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(54) **Laundry dryer**

(57) Laundry dryer (1) comprising an outer casing (2) having a front wall (2a) provided with a laundry loading/unloading pass-through opening, and an air-filtering cartridge (15) which is fitted in removable manner into an air-vent (10) which is passed through by a laundry drying airflow (f), said air-filtering cartridge (15) comprising a first substantially bag- or pocket-shaped, air-filtering shell or vessel (20, 120) which is dimensioned for being inserted/plugged into said air-vent (10) and a second substantially bag- or pocket-shaped, air-filtering shell or vessel (30, 130) which is fitted/recessed into said first air-filtering shell or vessel (20, 120), so as to be passed through by substantially the same airflow (f) that crosses

the first air-filtering shell or vessel (20, 120), each of said first and second air-filtering shells or vessels (20, 120, 30, 130) having a two valve-like structure (23a, 23b, 32a, 32b; 123a, 123b, 132a, 132b) which is openable in a book-like manner and has surfaces (21, 121, 31, 131) arranged to restrain fluff and/or lint particles in suspension into the airflow (f). The laundry dryer has the second air-filtering shell or vessel (30, 130) hingedly coupled to the first air-filtering shell or vessel (20, 120), such that, in an open position, both valve-like structures (23a, 23b, 32a, 32b; 123a, 123b, 132a, 132b) displace the inner faces (21a, 21b, 31a, 31b; 121a, 121b, 131a, 131b) of said surfaces (21, 121, 31, 131) on the same side.

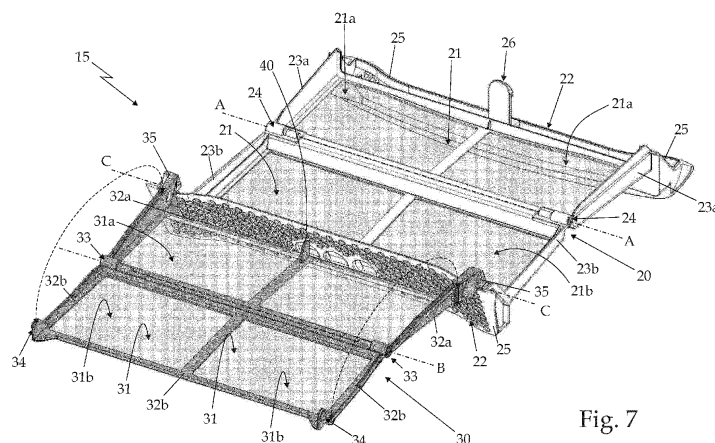


Fig. 7

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 comprise: 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 porthole door 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 an electronic central control unit which controls both the motor assembly and the hot-air generator to perform, on command, one of the user-selectable drying cycles stored in the same central control unit.

[0004] In most of the rotary-drum household laundry dryers currently on the market, the rotatable drum furthermore 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 boxlike 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 furthermore comprises: an air-cooling device which is located along the air recirculating conduit, and is structured to cool the moist air arriving from the rotatable drum, so as to cause the condensation of the surplus moisture inside the airflow; 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, though 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 device 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 the air-vent 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 air-vent. When the porthole door is in the wide-opened position, the user is allowed to manually extract the wedge-shaped filtering cartridge from the air-vent realized on the annular frame that delimits the laundry loading/unloading opening for periodical cleaning.

[0010] DE8437357U1 discloses a wedge-like air-filtering cartridge for laundry driers which is dimensioned for being inserted/plugged into the air-vent realized on the annular frame that delimits the laundry loading/unloading opening, so as to cover/close the whole air-vent, 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 air-vent realized on the annular frame that delimits the laundry loading/unloading opening, so as to cover/close the whole air-vent.

[0011] 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.

[0012] 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.

[0013] Unluckily, periodical cleaning of the DE8437357U1 wedge-like filtering cartridge is particularly unpleasant to the user because the particular structure of the filtering cartridge allows the fluff and/or lint particles to accumulate on faces of the permeable-to-air sidewalls of the two valve-like pieces and of the permeable-to-air panels hinged to the same valve-like pieces that result to be placed on opposite sides when the filter in unfolded, i.e. opened in a book-like manner, thus creating several problems at opening of the filtering cartridge.

[0014] Aim of the present invention is to provide a laundry dryer having an air-filtering cartridge which is easier to clean.

[0015] 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.

[0016] 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;
- Figure 2 is a section view of the Figure 1 laundry dryer with parts removed for clarity;
- Figure 3 is a perspective view of a first embodiment of the air-filtering member of the Figure 1 laundry dryer;
- Figures 4 is a section view of the Figure 3 air-filtering member;
- Figures 5, 6 and 7 show three partly-exploded perspective views of the Figure 3 air-filtering member;

- Figure 8 is a perspective view of a second embodiment of the air-filtering member of the Figure 1 laundry dryer;
- Figures 9 is a section view of the Figure 8 air-filtering member;
- Figures 10, 11 and 12 show three partly-exploded perspective views of the Figure 8 air-filtering member.

[0017] With reference to Figures 1 and 2, reference number 1 indicates as a whole a rotary-drum household laundry dryer which comprises: a preferably, though not necessarily, parallelepiped-shaped, outer boxlike casing 2 which is structured for resting on the floor and is provided with reciprocally-faced, substantially vertically-oriented, front and rear walls 2a and 2b; a substantially cylindrical rotatable drum 3 which is structured for housing the laundry to be dried, and is fixed in axially rotating manner inside the boxlike casing 2, directly facing a laundry loading/unloading pass-through opening formed on the front wall 2a of casing 2; and a porthole door 4 hinged to the front wall 2a of casing 2 so to be able to rotate about a preferably, though not necessarily, vertically-oriented reference axis, to and from a closing position in which the porthole door 4 rests completely against the front wall 2a to close the laundry loading/unloading opening and substantially airtight seal the rotatable drum 3.

[0018] Inside the boxlike casing 2, the laundry dryer 1 additionally comprises an electrically-powered motor assembly 5 which is structured for driving into rotation the rotatable drum 3 about its longitudinal reference axis; a closed-circuit, hot-air generator 6 which is structured to circulate through the rotatable drum 3 a stream of hot air having a low moisture level, and which flows over and rapidly dries the laundry located inside the drum 3; an electronic central control unit (not shown in the drawing) controls the motor assembly 5, the hot-air generator 6 to perform, on command, one of the user-selectable drying cycles preferably, though not necessarily, stored in the same central control unit, a further control unit 7 may be provided for controlling the operation of the compressor 19.

[0019] With reference to Figure 2, in particular, the rotatable drum 3 preferably consists in a substantially cylindrical-shaped, rigid tubular body 3 which is preferably made of metal material and extends inside the boxlike casing 2 coaxial to a preferably substantially horizontally-oriented, longitudinal reference axis L while remaining locally substantially aligned to the laundry loading/unloading opening on the front wall 2a of the boxlike casing 2. The substantially cylindrical-shaped, rigid tubular body 3 is furthermore preferably structured for resting on a number of idle supporting rollers 8 which are arranged approximately at the two axial ends of the tubular body 3 with their rotation axis locally substantially parallel to the longitudinal reference axis L of tubular body 3, and are fixed to the boxlike casing 2 in free revolving manner so as to allow the tubular body 3 to freely rotate about its

longitudinal reference axis L inside the boxlike casing 2. Even if it is here described a drum supported by rotatable rollers, it should be understood that the present invention covers also an arrangement wherein the drum is supported by a shaft mechanically connected to the drum rear wall, i.e. the wall opposite to the drumfront wall which is provided with an opening for loading/unloading laundry into/from the drum. Said shaft is also provided to rotate the drum.

[0020] The circular front rim 3f of tubular body 3 surrounds the laundry loading/unloading opening realized on the front wall 2a of boxlike casing 2 and is coupled in substantially airtight and axially rotating manner to the same front wall 2a, preferably with the interposition of a first circular sealing gasket. The circular rear rim 3r of tubular body 3 instead abuts against the rear wall 2b of boxlike casing 2 and is coupled in substantially airtight and axially rotating manner directly to the same rear wall 2b with the interposition of a second circular sealing gasket. Front and rear circular sealing gaskets are therefore substantially coaxial to the longitudinal reference axis L of tubular body 3.

[0021] The stream of hot air produced by the hot-air generator 6 preferably enters into tubular body 3 through the rear mouth of tubular body 3, i.e. the mouth of tubular body 3 delimited by the rear rim 3r, flows inside tubular body 3 for the entire length of the latter, and finally comes out of tubular body 3 through the front mouth of tubular body 3, i.e. the mouth of tubular body 3 delimited by the front rim 3f, or vice versa.

[0022] In other words, the stream of hot air produced by hot-air generator 6 preferably enters into tubular body 3 via a first air-vent 9 which is incorporated in the rear wall 2b of casing 2 locally aligned/faced to the rear mouth of tubular body 3, i.e. within the perimeter of the rear rim 3r of tubular body 3, and comes out of tubular body 3 via a second preferably substantially slot-shaped, air-vent 10 which is preferably incorporated in the annular frame that, on front wall 2a, delimits the laundry loading/unloading opening of boxlike casing 2.

[0023] With reference to Figures 1 and 2, the hot-air generator 6 in turn is structured for gradually drawing air from rotatable drum 3; cooling down the air arriving from rotatable drum 3 so to extract and retain the surplus moisture in the air drawn from rotatable drum 3; heating the dehumidified air to a predetermined temperature, normally higher than the temperature of the air from rotatable drum 3; and finally feeding the heated, dehumidified air back into the rotatable drum 3, where it flows over, to rapidly dry, the laundry inside the drum.

[0024] In other words, hot-air generator 6 provides for continually dehumidifying and heating the air circulating inside rotatable drum 3 to rapidly dry the laundry inside the drum, and basically comprises:

- an air recirculating conduit 11 which has a first end in direct communication with, i.e. fluidly connected to, the air-vent 9 located in the rear wall 2b of casing

2, and a second end in direct communication with, i.e. fluidly connected to, the air-vent 10 preferably located in the annular frame that delimits the laundry loading/unloading opening on front wall 2a;

- an electrically-powered centrifugal fan 12 (part of its volume is shown in Figures 1 and 2) or other type of air circulating pump, which is located along recirculating conduit 11 to produce, inside recirculating conduit 11, an airflow f which flows through the rotatable drum 3 and over the laundry inside drum 3;
- an air-cooling device 13 which is located along the air recirculating conduit 11 preferably, though not necessarily, upstream of the centrifugal fan 12, and is structured to cool the moist air arriving from rotatable drum 3, so as to cause the quick condensation of the surplus moisture inside the airflow f; and
- an air-heating device 14 which is located along the air recirculating conduit 11, downstream of the air-cooling device 13 and preferably also upstream of the centrifugal fan 12, and which is structured for heating the dehumidified airflow f arriving from the air-cooling device 13 and directed back to rotatable drum 3, so that the airflow f directed back into the rotatable drum 3 is heated to a temperature preferably, though not necessarily, higher than or equal to that of the moist air flowing out of the same rotatable drum 3.

[0025] With reference to Figure 2, the hot-air generator 6 lastly comprises a preferably substantially wedge-shaped, air-filtering cartridge 15 which is fitted in removable manner into the air-vent 10 preferably realized on the annular frame that delimits, on front wall 2a, the laundry loading/unloading opening of casing 2. This air-filtering cartridge 15 is dimensioned so as to cover/close the whole air-vent 10, i.e. the entrance of air recirculating conduit 11, and it is structured to restrain the fluff and/or lint particles in suspension into the airflow f so to prevent the same fluff and/or lint particles from reaching and clogging up the air-cooling device 13, the air-heating device 14 and the centrifugal fan 12 located along the air recirculating conduit 11.

[0026] With reference to Figures 1 and 2, in the example shown, in particular, the outer boxlike casing 2 preferably, though not necessarily, comprises a substantially parallelepiped-shaped lower supporting basement 16 which is structured for resting on the floor; and a substantially parallelepiped-shaped upper boxlike cabinet 17 which is rigidly fixed to the top of the lower supporting basement 16 and it is structured so as to house the rotatable drum 3.

[0027] In other words, the rotatable drum 3 extends inside the upper boxlike cabinet 17, immediately above the supporting basement 16; the laundry loading/unloading opening of boxlike casing 2 is realized in the front wall of the upper boxlike cabinet 17; and the porthole door 4 is hinged to the front wall of the same upper boxlike cabinet 17.

[0028] The lower supporting basement 16, in turn, is preferably, though not necessarily, structured for internally housing a central/intermediate section of air recirculating conduit 11, and the air-cooling device 13, the air-heating device 14 and the centrifugal fan 12 of hot-air generator 6 are preferably located inside said central/intermediate section of the air recirculating conduit 11. Thus the lower supporting basement 16 is preferably, though not necessarily, structured for internally housing part of the hot-air generator 6.

[0029] Preferably, though not necessarily, the lower supporting basement 16 is moreover structured to directly support the drum-supporting rollers 8. In other words, the idle rollers 8 that support in free revolving manner the tubular body 3 are preferably fixed in axially rotating manner directly to the top of the lower supporting basement 16.

[0030] With reference to Figures 1 and 2, the hot-air generator 6 preferably, though not necessarily, consists in a heat-pump type, closed-circuit, hot-air generator 6, and is therefore provided with a heat-pump circuit 18 which comprises a first and a second air/refrigerant heat exchanger, both located inside the air recirculating conduit 11 preferably upstream of the centrifugal fan 12.

[0031] The first air/refrigerant heat exchanger, traditionally referred to as the "evaporator" of the heat-pump circuit, is located inside the air recirculating conduit 11, and it is structured to remove/absorb heat from the airflow *f* arriving from rotatable drum 3, thus forming the air-cooling device 13 of the hot-air generator 6. The second air/refrigerant heat exchanger, traditionally referred to as the "condenser" of the heat-pump circuit, is instead located inside the air recirculating conduit 11 downstream of the first air/refrigerant heat exchanger 13, and it is structured to release heat to the airflow *f* arriving from the first air/refrigerant heat exchanger 13, thus forming the air-heating device 14 of the hot-air generator 6.

[0032] In the example shown, in particular, the first and second air/refrigerant heat exchangers 13 and 14 are recessed one after the other inside the section of air recirculating conduit 11 which is integrated into the lower supporting basement 16 of boxlike casing 2.

[0033] In addition to the above, the heat-pump circuit 18 furthermore comprises: an electrically-powered refrigerant compressing device 19 which is interposed between the refrigerant-outlet of air/refrigerant heat exchanger 13 and the refrigerant-inlet of air/refrigerant heat exchanger 14, and it is structured for compressing the gaseous-state refrigerant directed towards heat exchanger 14 so that refrigerant pressure and temperature are much higher at the refrigerant-inlet of heat exchanger 14 than at the refrigerant-outlet of heat exchanger 13; and an expansion valve or similar known passive/operated refrigerant expansion device (for example a capillary tube, a thermostatic valve or an electrically-controlled expansion valve) which is interposed between the refrigerant-outlet of air/refrigerant heat exchanger 14 and the refrigerant-inlet of air/refrigerant heat exchanger 13, and

it is structured so as to cause a rapid expansion of the refrigerant directed towards the air/refrigerant heat exchanger 13, so that refrigerant pressure and temperature are much higher at the refrigerant-outlet of heat exchanger 14 than at the refrigerant-inlet of air/refrigerant heat exchanger 13.

[0034] According to a different embodiment not shown, the hot air generator 6 may comprise an electric heater as air-heating device 14 and an air-air type heat exchanger as air-cooling device 13, where the airflow *f* is cooled by air taken from and exhausted to the environment surrounding the laundry machine. An appropriate air pumping device is further arranged to pump ambient air through the air-air type heat exchanger.

[0035] With reference to Figures 1 and 2, the centrifugal fan 12 of hot-air generator 6, in turn, is preferably, though not necessarily, located on the back of the supporting basement 16, i.e. on the rear wall 2b of the boxlike casing 2, and it is structured so as to produce an airflow *f* that flows from the central/intermediate section of the air recirculating conduit 11 to the air-vent 9 located in rear wall 2b of casing 2.

[0036] In the example shown, the centrifugal fan 12 of the hot-air generator 6 is preferably at least partly housed/recessed into the lower supporting basement 16 of casing 2, i.e. into the rear wall 2b of the boxlike casing 2, roughly at the end of the central/intermediate section of the air recirculating conduit 11, and the outer volute or impeller housing of the centrifugal fan 12 is shaped/structured so as to directly communicate with, i.e. be fluidly connected to, both the central/intermediate section of the air recirculating conduit 11 and with the air-vent 9 integrated in the rear wall 2b of casing 2.

[0037] With reference to Figures 3 to 7, the air-filtering cartridge 15 in turn comprises:

- a first substantially bag- or pocket-shaped, air-filtering shell or vessel 20 which is dimensioned for being inserted/plugged in manually extractable manner into the air-vent 10 which is preferably realized on the annular frame that delimits, on front wall 2a, the laundry loading/unloading opening of casing 2, so as to substantially fill up the whole clear section of the air-vent 10, and which is preferably provided with two preferably substantially flat, reciprocally-faced, permeable-to-air sidewalls 21 which are structured to restrain the fluff and/or lint particles in suspension into the airflow *f* that enters into the air recirculating conduit 11 through the air-vent 10; and
- a permeable-to-air, preferably substantially plate like-shaped, upper lid 22 which is rigidly associated/fixed to the substantially bag-shaped, air-filtering shell or vessel 20 so as to close the upper mouth of the same air-filtering shell or vessel 20, and which is furthermore shaped/dimensioned so as to close/cover the whole air-vent 10.

[0038] In the example shown, the permeable-to-air

sidewalls 21 of the air-filtering shell or vessel 20 are preferably, though not necessarily, substantially specularly inclined to a center-plane M of the air-filtering shell or vessel 20, so that the air-filtering shell or vessel 20 has a substantially V- or U-shaped cross-section.

[0039] The substantially bag-shaped, air-filtering shell or vessel 20 is furthermore divided into two complementary valve-like pieces 23a, 23b which are selectively separable to one another, and each of which incorporates a respective permeable-to-air sidewall 21 of the air-filtering shell or vessel 20. Preferably, the two valve-like pieces 23a, 23b are furthermore laterally hinged to one another approximately at the bottom of the air-filtering shell or vessel 20, i.e. opposite to the permeable-to-air upper lid 22, for reciprocal rotation about a transversal reference axis A which is preferably substantially parallel to the permeable-to-air sidewalls 21 of the air-filtering shell or vessel 20, so that the whole air-filtering shell or vessel 20 is openable in a book-like manner about the same reference axis A.

[0040] With reference to Figures 3 to 7, in the example shown, the two valve-like pieces 23a, 23b of the air-filtering shell or vessel 20 are preferably pivotally jointed to one another via a pair of connecting hinges 24 which are aligned to reference axis A and are located approximately on the bottom of the air-filtering shell or vessel 20, i.e. opposite to the upper lid 22. Furthermore the articulation axis of the two connecting hinges 24, i.e. the rotation axis A of the two valve-like pieces 23a, 23b, preferably substantially lies on the center-plane M of the air-filtering shell or vessel 20, and further preferably, it extends transversally relative to the direction of the airflow f passing through the air-filtering cartridge 15..

[0041] With reference to Figures 3 to 7, similarly to the air-filtering shell or vessel 20, the permeable-to-air upper lid 22 of the air-filtering cartridge 15 is preferably divided into two permeable-to-air, complementary pieces 25 which are preferably substantially plate-like shaped and selectively separable to one another, and each of which is permanently rigidly fixed to a respective valve-like piece 23a, 23b of the bag-shaped, air-filtering shell or vessel 20, so as to allow the bag-shaped, air-filtering shell or vessel 20 to open in a book-like manner.

[0042] Preferably, the permeable-to-air upper lid 22 furthermore comprises a manually-operable snap-on locking mechanism 26 which is structured for selectively rigidly anchoring/fixing the two complementary pieces 25 to one another when they are reciprocally coupled to form/compose the permeable-to-air upper lid 22, thus preventing any unintended opening of the first air-filtering shell or vessel 20.

[0043] In the example shown, the snap-on locking mechanism 26 is preferably incorporated into the two complementary pieces 25 of the permeable-to-air upper lid 22. Furthermore each substantially complementary piece 25 of the permeable-to-air upper lid 22 is preferably realized in one piece with a respective valve-like piece 23a, 23b of the bag-shaped, air-filtering shell or vessel

20.

[0044] As an alternative, the permeable-to-air upper lid 22 of the air-filtering cartridge 15 may be permanently rigidly associated/fixed to one of the two valve-like pieces 23a, 23b of the air-filtering shell or vessel 20, and be structured for selectively couple in a rigid and stable, though easily releasable manner to the edge of the other valve-like piece 23b, 23a of the air-filtering shell or vessel 20.

[0045] With reference to Figures 4 to 7, the air-filtering cartridge 15 furthermore comprises a second substantially bag- or pocket-shaped, air-filtering shell or vessel 30 which is fitted/recessed into the first substantially bag-shaped, air-filtering shell or vessel 20, beneath the upper lid 22, so as to be crossed by substantially the same airflow f that crosses the first air-filtering shell or vessel 20. Similarly to the first air-filtering shell or vessel 20, the second air-filtering shell or vessel 30 is furthermore preferably provided with two preferably substantially flat, reciprocally-faced, permeable-to-air sidewalls 31, each of which is structured to restrain the fluff and/or lint particles in suspension into the airflow f and is moreover locally faced and superimposed to a respective permeable-to-air sidewall 21 of the air-filtering shell or vessel 20. According to the invention, the airflow f, after having passed through the upper lid 22, passes first through the second substantially bag- or pocket-shaped, air-filtering shell or vessel 30 and then through the first bag- or pocket-shaped, air-filtering shell or vessel 20.

[0046] With reference to Figure 4, in the example shown, the permeable-to-air sidewalls 31 of the second air-filtering shell or vessel 30 are preferably substantially specularly inclined to the center-plane of the second air-filtering shell or vessel 30, and are also locally substantially parallel to corresponding permeable-to-air sidewalls 21 of the air-filtering shell or vessel 20, so that the second air-filtering shell or vessel 30 has a substantially V- or U-shaped cross-section similar to that of the first air-filtering shell or vessel 20. Preferably the center-plane of the second air-filtering shell or vessel 30 is furthermore locally substantially coincident to the center-plane M of the first air-filtering shell or vessel 20.

[0047] Preferably, the permeable-to-air sidewalls 31 of the second air-filtering shell or vessel 30 are furthermore structured to restrain fluff and/or lint particles having lower dimensions than those restrained by the permeable-to-air sidewalls 21 of the first air-filtering shell or vessel 20. However, if preferred, the permeable-to-air sidewalls 31 of the second air-filtering shell or vessel 30 may be structured to restrain fluff and/or lint particles having greater or equal dimensions than those restrained by the permeable-to-air sidewalls 21 of the first air-filtering shell or vessel 20.

[0048] With reference to Figures 5, 6 and 7, the second substantially bag-shaped, air-filtering shell or vessel 30 is furthermore divided into two complementary valve-like pieces 32a, 32b which are selectively separable to one another, and each of which incorporates a respective per-

meable-to-air sidewall 31 of the second air-filtering shell or vessel 30.

[0049] In other words, each of the two valve-like pieces 32a, 32b of the second air-filtering shell or vessel 30 is provided with a preferably substantially flat, permeable-to-air sidewall 31 which is structured to restrain fluff and/or lint particles, and it is recessed into a corresponding valve-like piece 23a, 23b of the first air-filtering shell or vessel 20, so that the outer face side of permeable-to-air sidewall 31 provided on the same valve-like piece 32a, 32b can cover substantially the whole inner face side 21a, 21b of permeable-to-air sidewall 21 provided on the corresponding valve-like piece 23a, 23b of the first air-filtering shell or vessel 20.

[0050] A first valve-like piece 32a of the second air-filtering shell or vessel 30 is therefore recessed/fitted into a corresponding first valve-like piece 23a of the first air-filtering shell or vessel 20, whereas the second/other valve-like piece 32b of the second air-filtering shell or vessel 30 is recessed/fitted into the remaining second/other valve-like piece 23b of the first air-filtering shell or vessel 20.

[0051] The two valve-like pieces 32a, 32b are furthermore laterally hinged to one another approximately at the bottom of the air-filtering shell or vessel 30, i.e. opposite to the permeable-to-air upper lid 22 and close to the bottom of the first air-filtering shell or vessel 20, for reciprocal rotation about a transversal reference axis B which is substantially parallel and adjacent to the rotation axis A of the two valve-like pieces 23a, 23b of the first air-filtering shell or vessel 20, so that the whole second air-filtering shell or vessel 30 is openable in a book-like manner about the reference axis B. However, as it will be described in greater detail below, when the second air-filtering shell or vessel 30 is in the position shown in Figure 5, i.e. it is still fitted/recessed into the first air-filtering shell or vessel 20 after the latter has been opened in a book-like manner, the second air-filtering shell or vessel 30 is prevented from being opened in book-like manner.

[0052] With reference to Figures 3 to 7, in the example shown, the two valve-like pieces 32a, 32b of the second air-filtering shell or vessel 30 are preferably pivotally jointed to one another via a pair of connecting hinges 33 which are aligned to reference axis B and are located substantially on the bottom of the second air-filtering shell or vessel 30, i.e. opposite to the upper lid 22 and close to the bottom of the first air-filtering shell or vessel 20.

[0053] Furthermore, the articulation axis of the two connecting hinges 33, i.e. the rotation axis B of the two valve-like pieces 32a, 32b, preferably substantially lies on the center-plane of the second air-filtering shell or vessel 30 which in turn is preferably locally substantially coincident to the center-plane M of the first air-filtering shell or vessel 20.

[0054] With reference to Figure 7, the second air-filtering shell or vessel 30 is preferably furthermore provided with a snap-on locking mechanism 34 which is structured

for selectively rigidly anchoring/fixing the two complementary valve-like pieces 32a, 32b of the second air-filtering shell or vessel 30 to one another when the same valve-like pieces 32a, 32b are reciprocally coupled to form/compose the second air-filtering shell or vessel 30, thus preventing any unintended opening of the second air-filtering shell or vessel 30.

[0055] With reference to Figures 6 and 7, one of the two valve-like pieces 32a, 32b of the second air-filtering shell or vessel 30 is furthermore hinged to one of the two valve-like pieces 23a, 23b of the first air-filtering shell or vessel 20, so as to allow the second air-filtering shell or vessel 30 to open, when the first air-filtering shell or vessel 20 is opened in a book-like manner (see Figure 7), in a similar book-like manner with the inner faces 31a, 31b of the two valve-like pieces 32a, 32b oriented upwards alike the inner faces 21a, 21b of the two valve-like pieces 23a, 23b of the first air-filtering shell or vessel 20.

[0056] Preferably, one of the two valve-like pieces 32a, 32b of the second air-filtering shell or vessel 30 is hinged to one of the two valve-like pieces 23a, 23b of the first air-filtering shell or vessel 20 so as to keep the other valve-like piece 32b, 32a of the second air-filtering shell or vessel 30 placed between the valve piece 32a, 32b of the second air-filtering shell or vessel 30 and the valve piece 23a, 23b of the first air-filtering shell or vessel 20 that are reciprocally hinged to one another. In the example shown in Figures 5 to 7, the valve piece 32a of the second air-filtering shell or vessel 30 is hinged to the valve-like piece 23b of the first air-filtering shell or vessel 20 while the valve piece 32b of the second air-filtering shell or vessel 30 remains placed between the two hingedly coupled valve pieces 23b, 32a of the first and second air-filtering shells or vessels 20, 30, respectively (Figure 5). With such arrangement, the second air-filtering shell or vessel 30 is prevented from being opened in book-like manner when it is kept fitted/recessed into the first air-filtering shell or vessel 20 and the latter is opened in a book-like manner. In this way a user can carry out a selective removal of fluff and/or lint particles retrained by the air-filtering shells or vessels 20, 30.

[0057] The upper edge of a first valve-like piece 32a of the second air-filtering shell or vessel 30 is hinged, roughly immediately beneath the permeable-to-air upper lid 22, to the second valve-like piece 23b of the air-filtering shell or vessel 20 that houses the second/other valve-like piece 32b of the same second air-filtering shell or vessel 30, or to the complementary piece 25 of the upper lid 22 fixed/associated to the second valve-like piece 23b of the air-filtering shell or vessel 20 that houses the second/other valve-like piece 32b of the same second air-filtering shell or vessel 30, such that the latter is manually rotatable with respect to said second valve-like piece 23b about a reference axis C. Axis C is spaced and substantially parallel to rotation axis A of the valve-like pieces 23a, 23b and/or to rotation axis B of the valve-like pieces 32a, 32b, and second air-filtering shell or vessel 30 is rotatable about the axis C between

- a first position (see Figures 4 and 5) in which the second air-filtering shell or vessel 30 rests/extends on the second valve-like piece 23b of the first air-filtering shell or vessel 20 that houses the second/other valve-like piece 32b of the second air-filtering shell or vessel 30, with the second/other valve-like piece 32b recessed into the same second valve-like piece 23b of the first air-filtering shell or vessel 20 and with the first valve-like piece 32a of the second air-filtering shell or vessel 30 holding the second/other valve-like piece 32b in abutment against the second valve-like piece 23b of the first air-filtering shell or vessel 20; and
- a second position (see Figures 6 and 7) in which the second air-filtering shell or vessel 30 is overturned outside the first air-filtering shell or vessel 20, beyond the permeable-to-air upper lid 22, so that both valve-like pieces 32a, 32b of the second air-filtering shell or vessel 30 are spaced apart from the corresponding valve-like pieces 23a, 23b of the first air-filtering shell or vessel 20.

[0058] When the second air-filtering shell or vessel 30 is arranged in the first position (see Figures 4 and 5), the first valve-like piece 32a of the second air-filtering shell or vessel 30 therefore keeps the second/other valve-like piece 32b of the second air-filtering shell or vessel 30 folded up against to the second valve-like piece 23b of the first air-filtering shell or vessel 20, thus preventing the two valve-like pieces 32a, 32b of the second air-filtering shell or vessel 30 from opening in book like manner even if the first air-filtering shell or vessel 20 is opened in a book like manner.

[0059] When the second air-filtering shell or vessel 30 is arranged in the second position (see Figures 6 and 7), instead, the valve-like pieces 32a, 32b of the second air-filtering shell or vessel 30 are spaced apart from the corresponding valve-like pieces 23a, 23b of the first air-filtering shell or vessel 20 and they can freely rotate about reference axis B, thus allowing the user to open the second air-filtering shell or vessel 30 in book like manner, beside the first air-filtering shell or vessel 20.

[0060] When the second air-filtering shell or vessel 30 is arranged in the first position (see Figures 4 and 5), the outer face side of the permeable-to-air sidewall 31 provided on the second/other valve-like piece 32b of the second air-filtering shell or vessel 30 is arranged substantially in a position which is faced and superimposed to the inner face side 21b of the permeable-to-air sidewall 21 provided on the second valve-like piece 23b of the first air-filtering shell or vessel 20 so as to cover the same inner face side 21b of the permeable-to-air sidewall 21.

[0061] With reference to Figures 6 and 7, in the example shown, the first valve-like piece 32a of the second air-filtering shell or vessel 30 is preferably provided with two substantially L-shaped connecting arms 35, which protrude upwards from respective opposite ends of the upper edge of the first valve-like piece 32a of the second

air-filtering shell or vessel 30 while remaining locally substantially reciprocally faced to one another, and have their distal ends pivotally jointed preferably to the complementary piece 25 of the upper lid 22 which is directly fixed/associated to the second valve-like piece 23b of the first air-filtering shell or vessel 20, so that the whole second air-filtering shell or vessel 30 is allowed to freely rotate with respect to the same piece 25 of the permeable-to-air upper lid 22 about the rotation axis C.

[0062] The first and second air-filtering shells or vessels 20, 30 may be permanently hinged one to the other so as to form an inseparable, unitary body. However, if desired, the hinge connection between the second air-filtering shell or vessel 30 and one of the valve-like pieces 23a, 23b of the first air-filtering shell or vessel 20 may be arranged to be easily releasable so as to allow a user to detach the second air-filtering shell or vessel 30 from first air-filtering shell or vessel 20.

[0063] With reference to Figures 4 to 7, in the inner face side of one valve-like piece 32a of the second air-filtering shell or vessel 30, a spacer 40 may be provided to keep valve-like pieces 32a, 32b spaced one another at a predetermined distance when the second air-filtering shell or vessel 30 is in a closed position, i.e. the two valve-like pieces 32a, 32b are coupled. The spacer 40 allows the valve-like pieces 32a, 32b to be pressed against the valve-like pieces 23a, 23b of the first air-filtering shell or vessel 20 to eliminate or reduce the possibility that the airflow *f* can flow between the first and second air-filtering shells or vessels 20, 30 rather than through the second air-filtering shell or vessel 30 first. On the outer face sides of each valve-like piece 32a, 32b of the second air-filtering shell or vessel 30, a further spacer 41, 42 may be provided to keep valve-like pieces 32a, 32b spaced at a predetermined distance from the valve-like pieces 23a, 23b of the first air-filtering shell or vessel 20 when the second air-filtering shell or vessel 30 is fitted/recessed into the first air-filtering shell or vessel 20. Spacers 41, 42 cooperate with spacer 40 to keep the valve-like pieces 32a, 32b pressed against the valve-like pieces 23a, 23b of the first air-filtering shell or vessel 20.

[0064] The spacer 40 provided in the inner face side of one valve-like piece 32a of the second air-filtering shell or vessel 30 is preferably arranged in a top portion of the second air-filtering shell or vessel 30, i.e. close to the upper lid 22. Spacers 41, 42 are preferably arranged in a bottom region of the second air-filtering shell or vessel 30, i.e. close to the rotation axis B of the two valve-like pieces 32a, 32b.

[0065] With reference to Figures 8 to 12, according to an alternative embodiment, the air-filtering cartridge 15 comprises:

- a first substantially bag- or pocket-shaped, air-filtering shell or vessel 120 which is dimensioned for being inserted/plugged in manually extractable manner into the air-vent 10 which is preferably realized on the annular frame that delimits, on front wall 2a, the

laundry loading/unloading opening of casing 2, so as to substantially fill up the whole clear section of the air-vent 10, and which is preferably provided with two preferably substantially flat, reciprocally-faced, permeable-to-air sidewalls 121 which are structured to restrain the fluff and/or lint particles in suspension into the airflow *f* that enters into the air recirculating conduit 11 through the air-vent 10; and

- a permeable-to-air, preferably substantially plate like-shaped, upper lid 122 which is rigidly associated/ fixed to the substantially bag-shaped, air-filtering shell or vessel 120 so as to close the upper mouth of the air-filtering shell or vessel 120, and which is furthermore shaped/dimensioned so as to close/cover the whole air-vent 10.

[0066] In the example shown, the permeable-to-air sidewalls 121 of the air-filtering shell or vessel 120 are preferably, though not necessarily, substantially specularly inclined to a center-plane *N* of the air-filtering shell or vessel 120, so that the air-filtering shell or vessel 120 has a substantially V- or U-shaped cross-section.

[0067] The substantially bag-shaped, air-filtering shell or vessel 120 is furthermore divided into two complementary valve-like pieces 123a, 123b which are selectively separable to one another, and each of which incorporates a respective permeable-to-air sidewall 121 of the air-filtering shell or vessel 120. Preferably, the two valve-like pieces 123a, 123b are furthermore laterally hinged to one another approximately at the bottom of the air-filtering shell or vessel 120, i.e. opposite to the permeable-to-air upper lid 122, for reciprocal rotation about a transversal reference axis *D*, so that the whole first air-filtering shell or vessel 120 is openable in a book-like manner about the same reference axis *D*.

[0068] With reference to Figures 8 to 12, in the example shown, the two valve-like pieces 123a, 123b of the air-filtering shell or vessel 120 are preferably pivotally jointed to one another via a pair of connecting hinges 124 which are aligned to reference axis *D* and are located approximately on the bottom of the first air-filtering shell or vessel 120, i.e. opposite to the upper lid 122. Furthermore the articulation axis of the two connecting hinges 124, i.e. the rotation axis *D* of the two valve-like pieces 123a, 123b, preferably substantially lies on the center-plane *N* of the air-filtering shell or vessel 120, and further preferably, it extends transversally relative to the direction of the airflow *f* passing through the air-filtering cartridge 15.

[0069] With reference to Figures 8 to 12, similarly to the air-filtering shell or vessel 120, the permeable-to-air upper lid 122 of the air-filtering cartridge 15 is preferably divided into two permeable-to-air, complementary pieces 125 which are preferably substantially plate like shaped and selectively separable to one another, and each of which is permanently rigidly fixed to a respective valve-like piece 123a, 123b of the bag-shaped, air-filtering shell or vessel 120, so as to allow the same air-filtering shell or vessel 120 to open in a book-like manner.

[0070] Preferably, the permeable-to-air upper lid 122 furthermore comprises a manually-operable snap-on locking mechanism 126 which is structured for selectively rigidly anchoring/fixing the two complementary pieces 125 to one another when they are reciprocally coupled to form/compose the permeable-to-air upper lid 122, thus preventing any unintended opening of the first air-filtering shell or vessel 120.

[0071] In the example shown, the snap-on locking mechanism 126 is preferably incorporated into the two complementary pieces 125 of the permeable-to-air upper lid 122. Furthermore each complementary piece 125 of the permeable-to-air upper lid 122 is preferably realized in one piece with a respective valve-like piece 123a, 123b of the bag-shaped, air-filtering shell or vessel 120.

[0072] As an alternative, the permeable-to-air upper lid 122 of the air-filtering cartridge 15 may be permanently rigidly associated/ fixed to one of the two valve-like pieces 123a, 123b of the air-filtering shell or vessel 120, and be structured for selectively couple in a rigid and stable, though easily releasable manner to the edge of the other valve-like piece 123b, 123a of the same air-filtering shell or vessel 120.

[0073] With reference to Figures 8 to 12, the air-filtering cartridge 15 furthermore comprises a second substantially bag- or pocket-shaped, air-filtering shell or vessel 130 which is fitted/recessed into the first substantially bag-shaped, air-filtering shell or vessel 120, beneath the permeable-to-air upper lid 122, so as to be crossed by substantially the same airflow *f* that crosses the first air-filtering shell or vessel 120. Similarly to the first air-filtering shell or vessel 120, the second air-filtering shell or vessel 130 is preferably provided with two preferably substantially flat, reciprocally-faced, permeable-to-air sidewalls 131, each of which is structured to restrain the fluff and/or lint particles in suspension into the airflow *f* and is moreover locally faced and superimposed to a respective permeable-to-air sidewall 121 of the first air-filtering shell or vessel 120. According to the invention, the airflow *f*, after having passed through the upper lid 122, passes first through the second substantially bag- or pocket-shaped, air-filtering shell or vessel 130 and then through the first bag- or pocket-shaped, air-filtering shell or vessel 120.

[0074] With reference to Figure 8, in the example shown, the substantially flat, reciprocally-faced, permeable-to-air sidewalls 131 of the second air-filtering shell or vessel 130 are preferably substantially specularly inclined to the center-plane of the second air-filtering shell or vessel 130, so that also the second air-filtering shell or vessel 130 has a substantially V- or U-shaped cross-section. Preferably the center-plane of the second air-filtering shell or vessel 130 is furthermore locally substantially coincident to the center-plane *N* of the first air-filtering shell or vessel 120.

[0075] Preferably, the permeable-to-air sidewalls 131 of the second air-filtering shell or vessel 130 are furthermore structured to restrain fluff and/or lint particles having

lower dimensions than that restrained by the permeable-to-air sidewalls 121 of the first air-filtering shell or vessel 120. However, if preferred, the permeable-to-air sidewalls 131 of the second air-filtering shell or vessel 130 may be structured to restrain fluff and/or lint particles having greater or equal dimensions than those restrained by the permeable-to-air sidewalls 121 of the first air-filtering shell or vessel 120.

[0076] With reference to Figures 10, 11 and 12, the second substantially bag-shaped, air-filtering shell or vessel 130 is furthermore divided into two complementary valve-like pieces 132a, 132b which are selectively separable to one another, and each of which incorporates a respective permeable-to-air sidewall 131 of the second air-filtering shell or vessel 130.

[0077] In other words, each of the two valve-like pieces 132a, 132b of the second air-filtering shell or vessel 130 is provided with a preferably substantially flat, permeable-to-air sidewall 131 which is structured to restrain fluff and/or lint particles, and it is recessed into a corresponding valve-like piece 123a, 123b of the first air-filtering shell or vessel 120 so that the outer face side of permeable-to-air sidewall 131 provided on the same valve-like piece 132a, 132b can cover substantially the whole inner face side 121a, 121b of permeable-to-air sidewall 121 provided on the corresponding valve-like piece 123a, 123b of the first air-filtering shell or vessel 120.

[0078] A first valve-like piece 132a of the second air-filtering shell or vessel 130 is therefore recessed/fitted into a corresponding first valve-like piece 123a of the first air-filtering shell or vessel 120, whereas the second/other valve-like piece 132b of the second air-filtering shell or vessel 130 is recessed/fitted into the remaining second valve-like piece 123b of the first air-filtering shell or vessel 120.

[0079] The two valve-like pieces 132a, 132b of the second air-filtering shell or vessel 130 are furthermore laterally hinged to one another approximately at the bottom of the air-filtering shell or vessel 130, i.e. opposite to the permeable-to-air upper lid 122 and close to the bottom of the first air-filtering shell or vessel 120, for reciprocal rotation about a transversal reference axis E which is substantially parallel and adjacent to the rotation axis D of the two valve-like pieces 123a, 123b of the first air-filtering shell or vessel 120, so that the whole second air-filtering shell or vessel 130 is openable in a book-like manner about the reference axis E.

[0080] With reference to Figures 9, 11 and 12, in the example shown, the two valve-like pieces 132a, 132b of the second air-filtering shell or vessel 130 are preferably pivotally jointed to one another via a pair of connecting hinges 133 which are aligned to reference axis E and are located approximately on the bottom of the second air-filtering shell or vessel 130, i.e. opposite to the upper lid 122 and close to the bottom of the first air-filtering shell or vessel 120.

[0081] Furthermore, the articulation axis of the two connecting hinges 133, i.e. the rotation axis E of the two

valve-like pieces 132a, 132b, preferably substantially lies on the center-plane N of the air-filtering shell or vessel 120.

[0082] Preferably, the second air-filtering shell or vessel 130 may be furthermore provided with a snap-on locking mechanism (not shown in the Figures) which is structured for selectively rigidly anchoring/fixing the two complementary valve-like pieces 132a, 132b of the second air-filtering shell or vessel 130 to one another when the same valve-like pieces 132a, 132b are reciprocally coupled to form/compose the second air-filtering shell or vessel 130, thus preventing any unintended opening of the second air-filtering shell or vessel 130.

[0083] With reference to Figures 10, 11 and 12, one of the two valve-like pieces 132a, 132b of the second air-filtering shell or vessel 130 is furthermore hinged, preferably in a stable though easily releasable/detachable manner, to one of the two valve-like pieces 123a, 123b of the first air-filtering shell or vessel 120, so as to allow the second air-filtering shell or vessel 130 to open, when the first air-filtering shell or vessel 120 is opened in a book-like manner, in a similar book-like manner with the inner faces 131a of the two valve-like pieces 132a, 132b oriented upwards alike the inner faces 121a of the two valve-like pieces 123a, 123b of the first air-filtering shell or vessel 120. However, if preferred, the first and second air-filtering shells or vessels 120, 130 may be permanently hinged one to the other so as to form an inseparable, unitary body.

[0084] Preferably, one of the two valve-like pieces 132a, 132b of the second air-filtering shell or vessel 130 is hinged to one of the two valve-like pieces 123a, 123b of the first air-filtering shell or vessel 120 so as to keep the other valve-like piece 132b, 132a of the second air-filtering shell or vessel 130 placed between the valve piece 132a, 132b of the second air-filtering shell or vessel 130 and the valve piece 123a, 123b of the first air-filtering shell or vessel 120 that are reciprocally hinged to one another.

[0085] More specifically, one of the two valve-like pieces 132a, 132b of the second air-filtering shell or vessel 130 is hinged, preferably in a stable though easily releasable/detachable manner, to one of the two valve-like pieces 123 of the first air-filtering shell or vessel 120 approximately at the bottom of the first air-filtering shell or vessel 120, so that the two valve-like pieces 132a, 132b of the second air-filtering shell or vessel 130 are allowed, when the first air-filtering shell or vessel 120 is opened in book-like manner, to freely rotate about their reference axis E on said valve-like piece 123 so as to open the second air-filtering shell or vessel 130 in book-like manner immediately above the first air-filtering shell or vessel 120.

[0086] In other words, one of the two valve-like pieces 132a, 132b of the second air-filtering shell or vessel 130 is hinged, preferably in a stable though easily releasable/detachable manner, to one of the two valve-like pieces 123a, 123b of the first air-filtering shell or vessel 120 ap-

proximately at the bottom of the first air-filtering shell or vessel 120, so that the two valve-like pieces 132a, 132b of the second air-filtering shell or vessel 130 are allowed to freely rotate, when the first air-filtering shell or vessel 120 is opened in a book-like manner, on the same valve-like piece 123a, 123b about a common rotation axis which is locally substantially coincident to rotation axis E, so that the second air-filtering shell or vessel 130 is allowed to open in a book-like manner immediately above and inside the perimeter of (see Figure 11) the first air-filtering shell or vessel 120.

[0087] With reference to Figures 10, 11 and 12, the connecting hinges 133 on the bottom of the second air-filtering shell or vessel 130 are preferably pivotally jointed, in a stable though easily releasable/ removable manner, to one of the two valve-like pieces 123a, 123b of the first air-filtering shell or vessel 120, close to the bottom of the first air-filtering shell or vessel 120. Thus, when the first air-filtering shell or vessel 120 is opened in a book-like manner, the two valve-like pieces 132a, 132b of the second air-filtering shell or vessel 130 are allowed to freely rotate on the valve-like piece 123a, 123b of the first air-filtering shell or vessel 120 about the rotation axis E.

[0088] With reference to Figure 12, in the example shown one of the two valve-like pieces 123a, 123b of the first air-filtering shell or vessel 120 is preferably provided, close to the bottom of the first air-filtering shell or vessel 120, with two reciprocally-faced protruding pins 135 that extend coaxial to a reference axis D' locally substantially parallel to rotation axis D of the two valve-like pieces 123a, 123b of the first air-filtering shell or vessel 120; and the connecting hinges 133 on the bottom of the second air-filtering shell or vessel 130 are each structured to fit in a rotatable and stable, though easily removable/releasable manner, on a respective protruding pins 135 of the valve-like piece 123 of the first air-filtering shell or vessel 120.

[0089] When connecting hinges 133 of the second air-filtering shell or vessel 130 are fitted to the protruding pins 135 on the first air-filtering shell or vessel 120, rotation axis E of the two valve-like pieces 132a, 132b of the second air-filtering shell or vessel 130 coincides with the reference axis D' of the protruding pins 135.

[0090] With reference to Figures 9 to 12, in the inner face side of one valve-like piece 132a of the second air-filtering shell or vessel 130, a spacer 140 may be provided to keep valve-like pieces 132a, 132b spaced one another at a predetermined distance when the second air-filtering shell or vessel 130 is in a closed position, i.e. the two valve-like pieces 132a, 132b are coupled. The spacer 140 allows the valve-like pieces 132a, 132b to be pressed against the valve-like pieces 123a, 123b of the first air-filtering shell or vessel 120 to eliminate or reduce the possibility that the airflow f can flow between the first and second air-filtering shells or vessels 120, 130 rather than through the second air-filtering shell or vessel 130 first. On the outer face sides of each valve-like piece

132a, 132b of the second air-filtering shell or vessel 130, a further spacer 141, 142 may be provided to keep valve-like pieces 132a, 132b spaced at a predetermined distance from the valve-like pieces 123a, 123b of the first air-filtering shell or vessel 120 when the second air-filtering shell or vessel 130 is fitted/recessed into the first air-filtering shell or vessel 120. Spacers 141, 142 cooperate with spacer 140 to keep the valve-like pieces 132a, 132b pressed against the valve-like pieces 123a, 123b of the first air-filtering shell or vessel 120.

[0091] The spacer 140 provided in the inner face side of one valve-like piece 132a of the second air-filtering shell or vessel 130 is preferably arranged in a top portion of the second air-filtering shell or vessel 130, i.e. close to the upper lid 122. Spacers 141, 142 are preferably arranged in a bottom region of the second air-filtering shell or vessel 130, i.e. close to the rotation axis B of the two valve-like pieces 132a, 132b.

[0092] General operation of the rotary-drum household laundry drier 1 is clearly inferable from the above description, with no further explanation required.

[0093] The advantages connected to the particular structure of the air-filtering cartridge 15 are large in number.

[0094] In the air-filtering cartridge 15, in fact, the fluff and/or lint particles tends to accumulate/settle on the inner faces 21a, 21b, 31a, 31b; 121a, 121b, 131a, 131b of the valve-like pieces 23a, 23b, 32a, 32b; 123a, 123b, 132a, 132b of the first and second air-filtering shell or vessels 20, 120 and 30, 130, which are all oriented upwards when the first and second air-filtering shell or vessels 20, 120 and 30, 130 are wide opened in book-like manner. Thus the fluff and/or lint particles remains inside/above both first and second air-filtering shells or vessels 20, 120 and 30, 130 when the user disassembles/opens the air-filtering cartridge 15 for periodical cleaning, greatly simplifying such operation.

[0095] Clearly, changes may be made to the rotary-drum household laundry drier 1 as described herein without, however, departing from the scope of the present invention.

[0096] For example, the air-cooling device 13 of hot-air generator 6 may comprise an air/air heat exchanger which is located inside the air recirculating conduit 11, preferably upstream of the centrifugal fan 12, and is structured for using the external fresh air to cool down the airflow f arriving from rotatable drum 3; whereas the air-heating device 14 of hot-air generator 6 may consists in a resistor which is located inside the air recirculating conduit 11, downstream of the air/air heat exchanger and preferably also downstream of centrifugal fan 12.

Claims

1. Laundry dryer (1) comprising an outer casing (2) having a front wall (2a) provided with a laundry loading/unloading pass-through opening, and an air-filtering

- cartridge (15) which is fitted in removable manner into an air-vent (10) which is passed through by a laundry drying airflow (f), said air-filtering cartridge (15) comprising a first substantially bag- or pocket-shaped, air-filtering shell or vessel (20, 120) which is dimensioned for being inserted/plugged into said air-vent (10) and a second substantially bag- or pocket-shaped, air-filtering shell or vessel (30, 130) which is fitted/recessed into said first air-filtering shell or vessel (20, 120), so as to be passed through by substantially the same airflow (f) that crosses the first air-filtering shell or vessel (20, 120), each of said first and second air-filtering shells or vessels (20, 120, 30, 130) having a two valve-like structure (23a, 23b, 32a, 32b; 123a, 123b, 132a, 132b) which is openable in a book-like manner and has surfaces (21, 121, 31, 131) arranged to restrain fluff and/or lint particles in suspension into the airflow (f); the laundry dryer being **characterized in that** the second air-filtering shell or vessel (30, 130) is hinged/coupled to the first air-filtering shell or vessel (20, 120), such that, in an open position, both valve-like structures (23a, 23b, 32a, 32b; 123a, 123b, 132a, 132b) displace the inner faces (21a, 21b, 31a, 31b; 121a, 121b, 131a, 131b) of said surfaces (21, 121, 31, 131) on the same side.
2. Laundry dryer according to Claim 1, **characterized in that** each two valve-like structure (23a, 23b, 32a, 32b; 123a, 123b, 132a, 132b) of said first and second air-filtering shells or vessels (20, 120, 30, 130) comprises two valve-like pieces (23a, 23b, 32a, 32b; 123a, 123b, 132a, 132b) which are hinged to one another in a bottom region thereof so as to be selectively separable to one another, one of the two valve-like pieces (32a, 132a) of the second air filtering shell or vessel (30, 130) being furthermore hinged to one of the two valve-like pieces (23b, 123a) of the first air filtering shell or vessel (20, 120).
 3. Laundry dryer according to Claim 2 wherein the other of the two valve-like pieces (32b, 132b) of the second air filtering shell or vessel (30, 130) being displaced between the hinged/coupled valve pieces (23b, 123a, 32a, 132a) of the first and second filtering shells or vessels (20, 30; 120, 130).
 4. Laundry dryer according to any one of the foregoing Claims, **characterized in that** the second air filtering shell or vessel (30, 130) is hinged in a releasable/detachable manner to one of the two valve-like pieces (23b, 123a) forming the two valve-like structure of the first air filtering shell or vessel (20, 120).
 5. Laundry dryer according to any claim Claim 2 to 4, **characterized in that** the second air-filtering shell or vessel (30, 130) is provided with a snap-on locking mechanism (34) which is structured for selectively rigidly anchoring/fixing the two valve-like pieces (32a, 32b; 132a, 132b) of the second air-filtering shell or vessel (30, 130) to one another when the same valve-like pieces (32a, 32b; 132a, 132b) are reciprocally coupled to form/compose the second air-filtering shell or vessel (30, 130)
 6. Laundry dryer according to any claim Claim 2 to 5, **characterized in that** the valve-like pieces (23a, 23b) forming the two valve-like structure of the first air filtering shell or vessel (20) are rotatable one relative to the other about a first axis (A) and the valve-like pieces (32a, 32b) forming the two valve-like structure of the second air filtering shell or vessel (30) are rotatable one relative to the other about a second axis (B), the second air filtering shell or vessel (30) being rotatable relative to one of the two valve-like pieces (23b) of the first air filtering shell or vessel (20) about a third axis (C) parallel to the first and/or second axis (A, B) between a first position wherein the second air-filtering shell or vessel (30) is fitted/recessed into said first air-filtering shell or vessel (20) and a second position wherein the second air-filtering shell or vessel (30) is overturned outside the first air-filtering shell or vessel (20), in said first position the second air-filtering shell or vessel (30) being prevented from being opened in a book like manner even if the first air-filtering shell or vessel (20) is opened in a book like manner.
 7. Laundry dryer according to any Claim 2 to 5, **characterized in that** a first of the two valve-like pieces (132a, 132b) of the second air-filtering shell or vessel (130) is hinged to one of the two valve-like pieces (123a, 123b) of the first air-filtering shell or vessel (120) in a bottom region of the first air-filtering shell or vessel (120), so that the two valve-like pieces (132a, 132b) of the second air-filtering shell or vessel (130) are allowed, when the first air-filtering shell or vessel (120) is opened in a book-like manner, to rotate about their rotation axis (E) on said valve-like piece (123a, 123b) for opening the second air-filtering shell or vessel (130) in book-like manner immediately above the first air-filtering shell or vessel (120).
 8. Laundry dryer according to Claim 7, **characterized in that** the two valve-like pieces (132a, 132b) of the second air-filtering shell or vessel (130) are pivotally connected to one another through hinges (133) which are pivotally jointed to one of the two valve-like pieces (123a, 123b) of the first air-filtering shell or vessel (120).
 9. Laundry dryer according to any one of the foregoing claims, **characterized in that** the air-filtering cartridge (15) additionally comprises a permeable-to-air, upper lid (22, 122) which is rigidly associated/

fixed to the first air-filtering shell or vessel (20, 120), so as to close the upper mouth of said first air-filtering shell or vessel (20, 120).

10. Laundry dryer according to Claim 9, **characterized in that** said permeable-to-air upper lid (22, 122) is divided into two complementary pieces (25, 125) which are selectively separable to one another, and each of which is permanently rigidly fixed to and/or formed in one piece with a respective valve-like piece (23a, 23b, 123a, 123b) of the first air-filtering shell or vessel (20, 120), so as to allow the first air-filtering shell or vessel (20, 120) to open in a book-like manner.

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11. Laundry dryer according to Claim 10, **characterized in that** the permeable-to-air upper lid (22, 122) furthermore comprises a manually-operated snap-on locking mechanism (26, 126) which is structured for selectively rigidly anchoring the two complementary pieces (25, 125) of the permeable-to-air upper lid (22, 122) to one another when they are reciprocally coupled to form/compose the permeable-to-air upper lid (22, 122).

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12. Laundry dryer according to any one of the foregoing claims, **characterized in that** each of said first and second air-filtering shells or vessels (20, 120, 30, 130) is provided with two reciprocally-faced, permeable-to-air sidewalls (21, 121, 31, 131) which are incorporated in respective two valve-like structures (23a, 23b, 32a, 32b; 123a, 123b, 132a, 132b) for restraining fluff and/or lint particles in suspension into the airflow (f) that crosses the air-vent (10).

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13. Laundry dryer according to Claim 12, **characterized in that** each permeable-to-air sidewall (31, 131) of the second air-filtering shell or vessel (30, 130) is arranged locally faced and superimposed to a respective permeable-to-air sidewall (21, 121) of the first air-filtering shell or vessel (20, 120).

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14. Laundry dryer according to one of the foregoing claims, **characterized in that** a heat pump circuit (18) is arranged in fluid communication with the airflow (f) to remove moisture therefrom and to release heat to said airflow (f).

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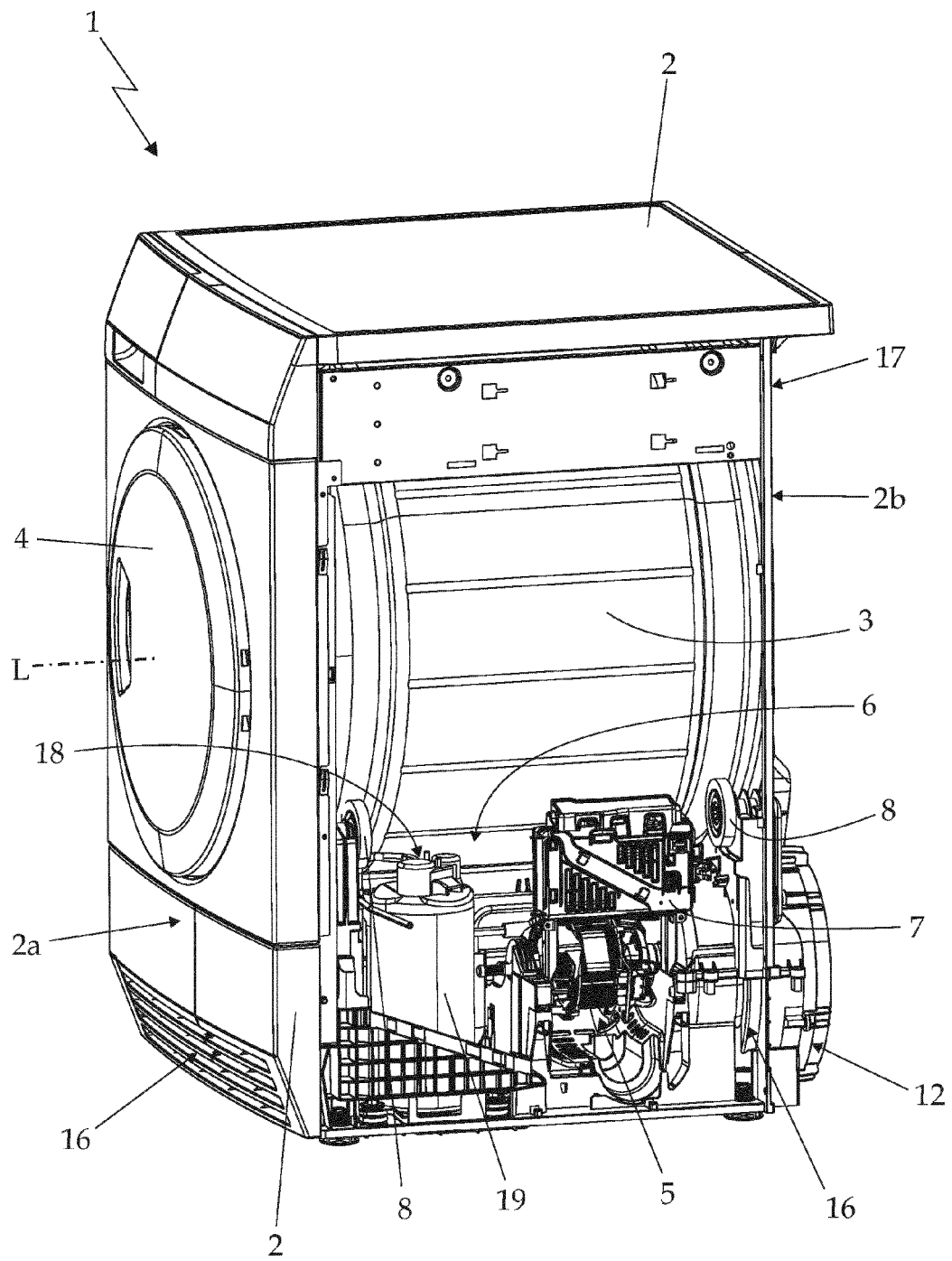


Fig. 1

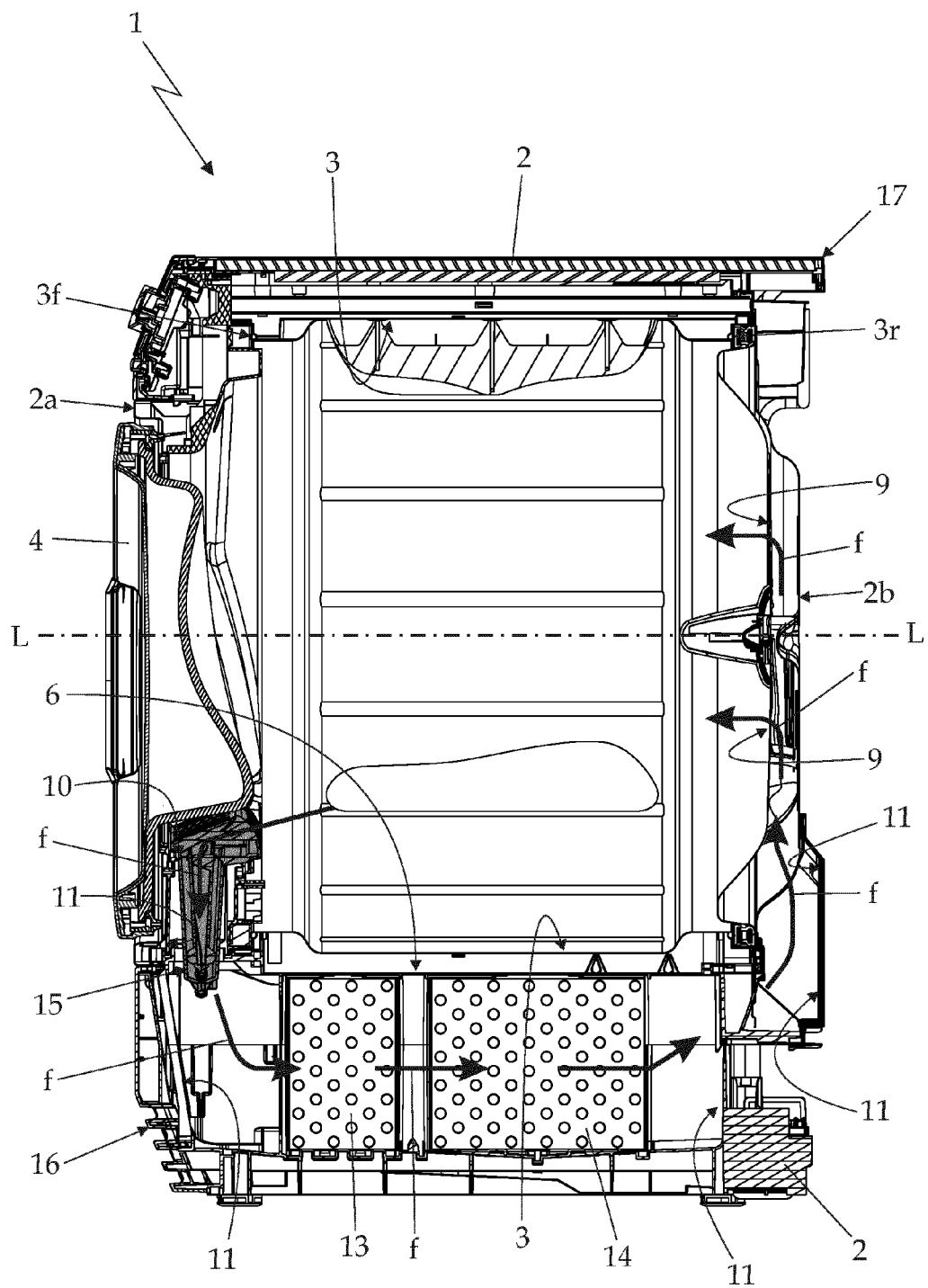
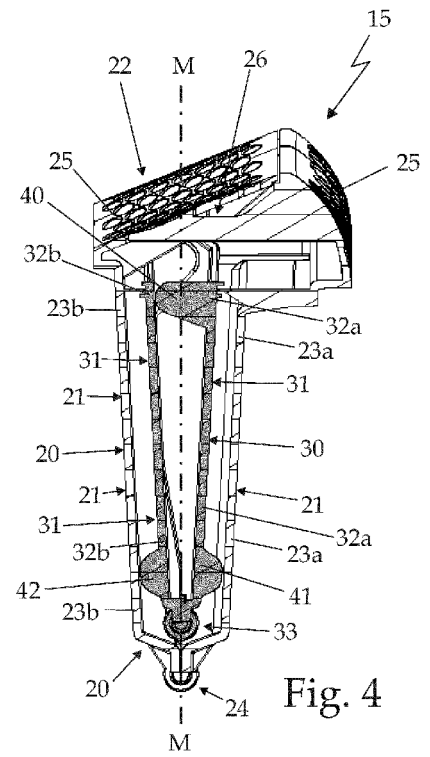
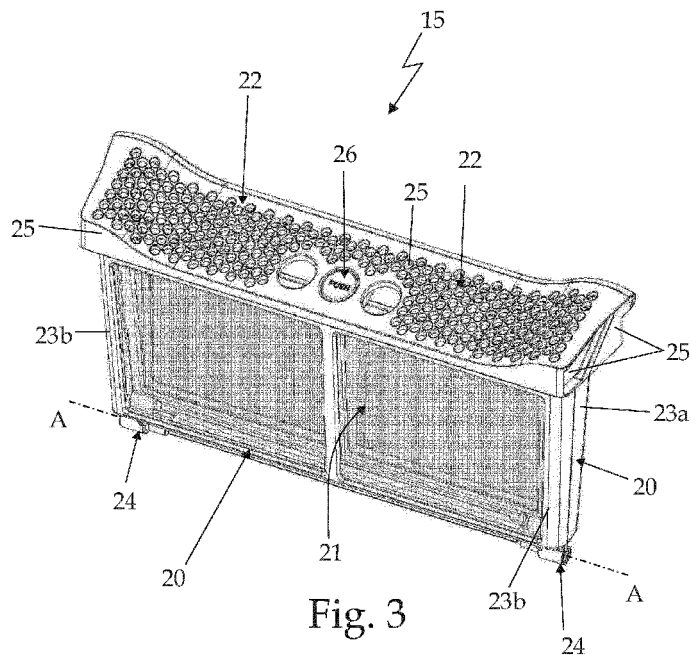


Fig. 2



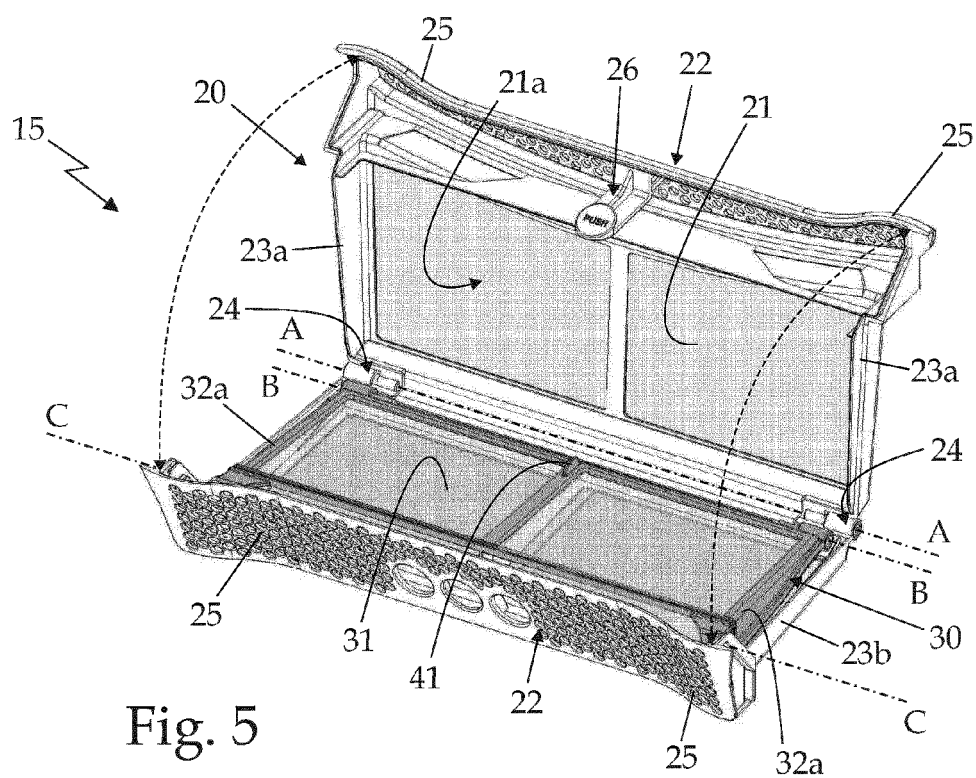


Fig. 5

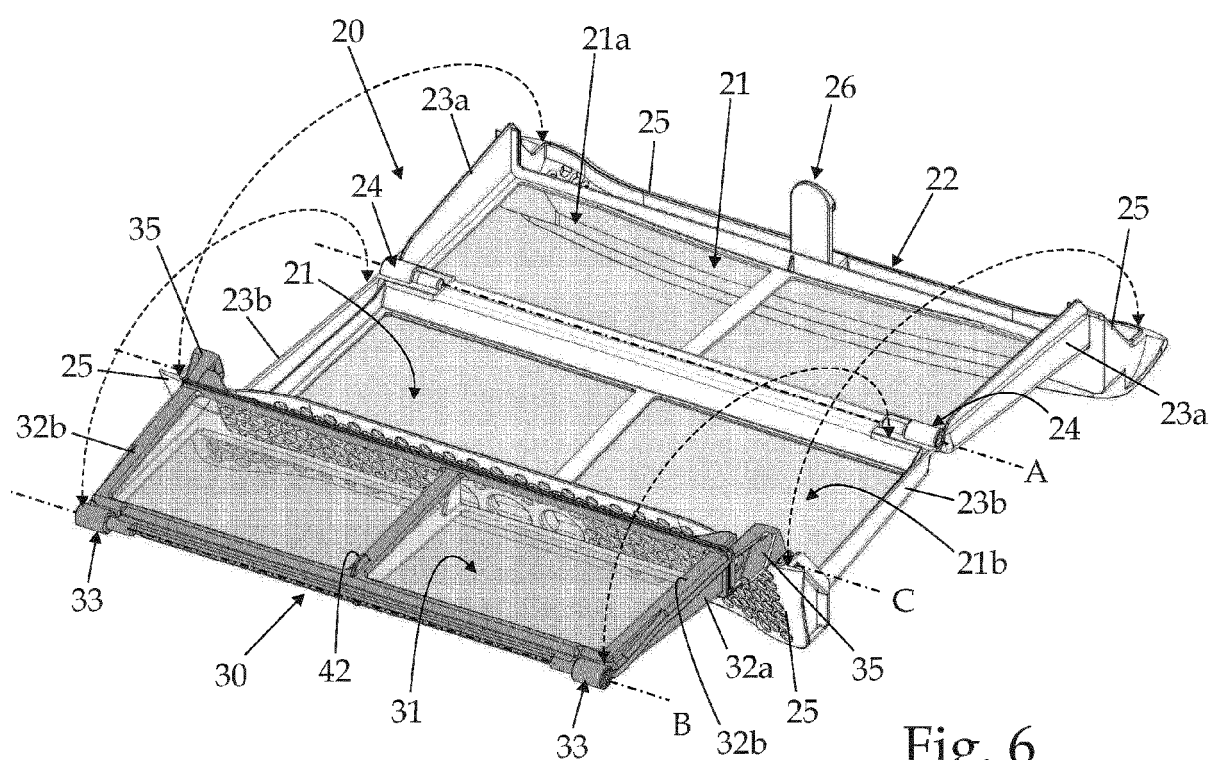
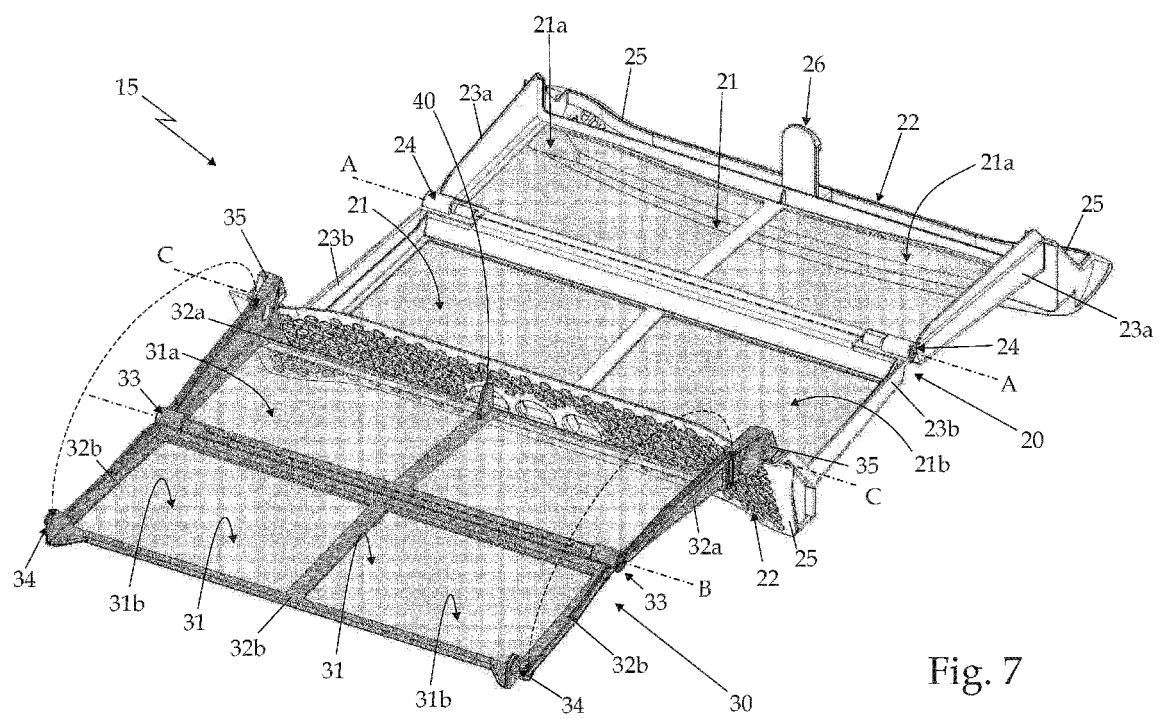
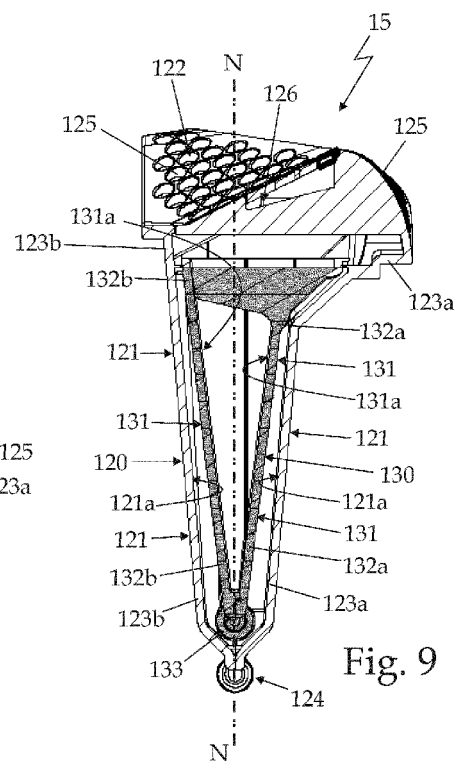
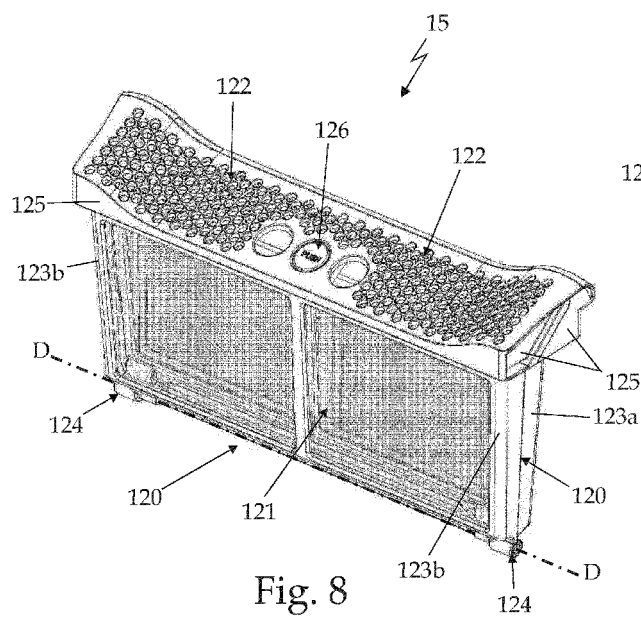


Fig. 6





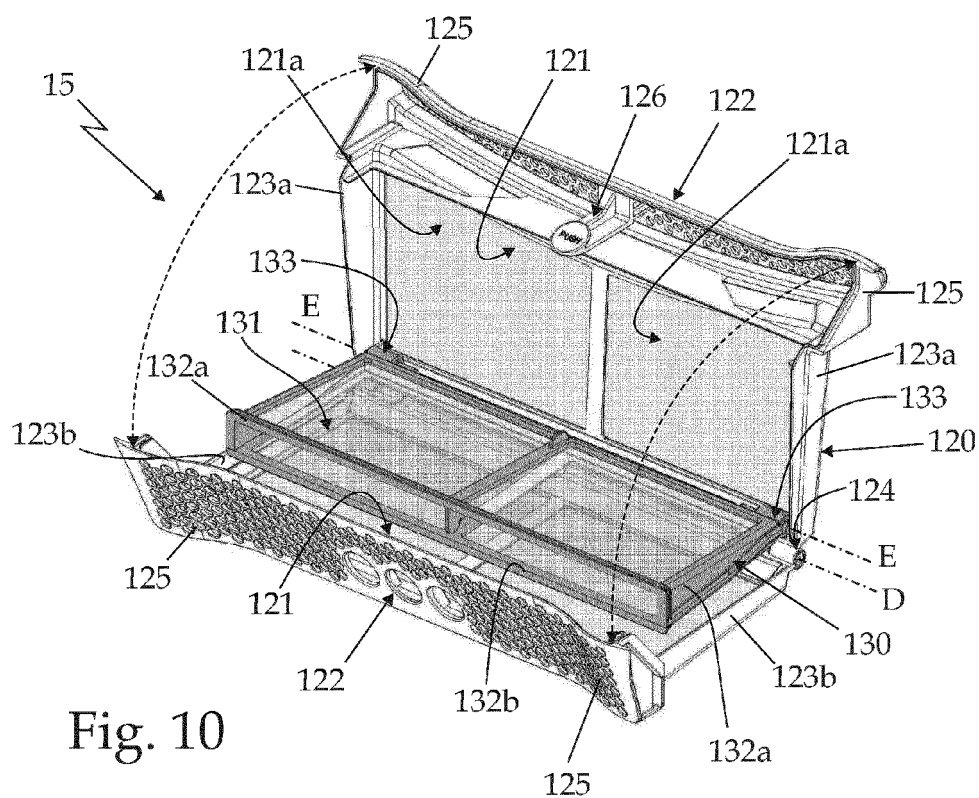


Fig. 10

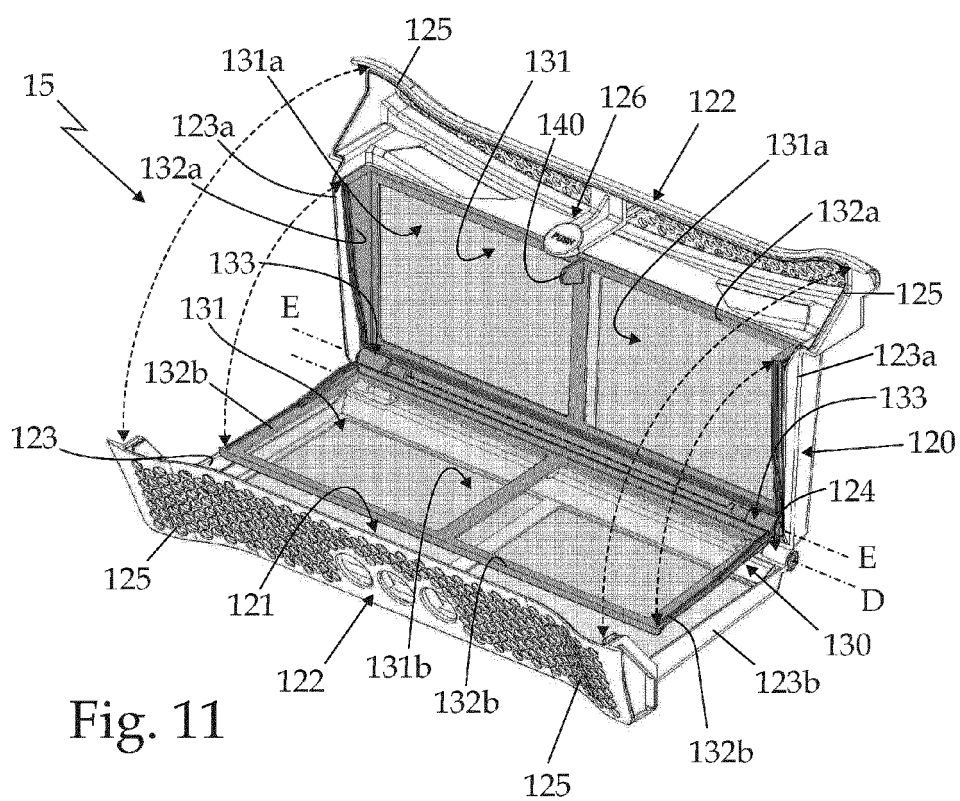


Fig. 11

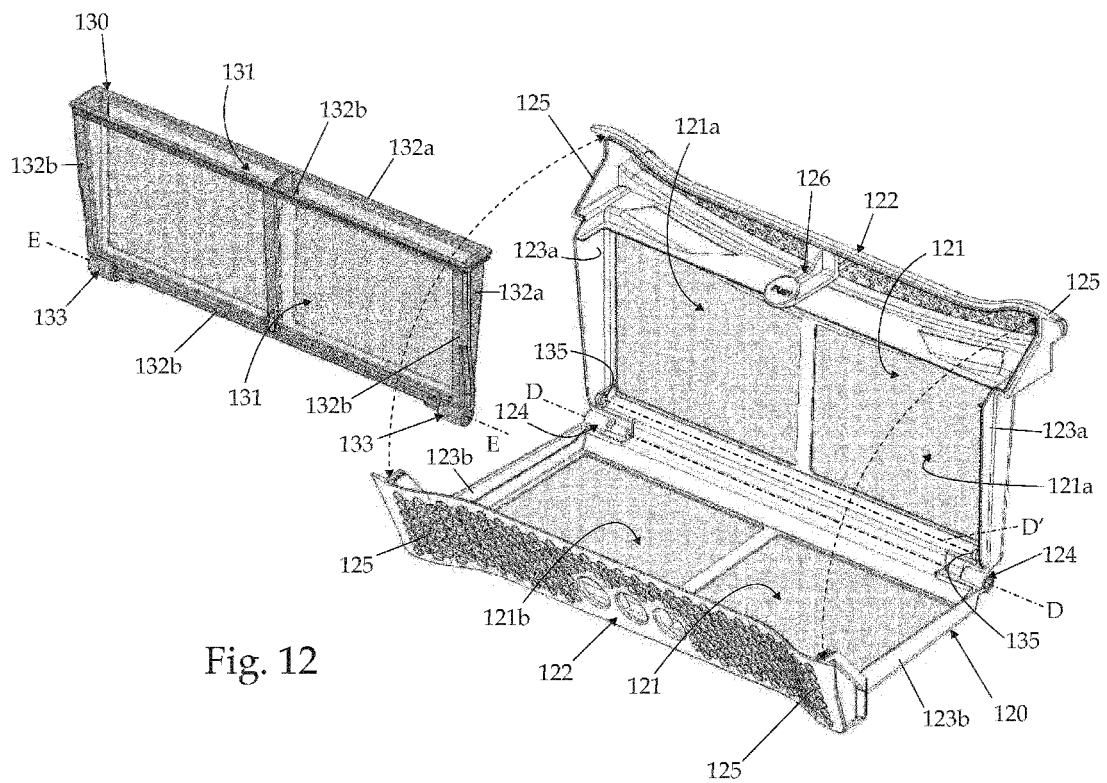


Fig. 12



EUROPEAN SEARCH REPORT

Application Number
EP 12 17 5288

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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			D06F B01D
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 6 February 2013	Examiner Kising, Axel
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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06-02-2013

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

REFERENCES CITED IN THE DESCRIPTION

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