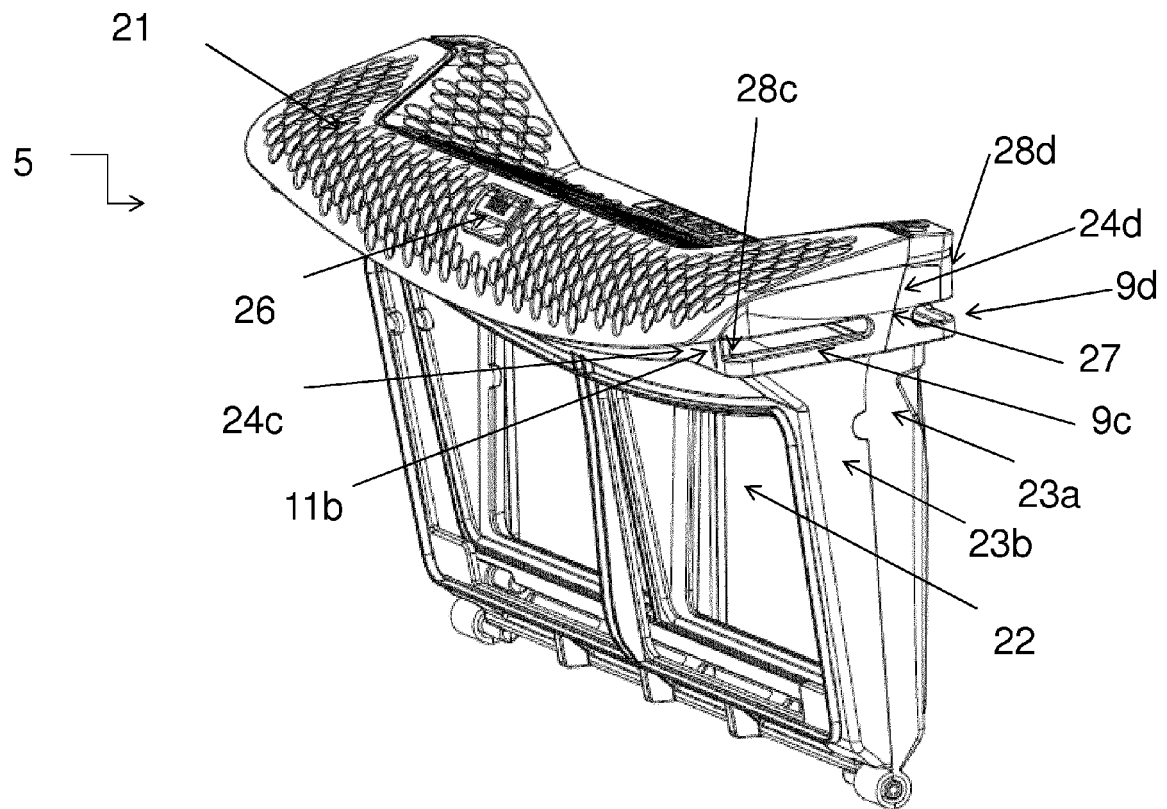


Fig 4

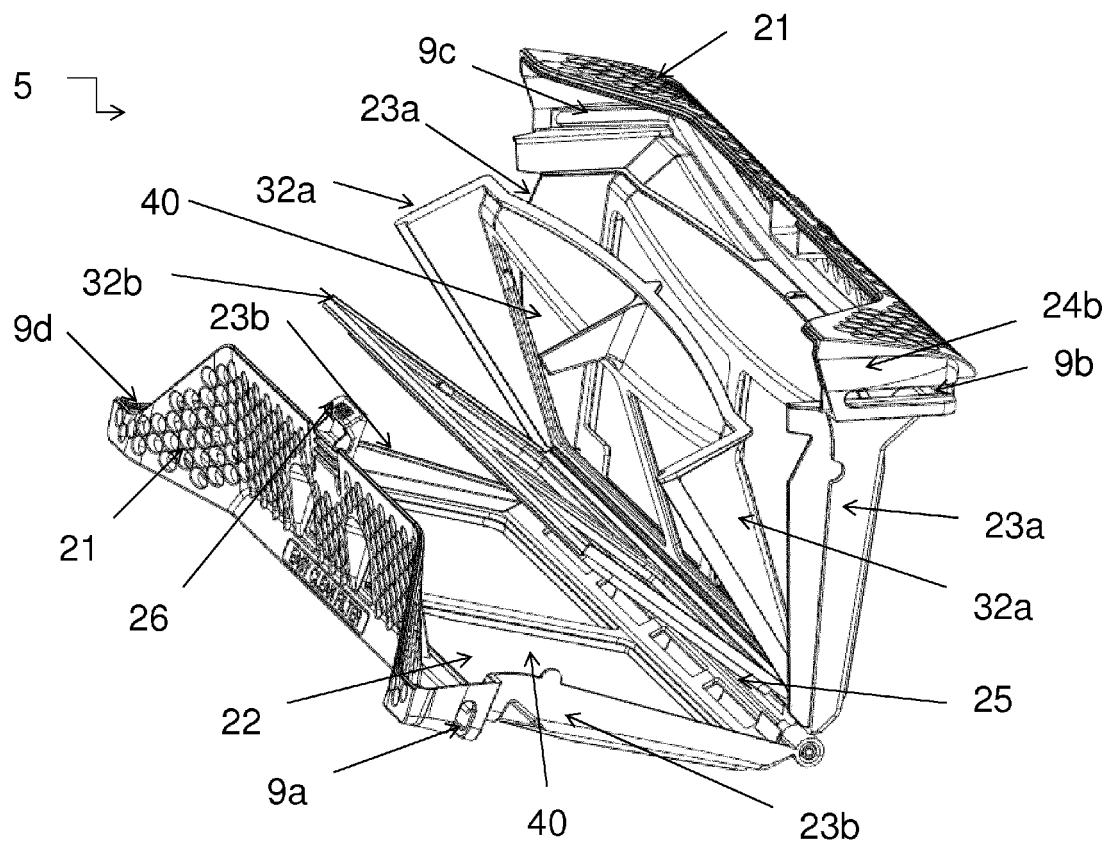


Fig 5

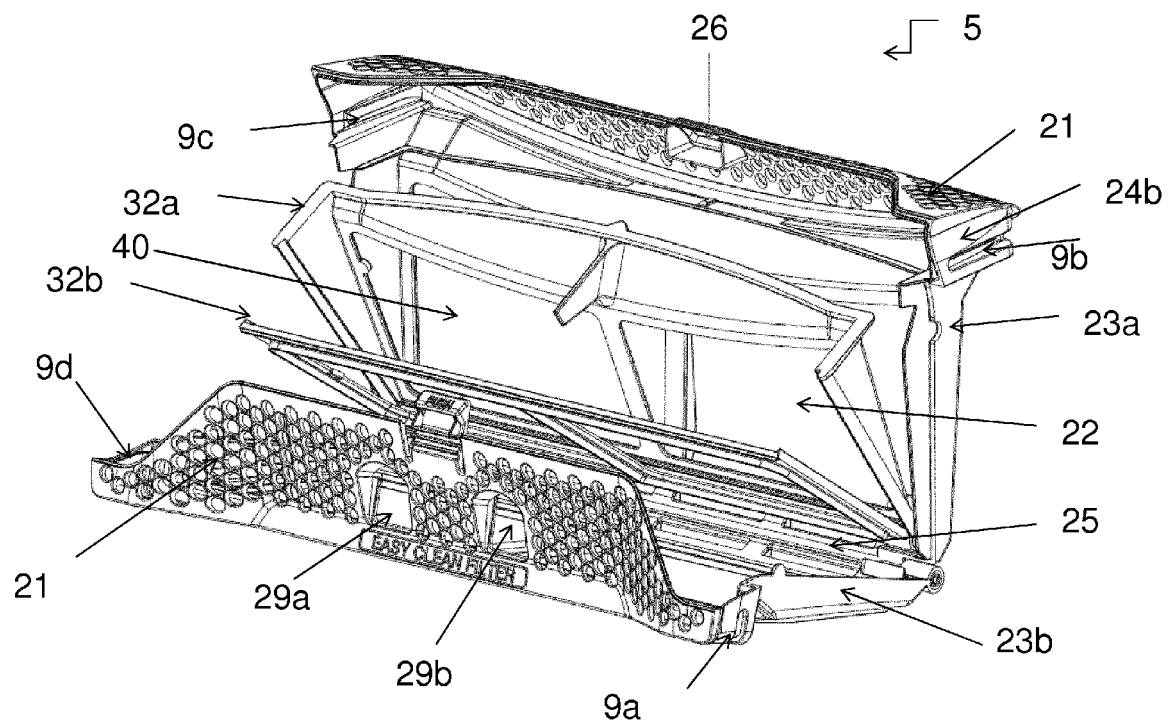


Fig 6

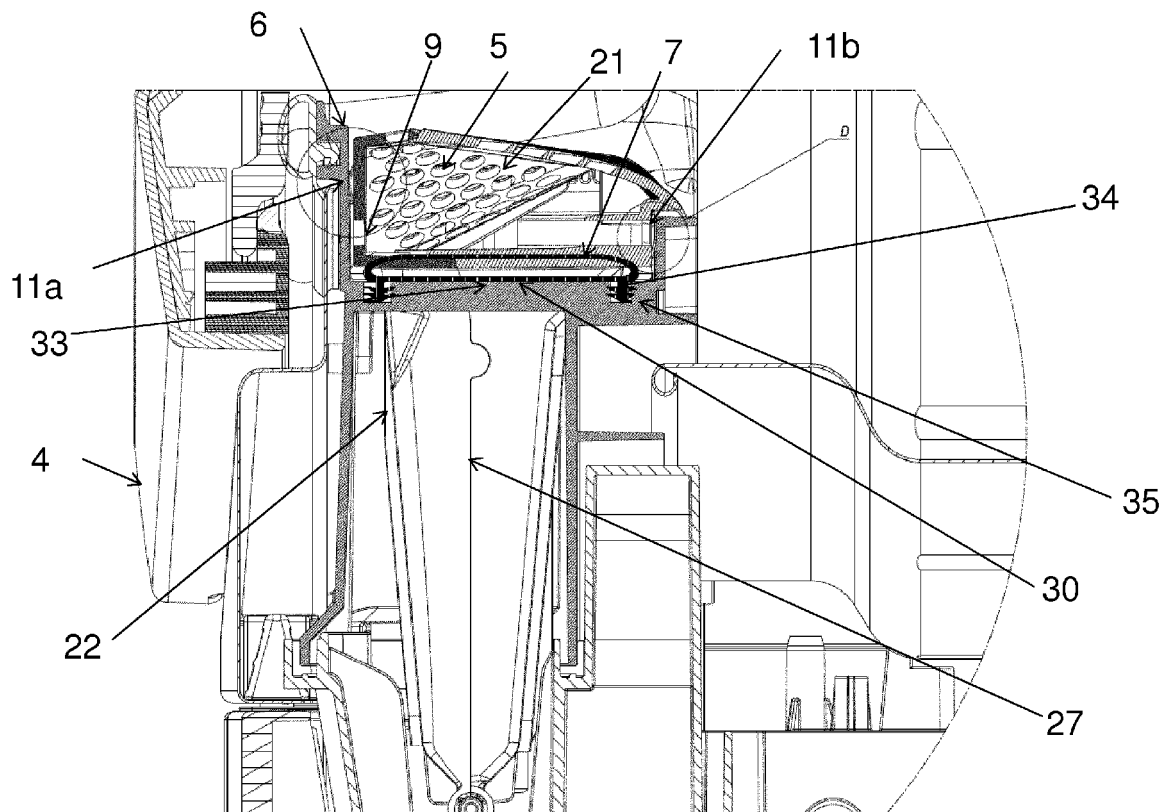


Fig 7

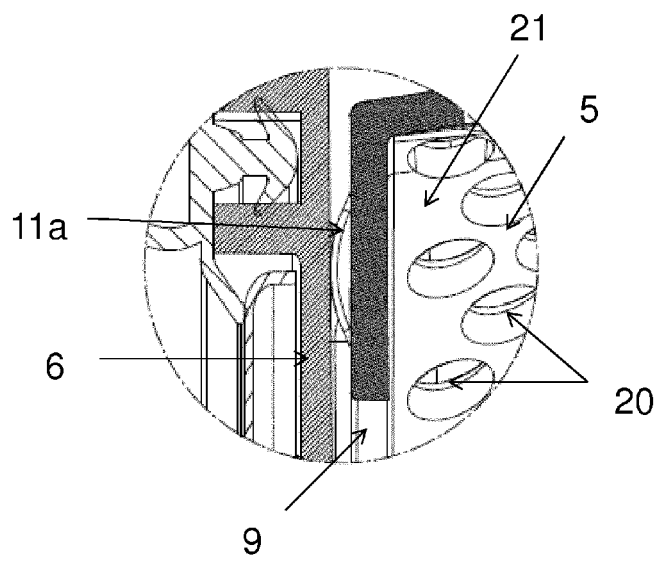


Fig 8

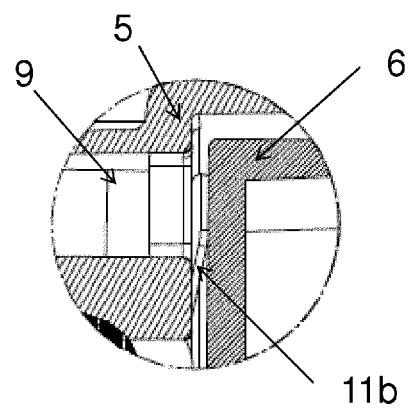


Fig 9

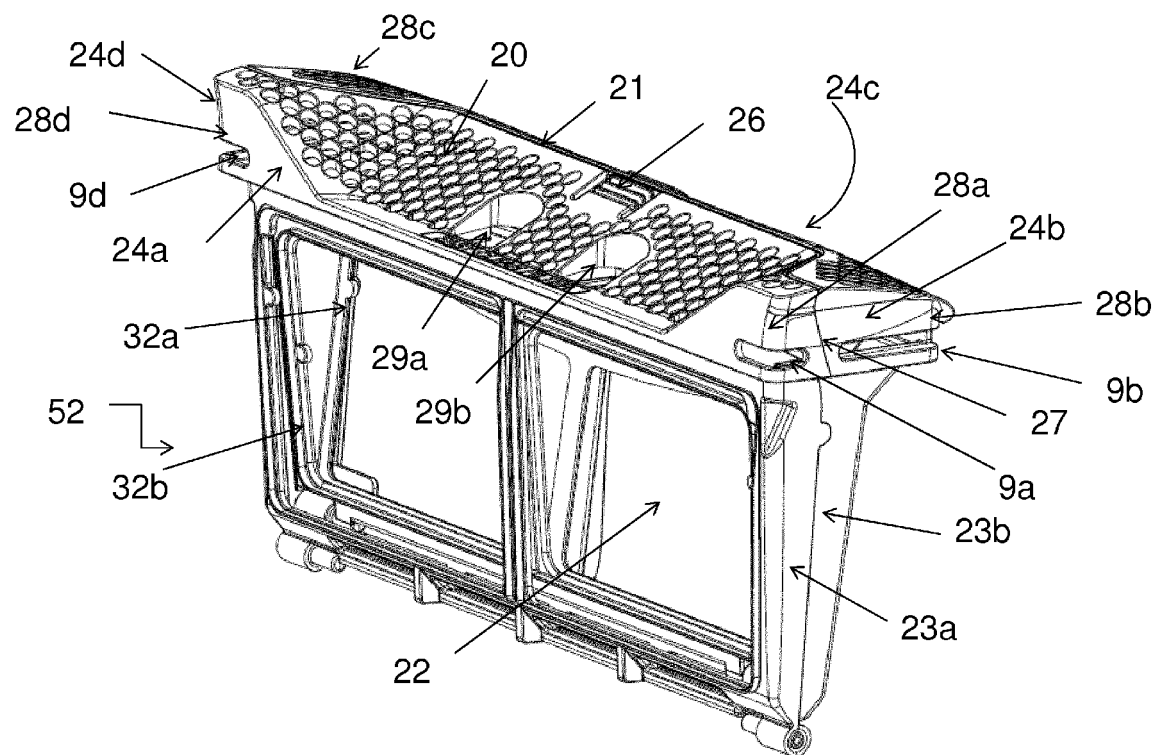


Fig 10

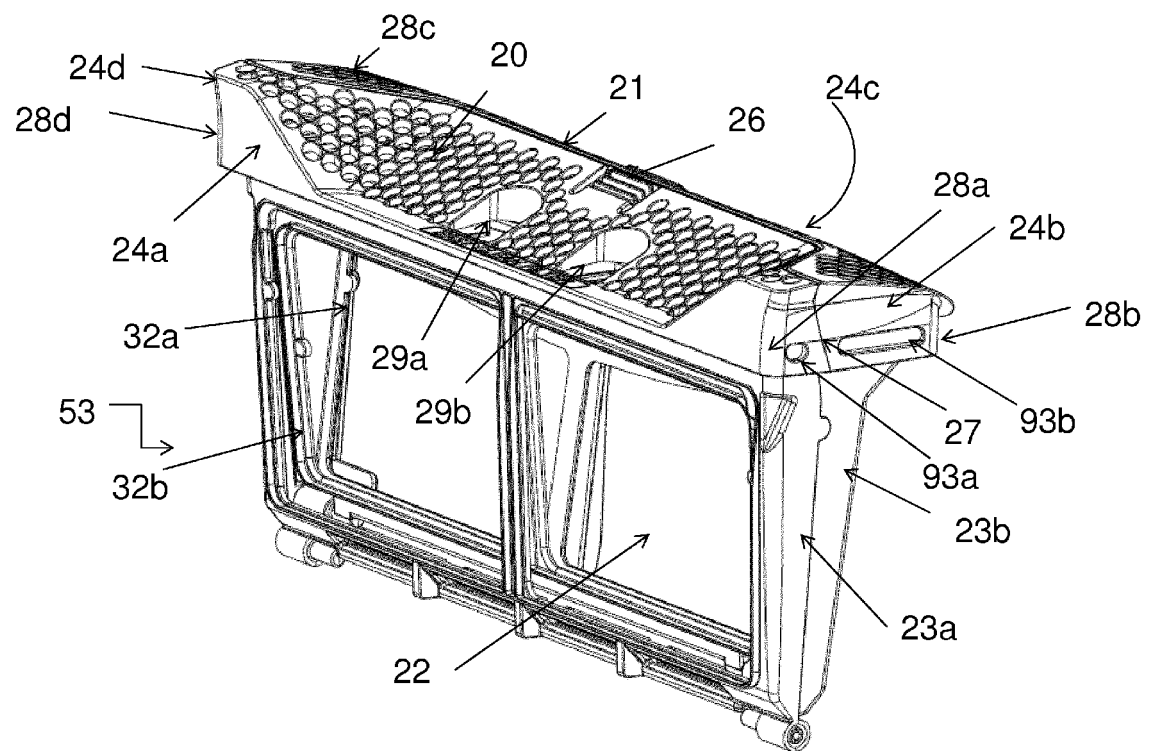


Fig 11

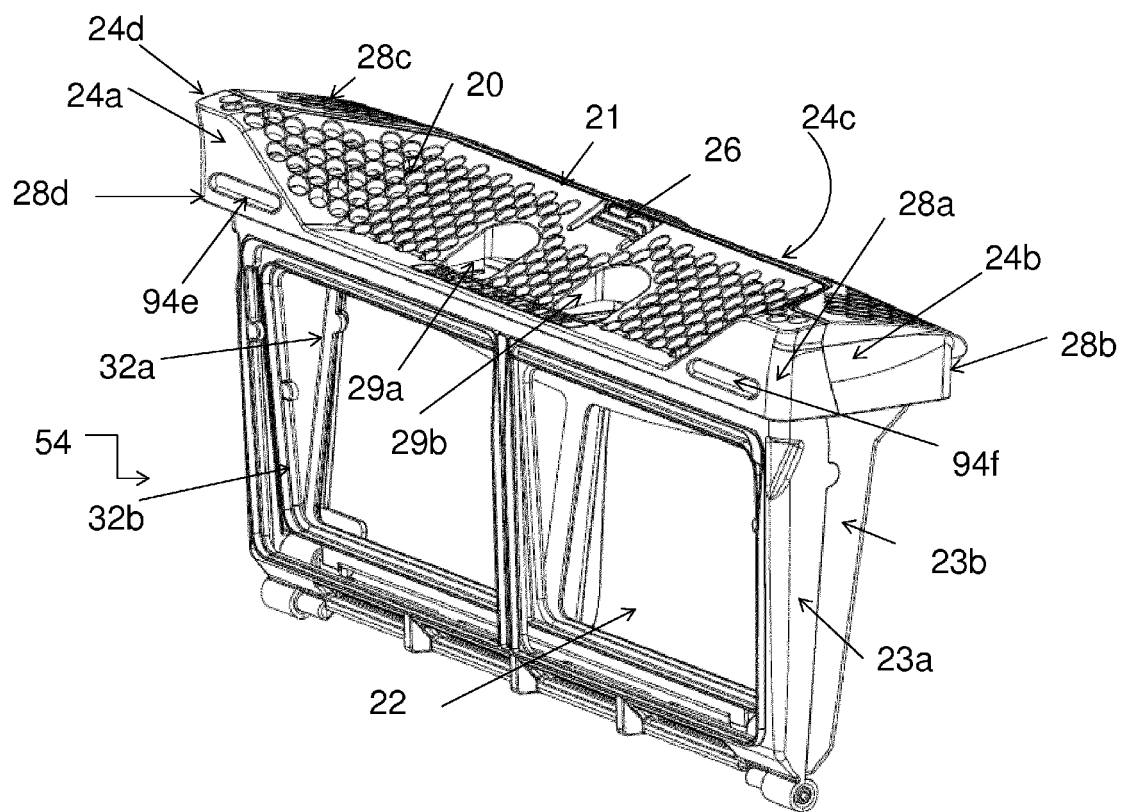


Fig 12

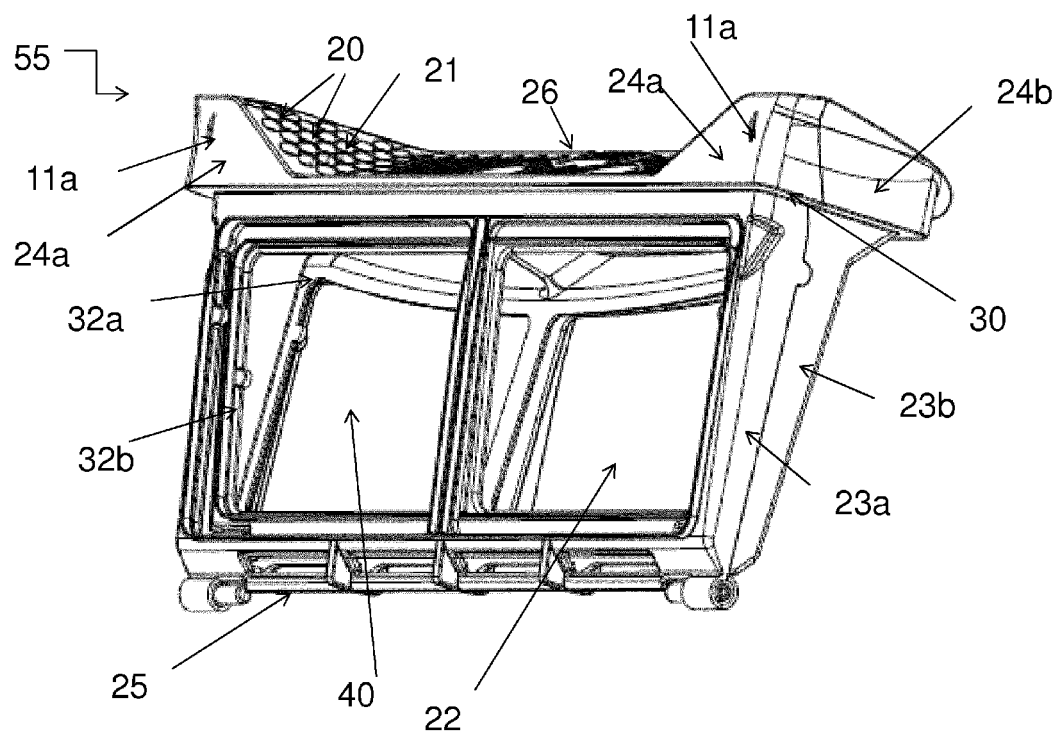


Fig 13

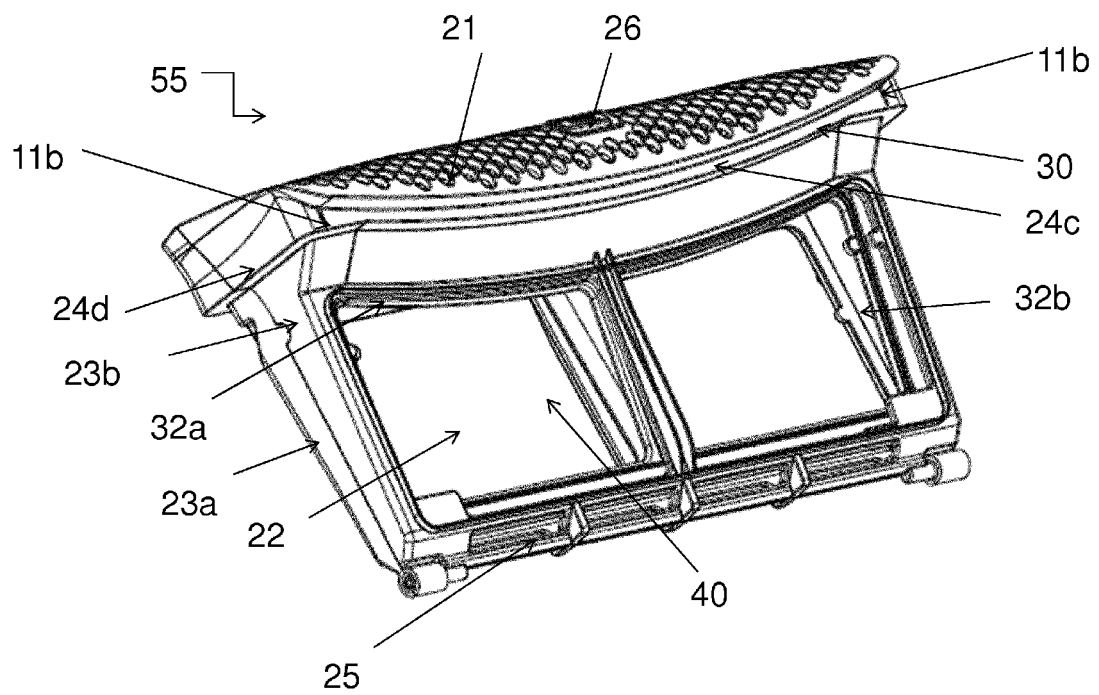


Fig 14

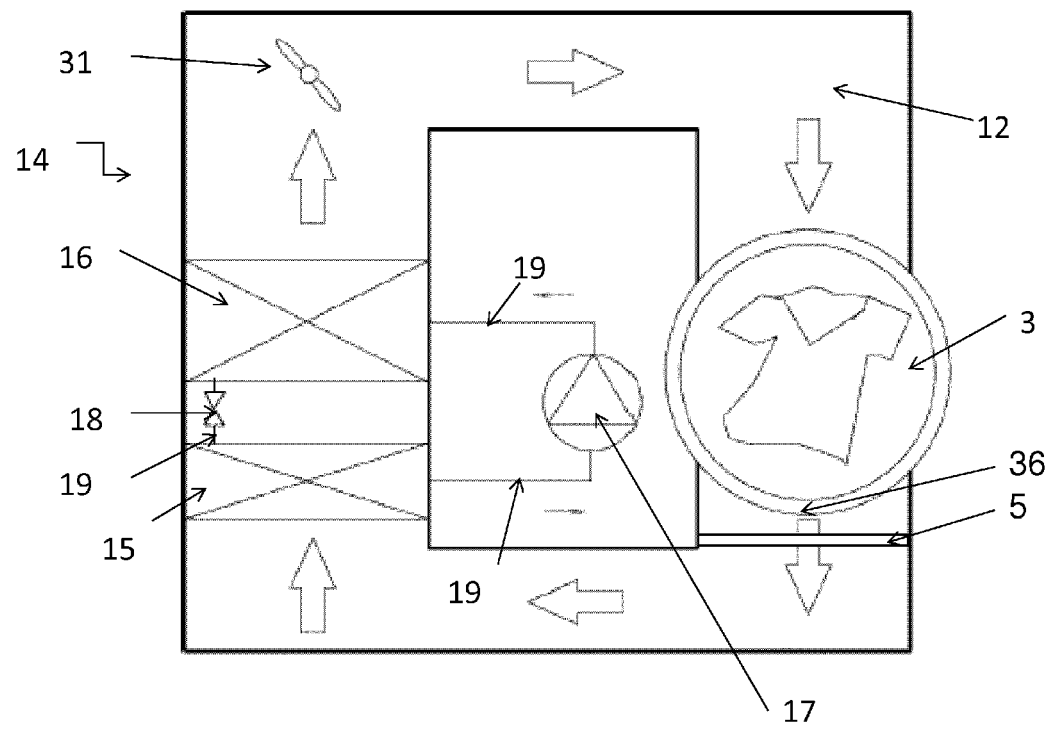


Fig 15



EUROPEAN SEARCH REPORT

Application Number
EP 13 19 4318

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	DE 84 37 357 U1 (BOSCH-SIEMENS-HAUSGERÄTE GMBH) 21 March 1985 (1985-03-21) * the whole document *	1-15	INV. D06F58/22
A	EP 2 230 349 A1 (ELECTROLUX HOME PROD CORP [BE]) 22 September 2010 (2010-09-22) * the whole document *	1-15	
A	EP 2 570 547 A1 (ELECTROLUX HOME PROD CORP [BE]) 20 March 2013 (2013-03-20) * the whole document *	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 19 May 2014	Examiner Spitzer, Bettina
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 19 4318

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The members are as contained in the European Patent Office EDP file on
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19-05-2014

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 8437357	U1	21-03-1985	NONE
EP 2230349	A1	22-09-2010	EP 2230349 A1 22-09-2010 RU 2010110539 A 27-09-2011
EP 2570547	A1	20-03-2013	NONE

REFERENCES CITED IN THE DESCRIPTION

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- DE 8437357 U1 [0011] [0013] [0014]