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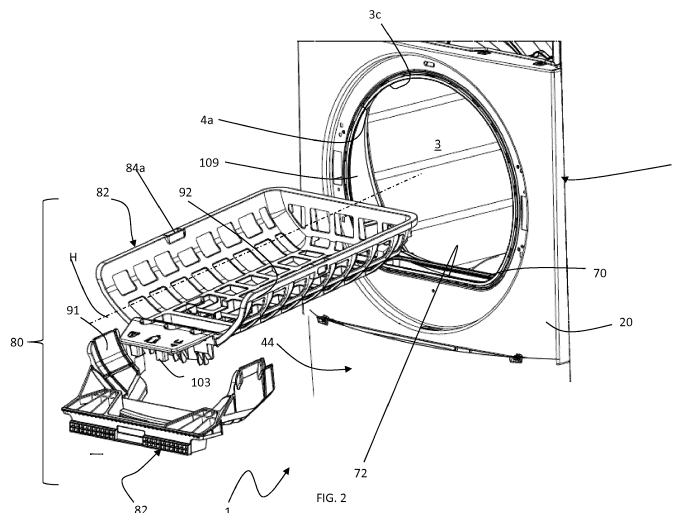
(54) **METHOD TO POSITION A RACK IN A LAUNDRY DRYER AND LAUNDRY DRYER INCLUDING A RACK**

(57) The invention relates to a method to position a rack to support items to be dried in a laundry dryer (1) which includes:

- a casing (2);
- a rotatable laundry drum (3),
- a drying air conduit (18) arranged for passing drying air through the laundry drum (3), said drying air exiting said drum from an air outlet (70),
- at least one filter element (15) arranged in a seat (72) located at the air outlet (70) for filtering drying air circulating in said drying air conduit (18), said filter element being removable from said seat,

said method comprising the steps of:

- providing a rack (80) having a tray portion apt (81) to support items to be dried and a support portion (82) apt to support the tray portion, said support portion including a filter component (97);
- removing said filter element (15) from said seat (72);
- mounting said support portion (82) on said seat (72) so as to removably fix said rack (80) to said dryer (1) and arrange the tray portion (81) within the laundry drum (3); and
- using said filter component (97) instead of the filter element (15) during drying of said items.



Description

Technical field

[0001] The present invention relates to a method to position a rack within a laundry dryer. The method allows a stable positioning of the rack without changing completely the outline of a dryer in which a rack is not provided. Therefore, costs are reduced because less different components have to be manufactured. Further, the invention relates to a kit of part comprising the rack and to a dryer including the kit of parts. Additionally, the invention related to a method for drying items by a rack.

Background art

[0002] In a laundry dryer, a rack can be used for storing delicate clothes and/or footwear articles to be dried. Said rack is arranged inside the laundry drum. The storage of the delicate clothes and/or footwear articles in the rack reduces not only fabric damages during the drying process but also possible damages to the dryer, since there is no contact of the clothes and footwear articles with the inner wall of the laundry drum.

[0003] As known, the laundry drum during drying cycles rotates inside a casing and a flow of drying or process air flows through the drum to dry the clothes. In an open drum, that is, in a drum formed by a hollow mantle closed at both ends by stationary elements, the rack positioned within the drum can be fixed to a back wall of the casing, which is stationary and does not rotate when the dryer is in operation during a drying cycle. In this way, a stable positioning of the rack is achieved: the drum may rotate, but the rack and the items to be dried positioned on top of it stay still.

[0004] However, this coupling between the rack and the back wall of the casing is not possible in case of a closed drum, that is, a drum which includes a cylindrical mantle and a rear wall closing one end of the mantle. In this case, also the rear wall of the drum is rotating together with the drum when the drying cycle is ongoing, thus fixing the rack on it requires particular fixation arrangements to allow free rotation of the drum relative to the rack.

[0005] Further, generally, in dryers the motor which rotates the drum also rotates the fan which blows the drying process air in a drying or process air circuit, to which the drum belongs. Therefore, it is not possible to keep the drum stationary in order to dry items placed on a stationary rack mounted on a drum portion, while supplying drying air.

Summary of the invention

[0006] It is an object of the present invention to render available a method for mounting the rack within the drum of a laundry dryer which overcomes the above mentioned drawbacks and problems. Further, it is another object of the invention to render available a method for mounting

the rack within the drum without changing many components of the dryer itself in order to accommodate the rack; in this way a rack can be installed in an already existing dryer. Moreover, it is desired that the method of the invention allows a functioning of the dryer when the rack is mounted as similar -in terms of efficiency and security - as possible to the functioning of the same dryer without rack.

[0007] According to a first aspect, the invention relates to a method to position a rack to support items to be dried in a laundry dryer which includes:

- a casing;
- a rotatable laundry drum;
- a drying air conduit arranged for passing drying air through the laundry drum, said drying air exiting said drum from an air outlet;
- at least one filter element arranged in a seat located at the air outlet for filtering drying air circulating in said drying air conduit, said filter element being removable from said seat;
- said method comprising the steps of:
 - providing a rack having a tray portion apt to support items to be dried and a support portion apt to support the tray portion, said support portion including a filter component;
 - removing said filter element from said seat;
 - mounting said support portion on said seat so as to removably fix said rack to said dryer and arrange the tray portion within the laundry drum; and
 - using said filter component instead of the filter element during drying of said items.

[0008] The dryer used to position a rack according to the method of the invention may include a laundry drier or a combined laundry washer-dryer. The dryer includes a washing and/or drying laundry drum where the laundry can be located in order to be washed and/or dried; the drum can be rotated around a chamber axis during the washing and/or drying operations. Further, the dryer may be a front-loading dryer, which means that the axis of rotation of the drum is positioned in a horizontal manner or slightly tilted with respect to a horizontal plane, or a top laundry dryer, where the axis of the laundry chamber is substantially vertical.

[0009] The dryer comprises a casing preferably including a front wall, a rear wall, side walls, top wall and a base section or basement. The front or top wall may comprise a user panel to command the functioning of the dryer by the user. The casing defines the limit between the internal volume of the dryer and the outside to the dryer. Further, preferably, the casing includes a door hinged to the casing itself, e.g. to the front wall in case of a front loading appliance, which is openable in order to introduce the laundry in the drum, or to the top wall in case of a top loading appliance. The door closes a loading/unloading opening realized on the casing itself which gives access to the drum. Conversely, also the drum in-

cludes a laundry loading/unloading opening facing the loading/unloading opening formed in the casing.

[0010] The dryer includes further a drying air circuit connected to the drum and a hot-air generator which generates and circulates the same drying air continually inside the drum, so as to continuously extract surplus moisture from the air issuing from the drum after flowing over the laundry. The hot-air generator can be for example a heat pump system or an air-to-air condenser.

[0011] The drying air therefore enters the drum, for example by means of a drum air inlet, and exits the drum by means of a drum air outlet. Preferably, said air outlet may be located at a peripheral edge of the loading/unloading opening on the casing.

[0012] Further, within the drying air circuit, the dryer includes at least one filter element for filtering lint and/or fluff released into the drying air by the laundry inside the drum, to prevent clogging of the component parts of the hot-air generator. Preferably, the filter element is inserted in a seat, or slit, formed at the loading/unloading opening, seat or slit which is realized at the air outlet.

[0013] Advantageously, the filter element comprises a mesh sized to trap fluff/lint, while allowing sufficient minimum airflow for the drying circuit to operate.

[0014] The filter element is removable from the seat so that, for example, it can be cleaned by the user or replaced in case of damage. In standard drying cycle of the dryer, when a rack is not used, the filter element is positioned within the seat and remains therein for the whole length of the drying cycle.

[0015] In addition, the dryer includes a rack which is attachable and detachable from the casing of the dryer. The rack is not used in all drying cycles of the dryer; it is an optional member which is used to dry items such as delicate laundry or shoes, which are preferably not to be tumbled during rotation of the drum. Therefore, the rack has to remain stationary during rotation of the drum and at the same time it needs to be hit by the flow of drying air flowing through the drying air circuit and the drum. For this purpose, the rack has a tray portion on which these items to be dried are supported and which is inserted in the drum in an operative configuration during a drying cycle. Advantageously, the tray portion includes a plurality of apertures to form substantially a grid so that the drying air can flow through the tray itself.

[0016] The tray portion of the rack, as mentioned, needs to be fastened not to the drum which rotates, but to a stationary element of the casing of the dryer. In order to be fastened to the casing, the rack includes a support portion which bears the weight and supports the tray portion. The support portion is fixed to the casing at the seat where the filter element is commonly inserted.

[0017] In order to allow this coupling, according to the method of the invention, when the rack is to be used, the filter element needs to be removed from the seat and, in place of the filter element, the support portion is mounted on the seat. However, in order to still have a filtering of the drying air flowing through the drying air process also

during those drying cycles in which the rack is used, that is, without the filter element, the support portion according to the invention is provided with a filter component still apt to filter the drying air.

5 **[0018]** The filter component could include for example an area of the support portion positioned on the seat having a mesh structure.

[0019] Although due to construction constraints the filter component may have a filtering surface smaller than a filtering surface of the filter element which has been removed to mount the rack, advantageously there is still a filtering step during the method of the invention while items on the rack are drying. This allows a correct functioning of the dryer also during drying cycles in which the rack is used.

[0020] Further, the separation of the rack into a tray portion and into a support portion allows to maintain the tray portion substantially identical for all rack and to change only the support portion which needs to be coupled to the seat in case different dryer's models having different seats' shapes are present on the market. In a different embodiment, however the two portions are integral one to the other so that few elements need to be mounted.

25 **[0021]** The rack according to the method of the invention is mounted on the seat which is already available for the housing of the filter element. No special adaptations of the dryer due to the rack are therefore needed.

[0022] Advantageously, the method of the invention is used in combination with dryers including a closed drum, that is, a drum having a back wall. The drum is generally formed by a cylindrical mantle, and in a closed drum this mantle is closed at one of its axial ends by a wall, for example made of metal or of polymeric material. The other end of the mantle not closed by the wall is used to insert laundry within the drum itself and is generally facing the loading/unloading aperture on the casing of the dryer. The fact that the track is fixed to the casing at the seat means that no contact is present between the rack and the drum, so that the rack can be used also within drum having a closed wall which can rotate without damaging the items on the rack and the rack itself.

[0023] According to a second aspect, the invention relates to a kit of parts for a laundry dryer, comprising:

- 45
- A filter element apt to be mounted in a drying air circuit of said laundry dryer;
 - A rack having a tray portion apt to support items to be dried and a support portion apt to support the tray portion, said support portion including a filter component;
 - Wherein the filter element and the rack are used alternatively in said dryer.

55 **[0024]** The kit of parts for a dryer includes a filter element which is apt to filter drying air flowing in a drying air circuit of the dryer and a rack, apt to dry items in the dryer. The rack has a support portion and a tray portion. The

support portion includes a filter component. Due to the fact that either the filter element or the rack is used in the dryer, advantageously the filter component acts as the filter element of the dryer during those drying cycles in which the rack is used and the "main" filter element is not.

[0025] Preferably, the kit of parts is provided together with the dryer.

[0026] According to a third aspect, the invention relates to a laundry dryer comprising:

- a casing;
- a rotatable laundry drum;
- a drying air conduit arranged for passing drying air through the laundry drum, said drying air exiting said drum from an air outlet;
- the kit of parts according to the second aspect, wherein either said filter element is removably arranged in a seat located at the air outlet or said support element is mounted on said seat so as to removably fix said rack to said dryer.

[0027] The dryer of the invention may include a laundry drier or a combined laundry washer-dryer. The dryer includes a washing and/or drying laundry drum where the laundry can be located in order to be washed and/or dried; the drum can be rotated around a chamber axis during the washing and/or drying operations. Further, the dryer may be a front-loading dryer, which means that the axis of rotation of the drum is positioned in a horizontal manner or slightly tilted with respect to a horizontal plane, or a top laundry dryer, where the axis of the laundry chamber is substantially vertical.

[0028] The dryer comprises a casing preferably including a front wall, a rear wall, side walls, top wall and a base section or basement. The front or top wall may comprise a user panel to command the functioning of the dryer by the user. The casing defines the limit between the internal volume of the dryer and the outside to the dryer. Further, preferably, the casing includes a door hinged to the casing itself, e.g. to the front wall in case of a front loading appliance, which is openable in order to introduce the laundry in the drum, or to the top wall in case of a top loading appliance. The door closes a loading/unloading opening realized on the casing itself which gives access to the drum. Conversely, also the drum includes a laundry loading/unloading opening facing the loading/unloading opening formed in the casing.

[0029] The dryer includes further a drying air circuit connected to the drum and a hot-air generator which generates and circulates the same drying air continually inside the drum, so as to continuously extract surplus moisture from the air issuing from the drum after flowing over the laundry. The hot-air generator can be for example a heat pump system or an air-to-air condenser.

[0030] The drying air therefore enters the drum, for example by means of a drum air inlet, and exits the drum by means of a drum air outlet. Preferably, said air outlet may be located at a peripheral edge of the loading/un-

loading opening on the casing.

[0031] Further, the dryer includes a kit of parts as described according to the second aspect. This means that the dryer includes at least one filter element for filtering lint and/or fluff released into the drying air by the laundry inside the drum, to prevent clogging of the component parts of the hot-air generator. Preferably, the filter element is inserted in a seat, or slit, formed at the boundary of the loading/unloading opening, which is also the air outlet for the drying air.

[0032] Advantageously, the filter element comprises a mesh sized to trap fluff/lint, while allowing sufficient minimum airflow for the drying circuit to operate. The filter element is removable from the seat so that, for example, it can be cleaned by the user or changed in case of damage. In standard drying cycle of the dryer, when a rack is not used, the filter element is positioned within the seat and remains therein for the whole length of the drying cycle.

[0033] In addition, the kit of parts includes a rack which is attachable and detachable from the casing of the dryer. The rack is not used in all drying cycles of the dryer; it is an optional which is used to dry items such as delicate laundry or shoes, which are preferably not to be tumbled during rotation of the drum. Therefore, the rack has to remain stationary during rotation of the drum and at the same time it needs to be hit by the flow of drying air flowing through the drying air circuit and the drum. For this purpose, the rack has a tray portion on which these items to be dried are supported and which is inserted in the drum in an operative configuration during a drying cycle. Advantageously, the tray portion includes a plurality of apertures to form substantially a grid so that the drying air can flow through the tray itself.

[0034] The tray portion of the rack, as mentioned, needs to be fastened not to the drum which rotates, but to a stationary element of the casing of the dryer. In order to be fastened to the casing, the rack includes a support portion which bears the weight and supports the tray portion. The support portion is fixed to the casing at the seat where the filter element is commonly inserted.

[0035] In order to allow this coupling, either the rack is to be used and the support portion is mounted on the seat, or the filter element is inserted in the seat. However, in order to still have a filtering of the drying air flowing through the drying air also during drying cycles in which the rack is used, that is, without the filter element, the support portion according to the invention is provided with a filter component still apt to filter the drying air.

[0036] The filter component could include for example an area of the support portion on the seat having a mesh structure.

[0037] Advantages of this dryer construction have been already mentioned with reference to the first aspect of the invention and are not herein repeated.

[0038] According to a fourth aspect, the invention relates to a method for drying laundry items with a rack which is mounted in a dryer according the third aspect

by a method according to the first aspect, characterized by filtering drying air through the filter component instead of the filter element.

[0039] The advantage of having a rack including a filter component in the support portion is that filtering of drying air takes place in all drying cycles, with or without filter element.

[0040] According to any of the four mentioned aspects, the invention includes alternatively or in combination any of the following characteristics.

[0041] Preferably, the method according to the first aspect comprises:

- coupling said support portion to said tray portion before mounting said support portion on said seat.

[0042] The tray portion needs to be positioned inside the drum so as to be exposed to the drying air to dry the items positioned therein. Therefore, in order to avoid cumbersome movements and uncomfortable positions by the user who mounts the rack in the dryer, it is preferred to first couple the support portion to the tray portion and insert the latter into the drum, keeping in the hands the rack from the support portion to fix it on the seat at the loading/unloading aperture of the casing.

[0043] Preferably, the method according to the first aspect comprises:

- providing either said support portion or said tray portion with at least a snap in element and the other of said support portion and tray portion with at least a snap in receiving element; and
- engaging said snap in element with said snap in receiving element in order to removably fix said support portion to said tray portion.

[0044] The coupling between the support portion and the tray portion of the rack is preferably enough stable to withstand the flow of drying air without disengagement and at the same time simple to couple and release by the user who mounts and dismounts the rack. A snap in coupling is in this case the preferred choice to achieve the aforementioned result. Further, the rack is preferably realized in polymeric material, so that a snap in element and a snap in receiving element are easy to realize in a molding process.

[0045] Advantageously, the method according to the first aspect comprises:

- Abutting with one or more support elements formed in said support portion an inner surface of the casing facing a laundry loading/unloading opening of said drum so as to distribute the weight of said rack.

[0046] The support portion preferably includes one or more support elements, such as protrusions, to abut an inner surface of the casing. The inner surface is located substantially in front of the laundry loading/unloading

opening of the drum. Preferably, a plurality of support elements is realized, so that the abutment takes place in a plurality of position, distributing the weight of the rack on a substantially wide surface and at the same time having an "anti-rotation" functionality. Indeed, an abutment in more than a position on a surface traverse to the tray portion hinders any rotation of the rack and in particular of its tray portion.

[0047] Advantageously, the method according to the first aspect comprises:

- coupling said rack to said drying air conduit by a hook/hook receiving element arrangement.

[0048] The rack needs not only to abut to the casing, but also to be stably fixed to the casing itself so that it does not move during the drying cycles. This is preferably achieved by means of a hook/hook receiving arrangement formed in the support portion and in the seat, or vice-versa.

[0049] The kit of parts according to the second aspect advantageously includes said filter element which is a wedge-shaped filter including one or more openable shells.

[0050] Preferably, the filter element of the kit is the "main" filter element of the dryer, including a broad filtering surface. Commonly in the art, this filter element includes at least an openable shell covered by a mesh to maximize the filtering surface. The "wedge" is thus inserted in the seat of the drying air circuit pointing downwards.

[0051] Advantageously, said support portion of the rack of said kit of parts according to the second aspect includes a plurality of support elements, all protruding in the same direction.

[0052] As mentioned with reference to the first aspect, the support portion preferably includes a plurality of support elements, such as protrusions, to abut an inner surface of the casing. The inner surface is located substantially in front the laundry loading/unloading opening of the drum. Preferably, a plurality of supporting elements is realized, so that the abutment takes place in a plurality of position, distributing the weight of the rack in a substantially broad surface and at the same time having an "anti-rotation" functionality. Indeed, an abutment in more than a position on a surface traverse to the tray portion hinders any rotation of the rack and in particular of its tray portion.

[0053] Preferably, said tray portion of said kit of parts according to the second aspect is integral to said support portion or removably mountable thereto.

[0054] In a preferred embodiment, the tray and support portion are a unitary piece realized in the same production step. In this way, a minimum number of assembly steps has to be performed by the user to mount the rack in the dryer. On the contrary, in a different preferred embodiment, tray portion and support portion are separated one to the other, so that a minimum number of different

pieces has to be manufactured. The tray portion is usable in all dryers, while the support portion might need to be changed depending on the seat configuration of the dryer. So having a separated tray portion allows to produce only different support portions applicable all to the same tray portion.

[0055] Preferably, said filter component of the rack of said kit of parts according to the second aspect is detachable from said support portion.

[0056] In this way, cleaning of the filter component is easier and furthermore, in case of damage, only the filter component has to be replaced and not the whole rack.

[0057] Preferably, in the kit of parts according to the second aspect, said support portion comprises a first surface and said tray portion comprises a second surface, said first and second surfaces being mating surfaces so that the second surface can lie on the first surface to be supported thereon.

[0058] The support of the tray portion by the support portion takes place by superimposing two mating surfaces, so that the weight of the tray portion is well distributed on a relatively wide area and no points of stress are present.

[0059] Advantageously, in the laundry dryer of the third aspect, said support portion abuts to an inner surface of said casing facing a laundry loading/unloading opening of said drum so as to prevent said rack to rotate.

[0060] Advantageously, in the laundry dryer of the third aspect, said support portion completely covers the air outlet so that drying air can pass through said support portion substantially only flowing through said filter component.

[0061] It is preferred that fluff or other dirt which can be present in the items to be dried does not reach the hot air generator. For this reason, it is desirable that all the drying air is filtered to remove such fluff/dirt before reaching the hot air generator. Thus, the support portion covers the whole surface of the air outlet so that the drying air, in order to continue flowing in the drying air circuit, has to pass the filter component and be filtered.

[0062] Preferably, the laundry dryer of the third aspect comprises one or more humidity sensors located in an inner surface of said casing at the front side, and said support portion being in abutment to said inner surface.

[0063] It is desirable during the drying cycle to measure the level of humidity still present in the items to be dried in order to adapt the drying time or other characteristics of the drying cycle accordingly. The humidity sensors which measure the humidity of the items need to come into contact with the items themselves to perform the measurement and for this reason they are generally positioned on a surface facing the loading/unloading opening of the drum. The same surface is used for the abutment of the support portion. Brief description of the drawings

[0064] The present invention will now be described with reference to the accompanying drawings that illustrate nonlimiting embodiments thereof, wherein:

- Figure 1 is a perspective view of a laundry dryer according to the invention;
- Figure 2 shows a perspective view with a portion of the casing removed of the laundry dryer of Figure 1 in a drying configuration with some element removed from the dryer;
- Figure 3 shows a perspective view analog to figure 2 with some element mounted in the dryer;
- Figure 4 shows a lateral view in section of the dryer of figure 1 in the operative configuration of figure 3;
- Figure 4a shows an enlarged view of the detail encircled in figure 4;
- Figure 5 shows a perspective view of an element of the dryer of figure 1;
- Figure 6 shows a perspective view of a kit of parts according to the invention including the element of figure 5;
- Figure 6a shows a second perspective view of the kit of parts of figure 6;
- Figure 7 and Figure 7a are two perspective view of a first part and of an enlarged detail thereof, respectively, of the element of figure 5;
- Figure 8 is a perspective view of a second part of the element of figure 5, complementary to the first part shown in figure 7;
- Figure 9 is a top view of the element of figure 5;
- Figure 10 is a lateral view in section along line E-E of figure 9;
- Figure 11 is a lateral view in section along line C-C of figure 9;
- Figure 12 shows a perspective view with a portion of the casing removed of the laundry dryer of Figure 1 in a different drying configuration with some element removed from the dryer;
- Figure 13 shows a perspective view of a part of the kit of parts of figure 6 and 6a.

Detailed description of preferred embodiments of the invention

[0065] With initial reference to Figs. 1 - 4, a laundry dryer realized according to the present invention is globally indicated with 1.

[0066] Although the present description refers to a front

loading dryer, the laundry appliance of the invention could comprise any type of dryer or a washer-dryer.

[0067] Laundry dryer 1 comprises an outer box or casing 2, preferably but not necessarily parallelepiped-shaped, and a treating chamber, such as a drum 3, for example having the shape of a hollow cylinder, for housing the laundry and in general the clothes and garments to be dried. The drum 3 is preferably rotatably fixed to the casing 2, so that it can rotate around a preferably horizontal axis R, visible in figure (in alternative embodiments, rotation axis may be tilted). Access to the drum 3 is achieved for example via a door 4, preferably hinged to casing 2, which can open and close a loading/unloading opening 4a realized on the casing itself.

[0068] More in detail, casing 2 generally includes a front wall 40, a rear wall 41 and two lateral walls 45, all mounted on a basement 44. Preferably, the basement 44 is realized in polymeric material. Preferably, basement 44 is molded via an injection molding process. Preferably, on the front wall 40, the door 4 is hinged so as to access the drum. The cabinet, with its walls, defines the volume of the laundry dryer 1. Advantageously, basement 44 includes an upper and a lower shell portion (not visible in the drawings).

[0069] The dryer 1, and in particular basement 44, defines an horizontal plane (X, Y) which is substantially the plane of the ground on which the dryer 1 is situated, thus it is considered to be substantially horizontal, and a vertical direction Z perpendicular to the plane (X, Y).

[0070] Laundry dryer 1 also preferably comprises an electrical motor assembly (not depicted) for rotating, on command, revolving drum 3 along its axis inside casing 2.

[0071] Further, laundry dryer 1 may include an electronic central control unit 150 (visible in a schematic form in figure 1) which controls both the electrical motor assembly and other components of the dryer 1 to perform, on command, one of the user-selectable drying cycles preferably stored in the same central control unit. The programs as well other parameters of the laundry dryer 1, or alarm and warning functions can be set and/or visualized in a control panel 11, preferably realized in a top portion of the dryer 1, such as above door 4. Advantageously, in the top portion of the dryer, close to the control panel 11, a drawer 12 may be realized, suitable for collecting water condensed during drying cycles.

[0072] With reference to Figure 4, the rotatable drum 3 includes a mantle 3a, having preferably a substantially cylindrical, tubular body, which is preferably made of metal or polymeric material and is arranged inside the casing 2 and apt to rotate around the general rotational axis R which can be - as said - horizontal, i.e. parallel to the (X, Y) plane, or tilted with respect to the latter.

[0073] Drum 3 may be an open drum, i.e. with both axial ends open, or it may include - as in the depicted embodiment - a back wall 3b (visible both in figures 3 and 4) fixedly connected to the mantle 3a closing one of its axial ends and rotating with the latter. The other axial end of the mantle 3a, opposite to the back wall 3b, defines

a loading/unloading opening 3c of the drum 3 with faces the front wall 40 of the casing 2 and in particular the loading/unloading opening 4a defined in the casing and possibly closed by door 4.

5 **[0074]** In order to rotate, support elements (not depicted) for the rotation of the drum are provided as well in the laundry of the invention. Such support elements might include rollers at the front and/or at the back of the drum, as well as or alternatively a shaft connected to the rear
10 end of the drum (not depicted in the appended drawings). Any support element for the rotation of the drum around axis R is encompassed by the present invention.

[0075] Dryer 1 additionally includes a drying air circuit which comprises the drum 3 and a drying air conduit 18,
15 depicted as a plurality of arrows showing the path flow of a drying air stream through the dryer 1 (see Figure 4). The drying air flow passes through the drum 3, exits the latter via an air outlet 70 and enters the basement 44. In the basement 44, a portion of the drying air conduit 18
20 is formed by the connection of the upper shell and the lower shell. Drying air conduit 18 is preferably connected with its opposite ends to the two opposite sides of drum 3, i.e. back wall 3b and loading/unloading opening 3c of mantle 3a. Therefore, drying air which exits drum 3 from
25 air outlet 70 enters the drum 3 from back wall 3b, which for this purpose preferably includes a plurality of apertures 71 (see figure 3). Drying air circuit also includes a fan or blower (not shown in the figures) to circulate drying air in the drying air circuit.

30 **[0076]** A dedicated motor can be coupled to the fan or blower, but in a possible simpler implementation the same motor can operate both the fan and the drum 3 (in other words only one motor can be present, driving both fan and drum), instead of having two separated motors.

35 **[0077]** The dryer 1 of the invention additionally comprises a drying or hot air generator (not shown), which in an embodiment may include a heat pump system including a first heat exchanger (called also condenser) and a second heat exchanger (called also evaporator). Alternatively, the drying air generator may include an air-to-
40 air condenser. Preferably the drying air generator is located in the basement 44.

[0078] Circulation of the drying air evaporates the moisture from the wet laundry in the drum 3 thus forming
45 a flow of moisture laden air circulating in the basement and dried by the drying or hot air generator.

[0079] With reference now to Figure 6, the dryer 1 comprises a kit of parts 100 including a filter element 15 and a rack 80. Rack 80 and filter element 15 are used alter-
50 natively in the dryer 1.

[0080] In a first drying configuration of the dryer 1, depicted in figure 12, the drying air circuit 18 advantageously comprises, at the exhaust air outlet 70 which commu-
55 nicates with the drum 3, a seat 72 in which the filter element 15 can be removably housed. As it can be appreciated from Figure 4, the seat 72 is advantageously defined in a front bulkhead 101 of the casing 2 advantageously positioned behind the front wall 40, or preferably comprising

the front wall 40, preferably in correspondence of a peripheral surface 109 of the loading/unloading opening 4a of casing 2. This peripheral surface 109 (better shown in figures 2 and 12) has preferably an annular shape.

[0081] Advantageously, the seat 72 is provided in the lower part of the peripheral surface 109 of the loading/unloading opening 4a of casing 2, and the filter element 15 is preferably inserted in the seat 72 by lowering it from the loading/unloading opening 4a of casing 2. In figure 12, the filter element is shown separated from the dryer for clarity purposes, however during the drying cycles, the filter is inserted in seat 72 (shown empty in figure 12).

[0082] In this manner, the filter element 15 can be easily reached by the hand of a person and, at the same time, advantageously no fastening elements are required in order to maintain the filter assembly 15 in the seat 72. According to a preferred embodiment, the filter element can be removed and positioned back in the seat 72 simply by pulling it.

[0083] It will be appreciated that the filter element 15 shown in detail in figures 6 and 13 is shaped such that when it is correctly positioned in the seat 72, it preferably substantially totally intercepts the flow of exhausted air from the laundry drum 3. Advantageously, the filter element 15 comprises a wedge-shaped frame 20 which is dimensioned for being inserted in manually extractable manner into the seat 72 in order to fill the whole clear section of the seat 72.

[0084] The frame 20 includes one or more surfaces which are both permeable to air and structured to restrain the fluff and/or lint particles in suspension into the drying air that enters into the drying air conduit 18 through the air outlet 70. In the figures, the filtering surfaces are shown "empty", that is filtering net has been removed, otherwise the interior of the filter element 15 would not be visible.

[0085] Advantageously, the filter element 15 includes a first and a second shell 23a, 23b associated one another in order to define the wedge shape. Preferably, 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 filter element 15. Furthermore, the filter element 15 comprises a second air permeable surface 22 for allowing exhausting drying air from the filter element 15. As shown in Figures 6 and 13, 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 drum 3 and faces the door 4 when the filter element 15 is inserted into the seat 70 and the door 4 closes the loading/unloading opening 4a, the second lateral wall 24b extends transversally with respect to the end open side of the drum 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

drum 3 when the filter element 15 is inserted into the seat 70, and the fourth lateral wall 24d extends substantially parallel to such a second lateral wall 24b and it is opposite thereto.

[0086] 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 72 when the filter element 15 is fitted thereto. 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 filter element 15 and its seat 73 to enter the filter 15 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 filter element 15 and the seat 72 to be sucked and kept into the filter 15.

[0087] In particular, in an embodiment of the filter element 15 shown in Figure 13, the drying air inlet pass-through opening 9 is formed in a portion of the first front lateral wall 24a interconnecting with the second lateral wall 24b. Furthermore, preferably the drying air inlet pass-through opening 9 is formed also in a portion of the second lateral wall 24b interconnecting with the third rear lateral wall 24c.

[0088] Preferably, two protruding ribs 11a, 11b 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 fourth lateral wall 24d. Such protruding ribs 11a, 11b are provided for interfering with the seat 72 thereby keeping shells 23a, 23b pressed one onto the other when the filter element 15 is fitted into the seat 72.

[0089] Furthermore, Figure 13 also shows two recesses 29 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 filter element 15 from the seat 72 when necessary, for example for carrying out cleaning operations or for changing drying configuration, as detailed below.

[0090] In addition, Figure 13 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.

[0091] The filter element 15 of Figure 13 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 filter element 15 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. The two shells 23a, 23b and the two further inner shells 32a, 32b are provided with a filtering mesh (not visible in the drawings) for retaining fluff and/or lint particles dispersed in the drying air. The filtering mesh is arranged on the second air permeable surface 22.

[0092] Further, the kit of parts 100 comprises the rack 80 which in turn includes a tray portion 81 and a support portion 82. A second drying configuration is thus shown in figure 3, where the rack 80 is mounted in the dryer 1 instead of the filter element 15. Rack 80 is preferably symmetrical with respect to a centerline H which is, when mounted, preferably parallel to the rotation axis R of the drum. As mentioned, the rack 80 is used in connection with the dryer 1 only when the filter element 15 is not inserted in seat 72.

[0093] The tray portion 81 is apt to be inserted within the drum 3, as depicted in the operative configuration of figure 3, and to support the items to be dried. The tray portion 81 includes an open cage 83 and a handle 84, as better shown in figures 9 and 10. The cage 83 comprises a bottom 86, two side walls 88 and a rear wall 87. The front side and the top side of the cage 83 are preferably open. The side walls 88 are preferably inclined, so that the broadness of the cage increases from the bottom up. The bottom 86, the side walls 88 and the rear wall 87 are advantageously formed as grids, including a plurality of apertures 89, so that drying air can flow there-through.

[0094] The handle 84 has the form of a bracket and it is removable from the cage 83, so that, when the dryer is in the operative configuration of figure 3 with the rack 80 mounted, the handle 84, which would have been inserted in the drum 3, is absent. When the tray portion 81 or the whole rack 80 needs to be transported, the handle 84, at its opposite axial ends, is inserted in seats 84a realized in the side walls 88 of the cage 83 and therein coupled.

[0095] Further, the support portion 82 comprises a U-shaped element 90 (better visible in figures 2, 6, 7 and 8) defining two opposite U-arms 90a, 90b and having a mating shape with the shape of a portion of the side walls 88 of the tray portion 81. The U-arms 90a, 90b comprise each an upper surface 91 which faces upwardly when the rack is in the operative configuration of figure 3 and this surface 91 is in abutment with a bottom surface 92 of the side walls 88 of the tray portion 81. Each U-arm is thus in abutment with a bottom surface of a side wall. The shape of the upper surface 91 and the shape of the bottom surface 92 is substantially the same, so that a portion of the bottom surface 92 of the side walls 88 abuts on the upper surface 91, so that the tray portion 81 is supported by means of the surfaces' 91/92 abutment by the support portion 82. The bottom surface 92 of the side walls 88 is located at the front part of the tray portion 81.

[0096] In order to removably fix the support portion 82 to the tray portion 81, the tray portion 81 is inserted between the two U-arms 90a, 90b of the U-shaped element 90 defined by the support portion 82 till bottom surfaces 92 of the side walls 88 abut against top surfaces 91 of the U-arms. The support portion 82 further includes, at the axial end of each of the U-arms 90a, 90b of the U-shaped element 90, a first and a second snap-in elements, both indicated with 95, which can be inserted in

apertures 89 of the cage 83. Preferably, each snap-in element 95 represents a pin mounted at the end of each U-arm 90a, 90b. The U-arm itself is preferably globally elastic, as depicted in figure 11. Advantageously symmetrically with respect to the centerline H of the cage 83, therefore, each snap-in element 95 is inserted in a respective aperture 89 formed in one of the two side walls 88 of the tray portion 81. The coupling is therefore a snap in coupling, easily removable by the user. In order to decouple the tray portion from the support portion, a pressure to the snap-in elements is preferably applied, so that they exit their respective apertures decoupling the tray portion from the support portion. The snap in element 95 when inserted in the aperture 89 of the cage 83 is better visible in figure 5 where it is highlighted by a circumference.

[0097] In a different embodiment of the rack 80, not depicted, tray portion 81 and support portion 82 are realized integral one to the other, so as to form a single unitary element.

[0098] Preferably the support portion and/or the tray portion are realized in polymeric material and more preferably they are molded.

[0099] The support portion 82 further includes a plate-like member 96 apt to cover the air outlet 70 at the peripheral boundary 109 of the loading/unloading aperture 4a of casing 2. As shown comparing the figures 2 and 3, where the rack 80 is shown in a dismounted and in a mounted configuration, respectively, the latter being the configuration in which the rack is positioned during a drying cycle, the plate-like member 96 covers the air outlet 70 completely. In order to allow the drying air to enter the drying air circuit 18, the plate-like member 96 comprises one or more filter components, in the depicted embodiment two filter components 97 symmetrically arranged with respect to the centerline H of the rack 80. Drying air from the drum 3 is thus forced to pass through the filter components 97 in order to exit the drum 3 and enter the basement 44. Preferably, filter components 97 are detachable from the plate-like member 96 and comprise a filtering surface, such as a mesh, as the filter element 15. Advantageously, the flow of exhausted air passing through drum 3 is directed towards said components 97 and, accordingly, fluff and other small particles dragged by the flow of exhausted air remain trapped on top of the filter components 97. To this purpose, the filtering surfaces of the filter components 97 are preferably formed by a very fine mesh that allows the passage of the flow of air while avoiding the passage of fluff and other similar particles.

[0100] As previously explained, the plate-like member 96 is dimensioned such that it can cover the air outlet 70 completely, intercepting the flow of exhausted air that can enter the drying air circuit only by passing through filter components 97 and, consequently, through the filtering surfaces.

[0101] Further, plate-like member 96 comprises one or more hooks or teeth 99 to fasten the rack 80 to the casing 2 of the dryer 1. The hooks or teeth 99 are inserted

in a hook or tooth receiving portion(s) 102 formed within the seat 72 at the drying air inlet 70, as visible in the cross-section of figure 4 and in the enlarged view of figure 4a. The teeth or hooks 99, when inserted in the receiving portions 102 at the seat 72, block the rack in the correct position during the drying cycles.

[0102] In the depicted embodiment, the plate-like member includes a first and a second tooth, both indicated with 99, forming a C, which on one side presses a gasket 108 positioned at the air outlet 70 of the seat 72 and on the other side of the seat is blocked by a step-like formation 107 of the receiving portion 102.

[0103] Tray portion 81 also includes a plate-like element 98 positioned on top of the plate-like member 96 when the rack 80 is mounted. Plate-like element 98 is visible on top of the drying air outlet 70 when the rack 80 is mounted in the dryer 1. Plate like element 98 includes a top surface 98a, which is the one positioned towards the items to be dried on the rack, and a second opposite bottom surface 98b facing the support portion 82. The plate like element 98 includes a plurality of projections 103, extending from the bottom surface 98b, which are apt to abut against an inner surface 110 of the bulkhead 101 which is facing the loading/unloading opening 3c of the drum 3. The inner surface 110 preferably belongs to a wall of the seat 72. Protrusions 103 abutting against inner surface 110 prevent rotations of the rack 80 when the latter is mounted in the dryer.

[0104] In the same inner surface 110, although not depicted, preferably electrodes are positioned so that the laundry in the drum 3 can come into contact with these electrodes. In other words, the electrodes preferably face the interior of the drum 3 and are connected to an electric circuit for transmitting a signal obtained from the electrodes, advantageously when they come into contact with items, to the control unit 150 of the dryer adapted to control the operations of the drier. The control unit 150 is advantageously configured for detecting the signal from the electrodes and processing it in order to obtain information about the actual humidity of the laundry and controlling accordingly the duration of the drying cycle and/or other operation parameters.

[0105] The kit of parts 100 is generally included in the dryer 1. When the dryer is delivered to the user, preferably the kit of parts is in the configuration of figure 6a, where the filter element 15 is positioned in the tray portion 81 of the rack 80. The filter portion 15 is kept in place on the tray portion 81 by means of a first and a second arrest members 111a, 111b for example realized in polystyrene, each of which mutually engage with both the rack - for example with one of apertures 89 of the tray portion 81 - and an axial end of the filter. The first and the second arrest members 111a, 111b blocks the front part of the rack 80 with a first axial end of the filter element 15 and the back part of the rack with the second axial end of the filter element 15.

[0106] Advantageously, the rack is mounted in the dryer 1 coupling the support portion 82 to the seat 72 and

the second arrest member 111b joining the back of the rack 80 with an axial end of the filter element 15 is abutting with the drum 3 internal surface, so that movements of the rack are hindered.

5 **[0107]** Depending on the type of items to be dried, therefore, the user has the selection between a drying cycle including the rack 80, on top of the tray portion of which for example some delicate items or shoes can be placed, or excluding it, so that the items are tumbled in the drum 3.

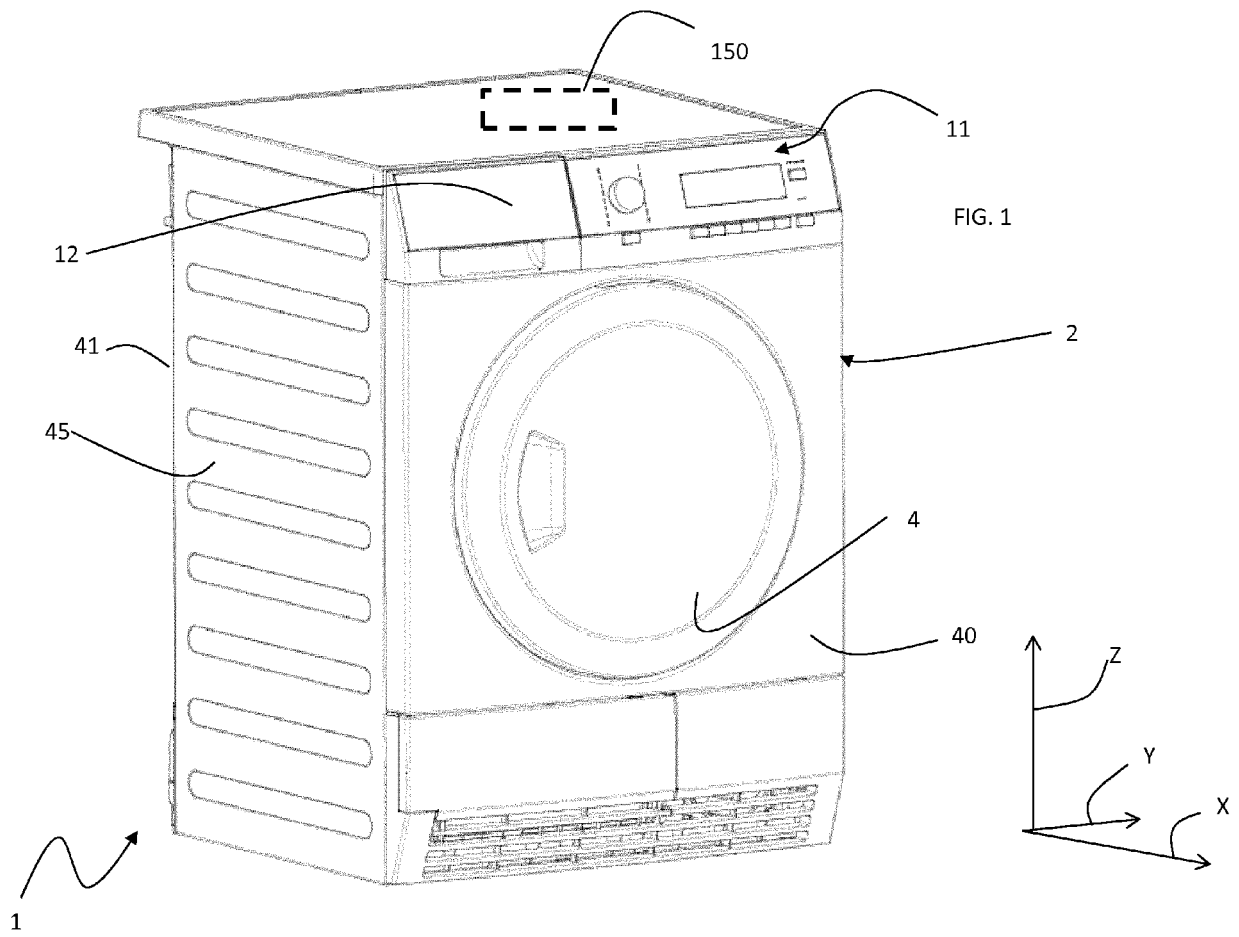
10 **[0108]** In case a drying cycle without the rack is selected, then the filter element 15 is inserted in the seat 72 and it remains within the seat 72 for the whole drying cycle so that humid drying air exiting the drum and flowing within the drying air conduit 18 to the hot or drying air generator, for example located within the basement, can be filtered from fluff and lint. Generally, the cycle without rack is the most common drying cycle.

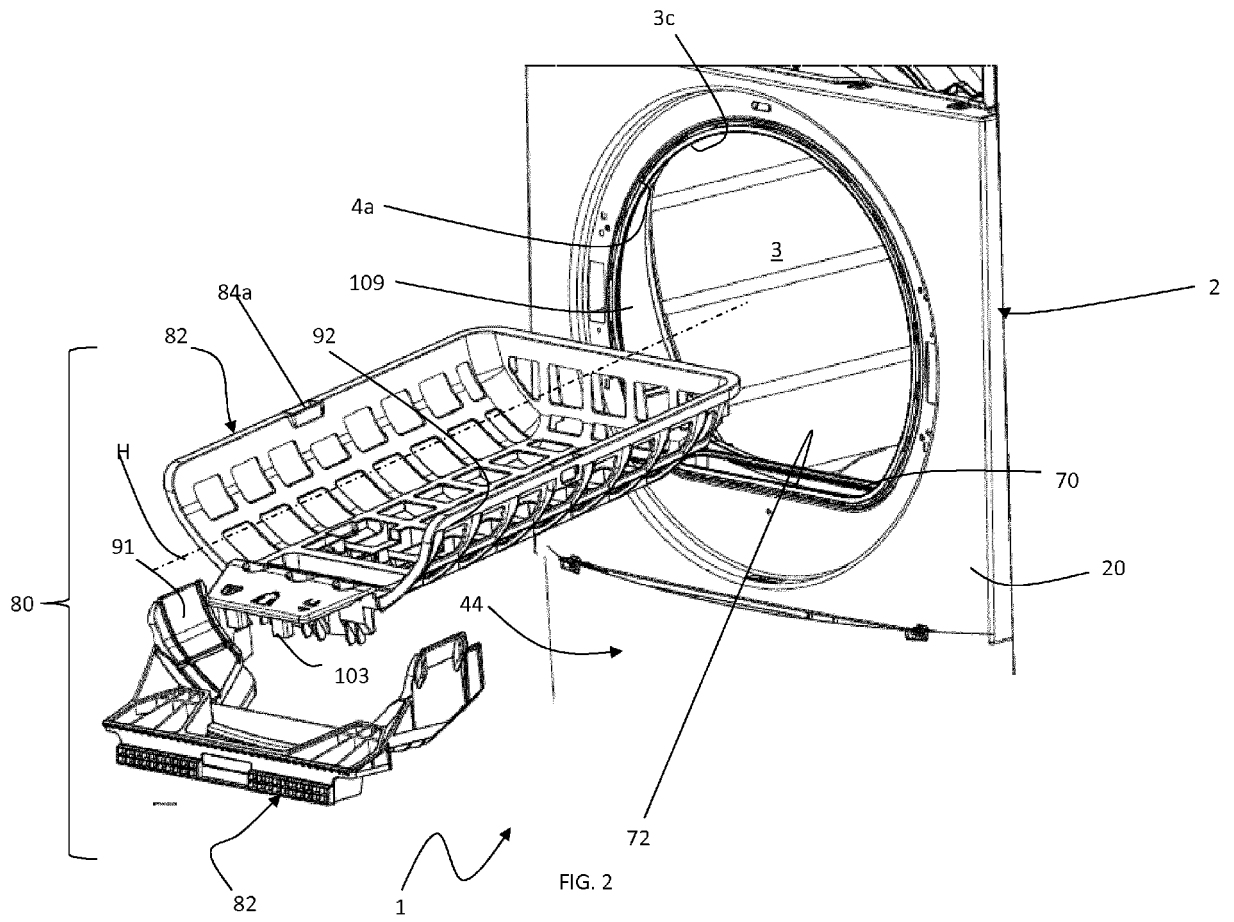
15 **[0109]** In case a drying cycle with rack is desired, then the filter element 15 is removed from seat 72. If the rack 80 is realized by two separated components, the tray and the support portions, they are coupled to each other by means of the snap-in elements 95 and apertures 89. Then the tray portion 81 is inserted in the drum 3 and the support portion is placed above the air outlet 70 till the hook 99 is inserted in the receiving portion 102 located within the filter seat 72. Due to the shape and dimension of the support portion, it covers the air outlet 70 completely. Protrusions 103 are in abutment with the inner surface 110 which faces the opening 3c of the drum 3. During the drying cycle, the filtering components 97 function as the filtering element so that fluff and lint does not reach, or only in minimal part, the hot or drying air generator.

Claims

- 40 1. Method to position a rack to support items to be dried in a laundry dryer (1) which includes:
- a casing (2);
 - a rotatable laundry drum (3);
 - a drying air conduit (18) arranged for passing drying air through the laundry drum (3), said drying air exiting said drum from an air outlet (70);
 - at least one filter element (15) arranged in a seat (72) located at the air outlet (70) for filtering drying air circulating in said drying air conduit (18), said filter element being removable from said seat;
- 45 said method comprising the steps of:
- providing a rack (80) having a tray portion (81) apt to support items to be dried and a support portion (82) apt to support the tray portion, said support portion including a filter component (97);
 - removing said filter element (15) from said seat (72);
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- mounting said support portion (82) on said seat (72) so as to removably fix said rack (80) to said dryer (1) and arrange the tray portion (81) within the laundry drum (3); and
 - using said filter component (97) instead of the filter element (15) during drying of said items.
2. Method according to claim 1, comprising:
- coupling said support portion (82) to said tray portion (81) before mounting said support portion on said seat (72).
3. Method according to claim 1 or 2, comprising:
- providing either said support portion (82) or said tray portion (81) with at least a snap in element (95) and the other of said support portion and tray portion with at least a snap in receiving element (89); and
 - engaging said snap in element (95) with said snap in receiving element (89) in order to removably fix said support portion (82) to said tray portion (81).
4. Method according to any of the preceding claims comprising:
- Abutting with one or more support elements (103) formed in said support portion (82) an inner surface (110) of the casing (2) facing a laundry loading/unloading opening (3c) of said drum (3) so as to distribute the weight of said rack (80).
5. Method according to any of the preceding claims comprising:
- coupling said rack (80) to said drying air conduit (18) by a hook/hook receiving element arrangement (99, 102)..
6. Kit of parts (100) for a laundry dryer (1), comprising:
- A filter element (15) apt to be mounted in a drying air circuit (18) of said laundry dryer (1);
 - A rack (80) having a tray portion (81) apt to support items to be dried and a support portion (82) apt to support the tray portion, said support portion including a filter component (97);
 - Wherein the filter element (15) and the rack (80) are used alternatively in said dryer (1).
7. Kit (100) according to claim 6, wherein said filter element (15) is a wedge-shaped filter including one or more openable shells (23a, 23b, 32a, 32b).
8. Kit (100) according to claim 7, wherein said support portion (82) includes a plurality of support elements (103), all protruding in the same direction.
9. Kit (100) according to any of claims 6-8, wherein said tray portion (82) is integral to said support portion (81) or removably mountable thereto.
10. Kit (100) according to any of claims 6-9, wherein said filter component (97) is detachable from said support portion (82).
11. Kit (100) according to any of claim 6-10, wherein said support portion (82) comprises a first surface (91) and said tray portion (81) comprises a second surface (92), said first and second surfaces being mating surfaces so that the second surface can lie on the first surface to be supported thereon.
12. A laundry dryer (1) comprising:
- a casing (2);
 - a rotatable laundry drum (3);
 - a drying air conduit (18) arranged for passing drying air through the laundry drum (3), said drying air exiting said drum from an air outlet (70),
 - the kit of parts (100) according to any of claims 6-11, wherein either said filter element (15) is removably arranged in a seat (72) located at the air outlet(70) or said support element (82) is mounted on said seat (72) so as to removably fix said rack (80) to said dryer (1).
13. Laundry dryer (1) according to claim 12, wherein said support portion (82) abuts to an inner surface (110) of said casing (2) facing a laundry loading/unloading opening (3c) of said drum (3) so as to prevent said rack (80) to rotate.
14. Laundry dryer (1) according to any of claims 12- 13, wherein said support portion (82) completely covers the air outlet (70) so that drying air can pass through said support portion (82) substantially only flowing through said filter component (97).
15. Method for drying laundry items with a rack (80) which is mounted in a dryer (1) according to any claim 12 to 14 by a method according to any claims 1 to 5, **characterized by** filtering drying air through the filter component (97) instead of the filter element (15).





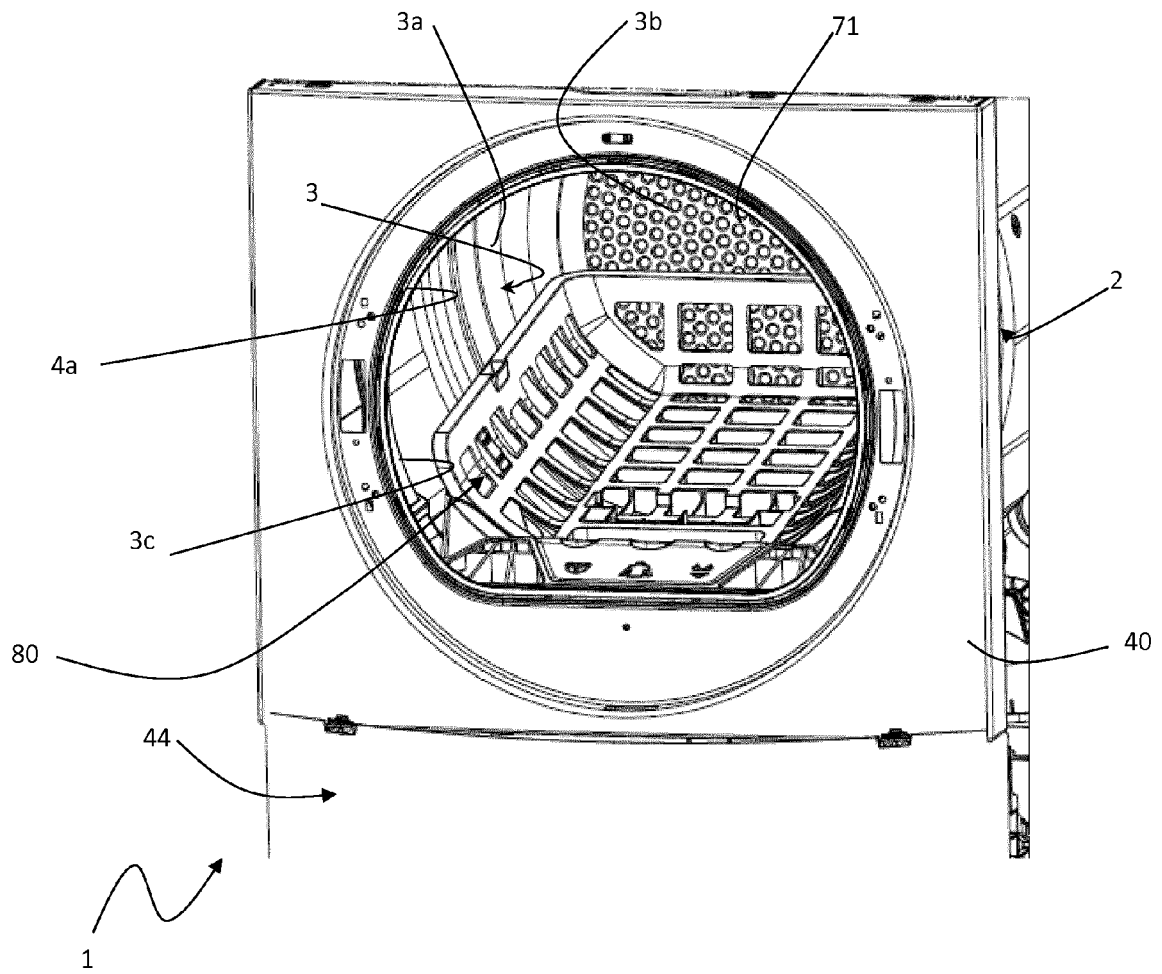
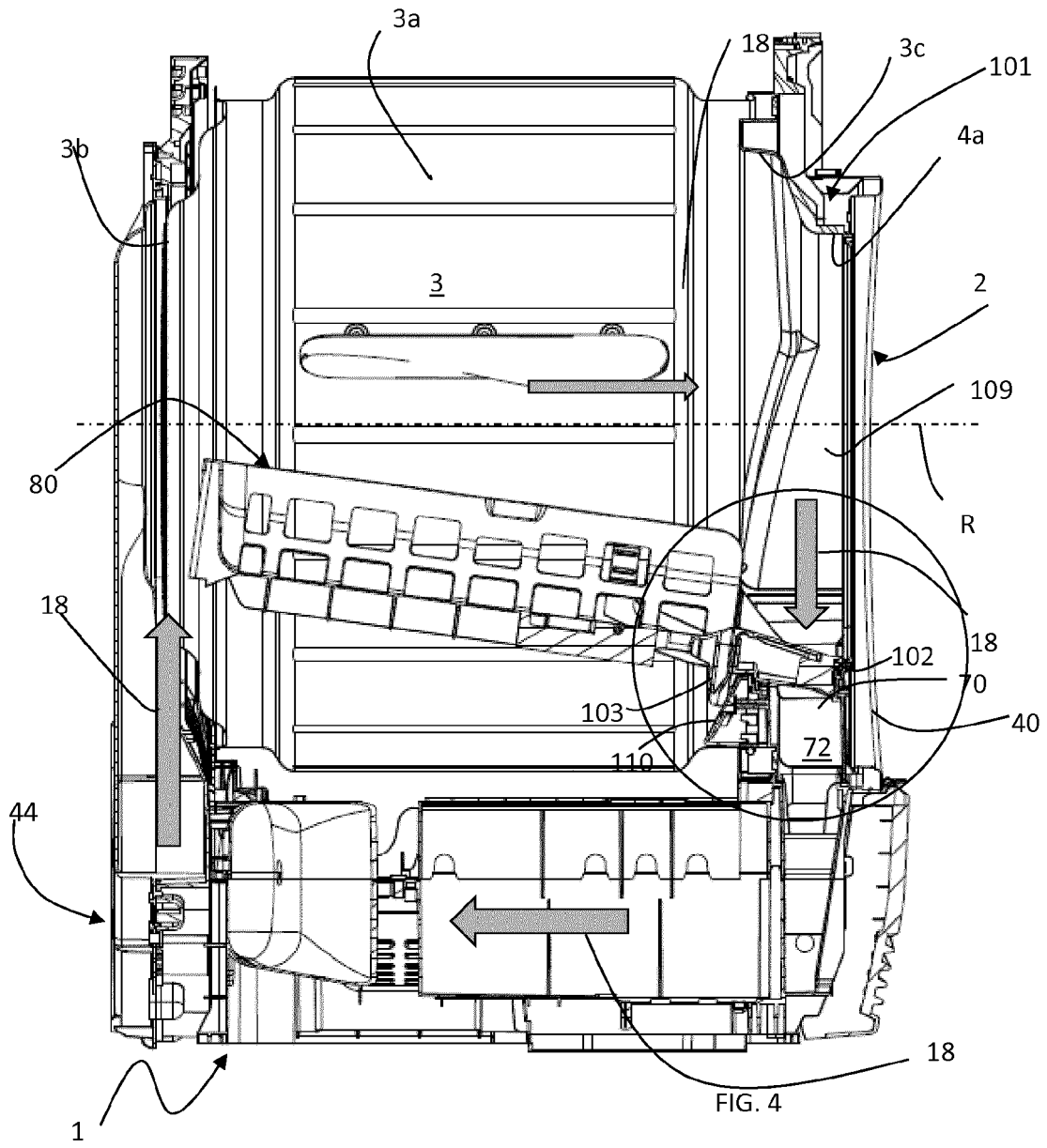
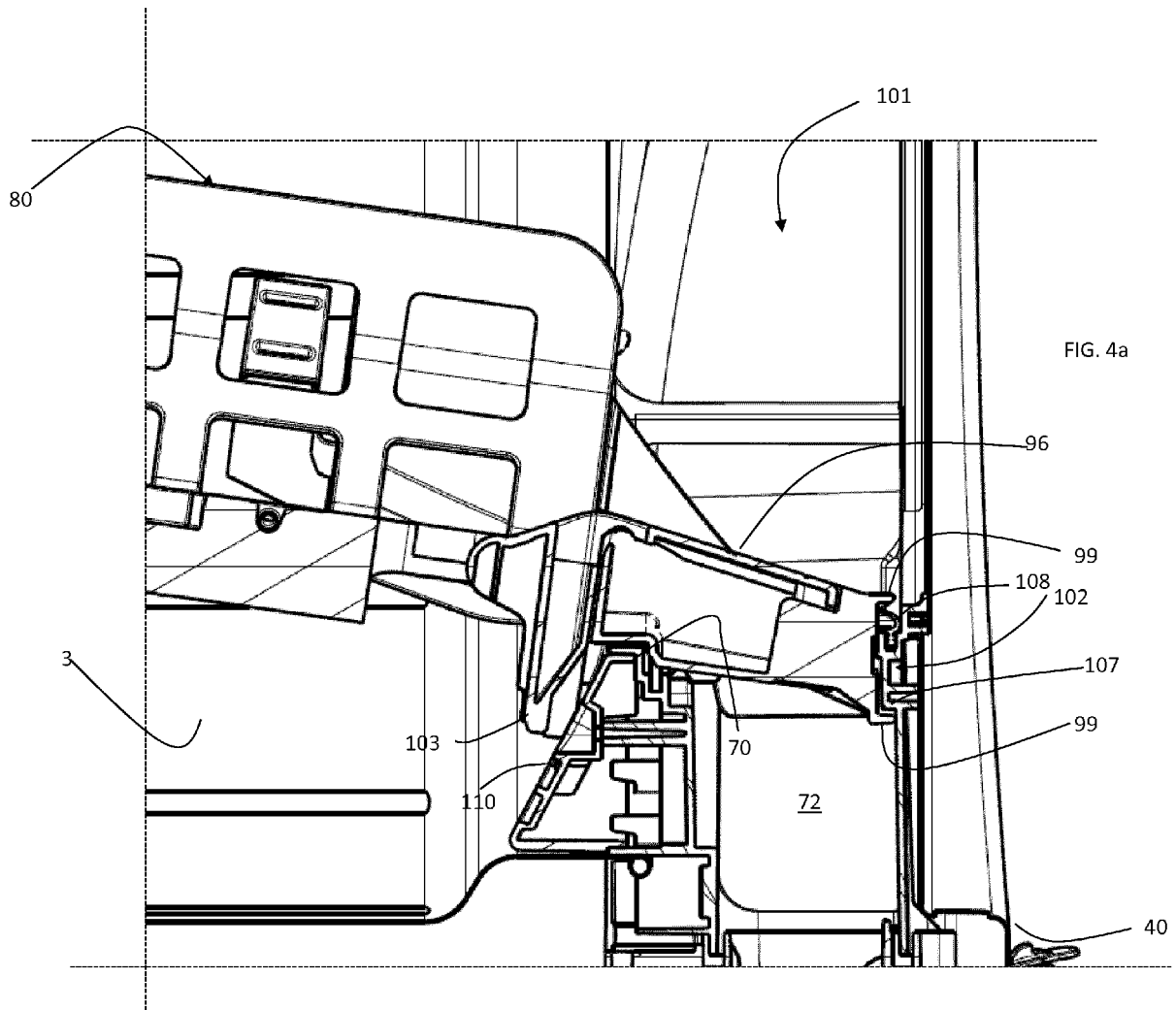
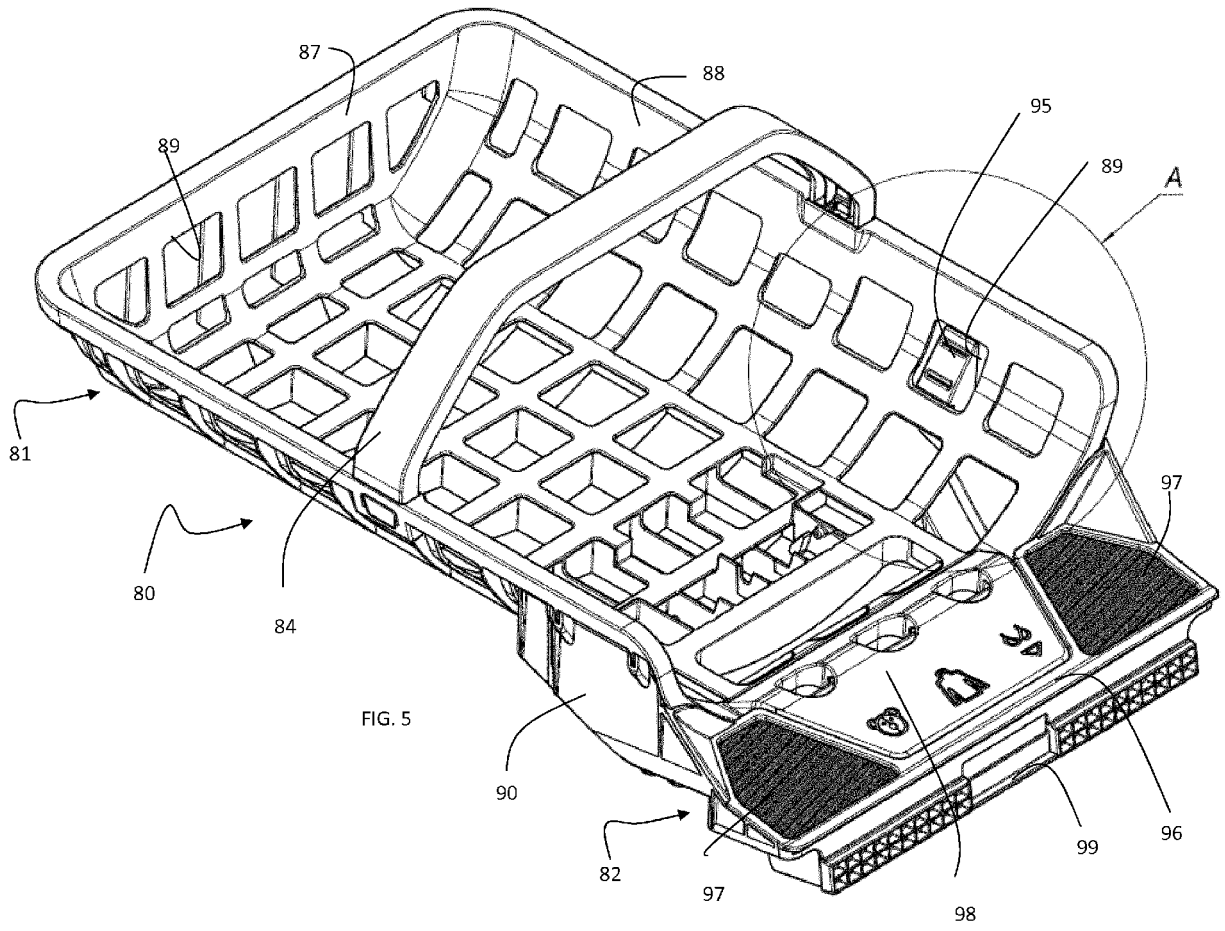
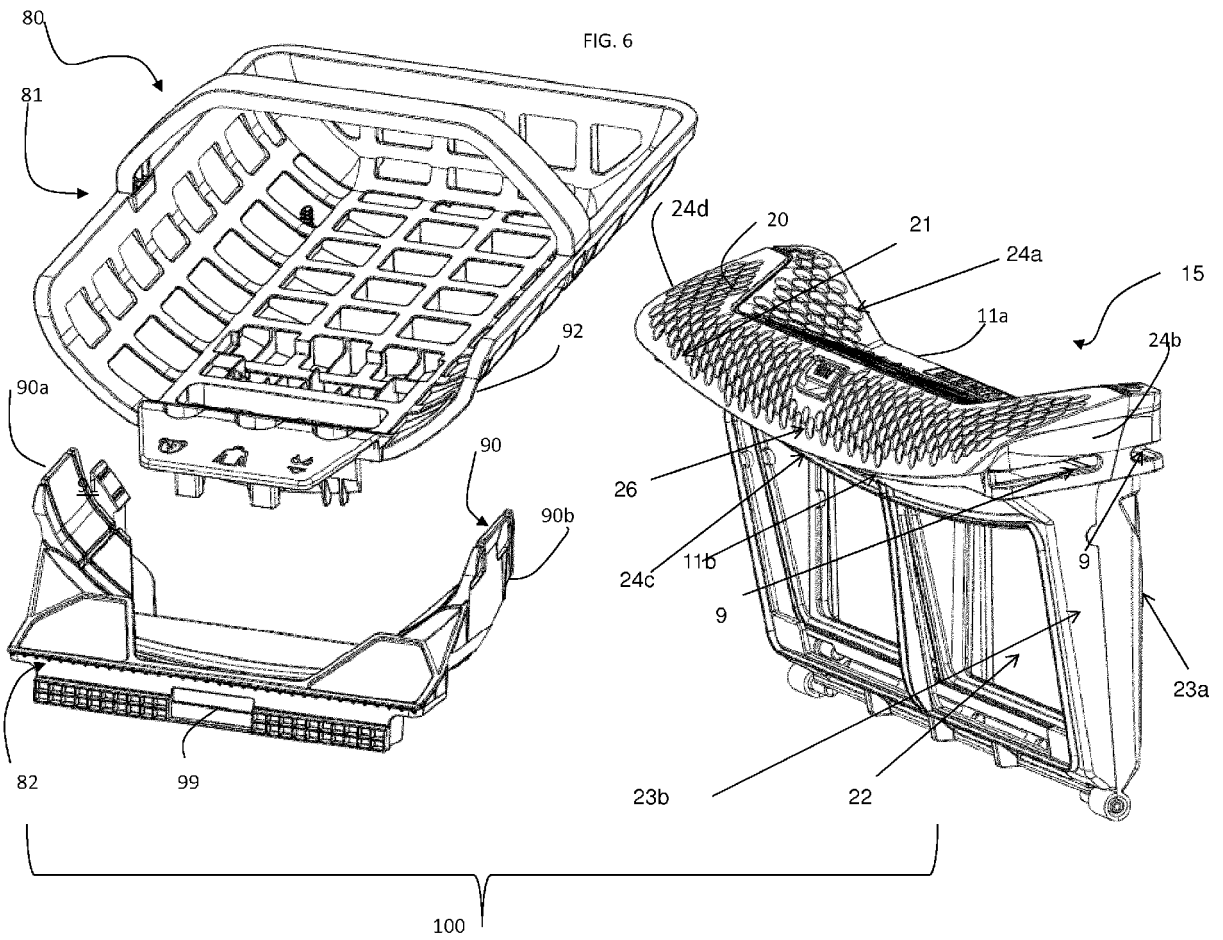


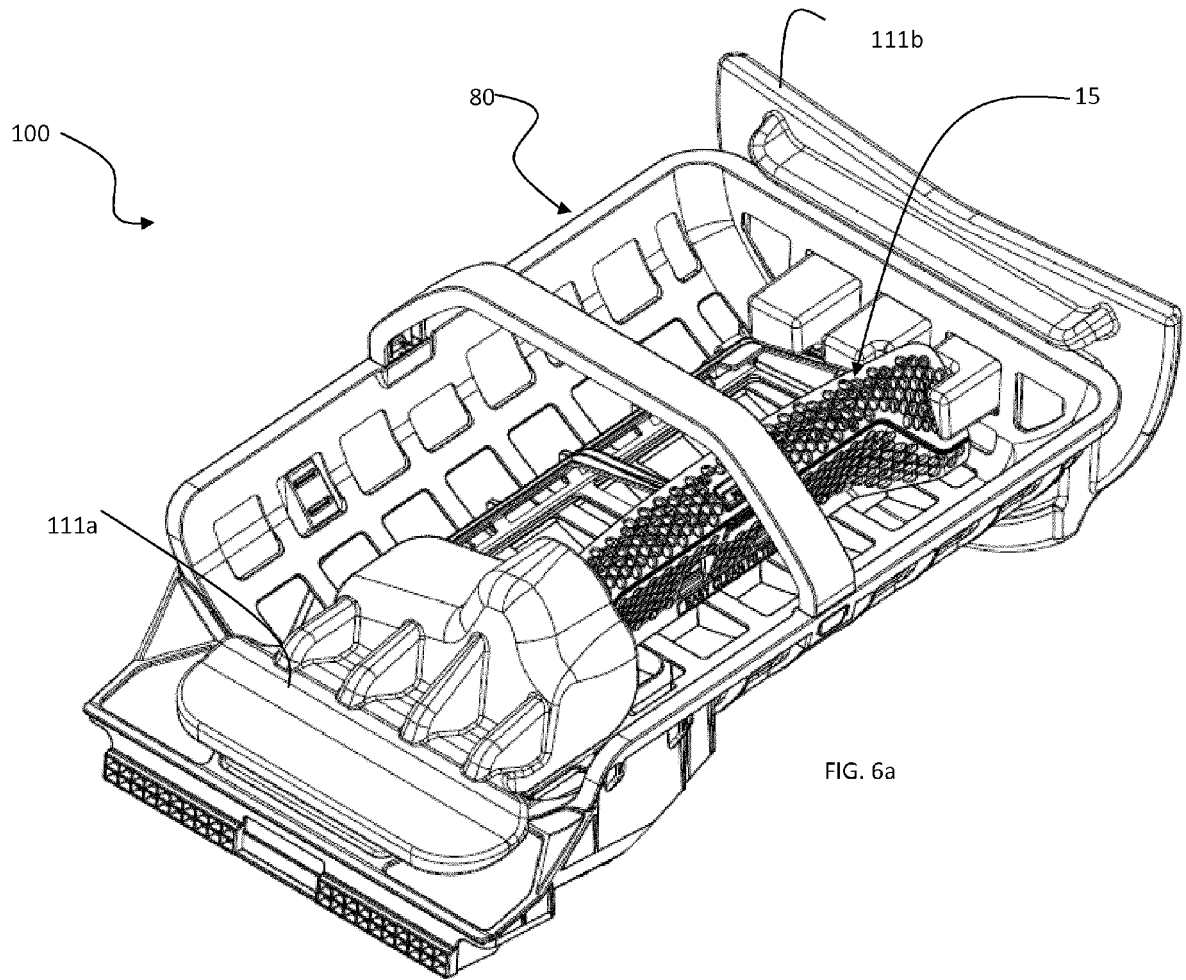
FIG. 3

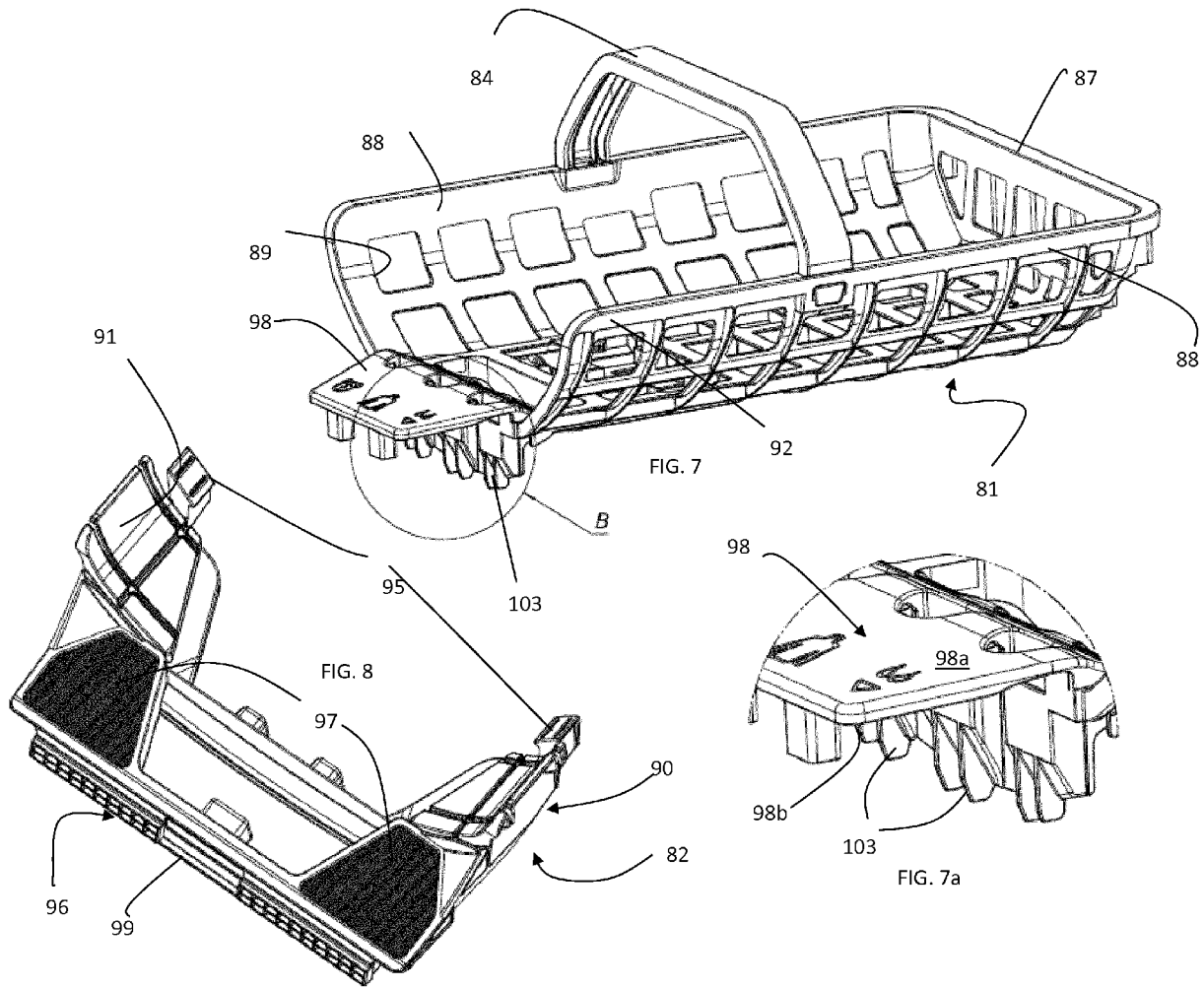


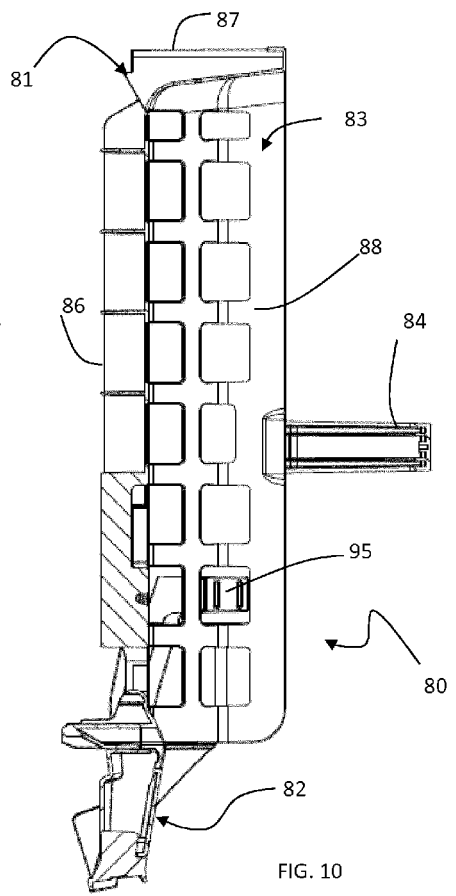
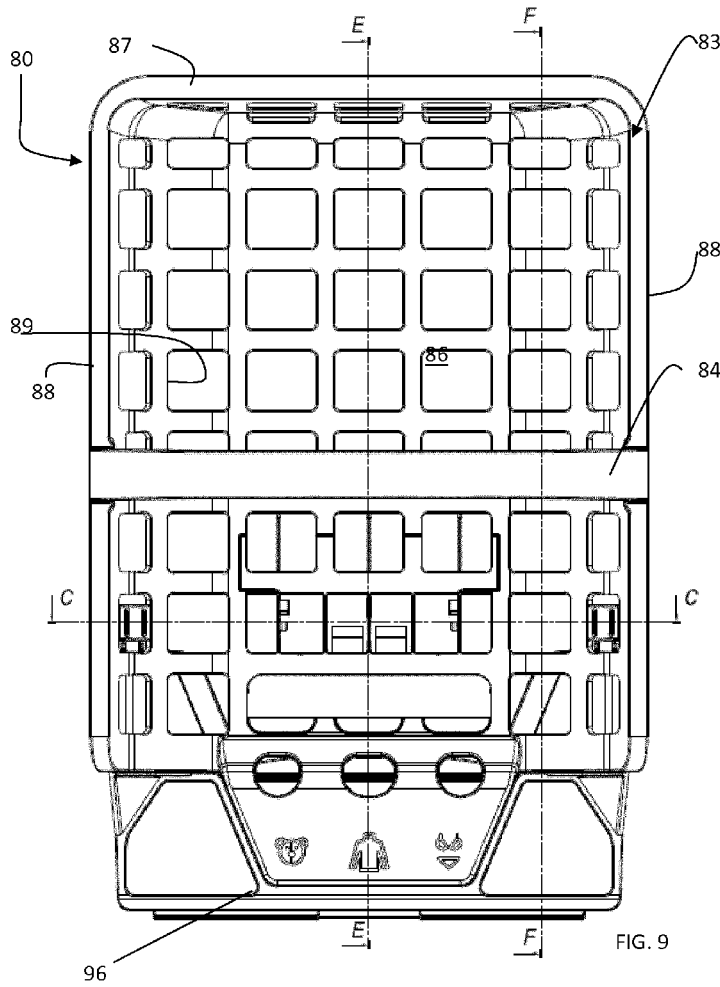


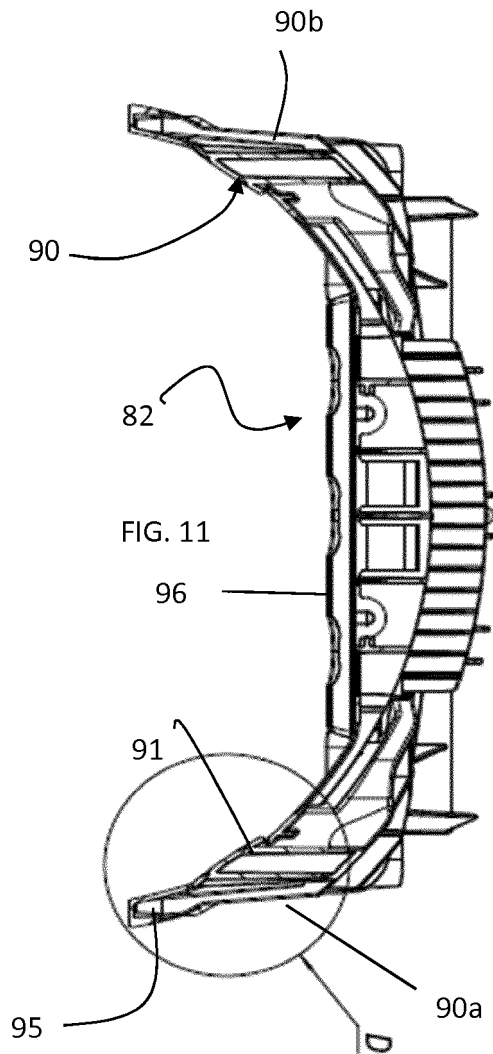












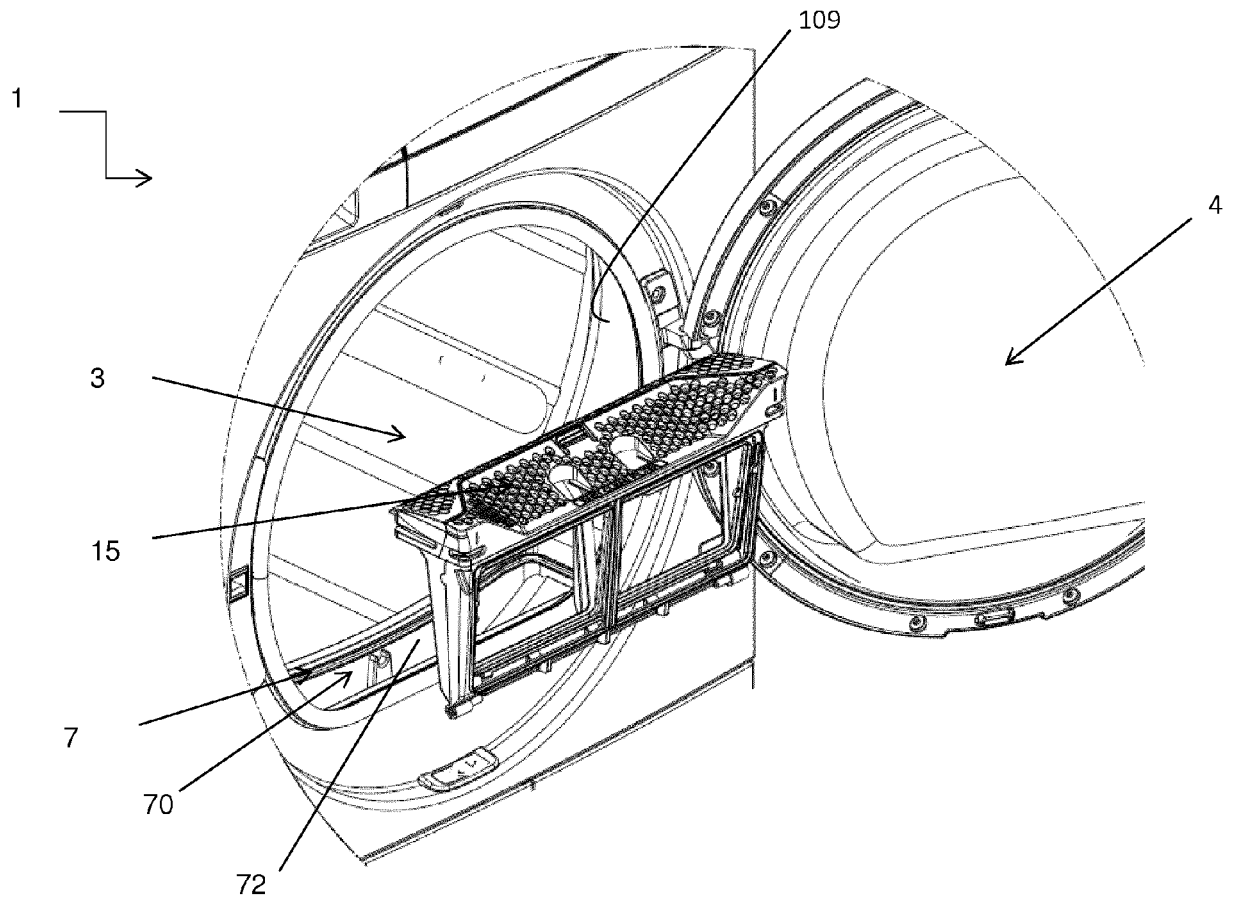


FIG. 12

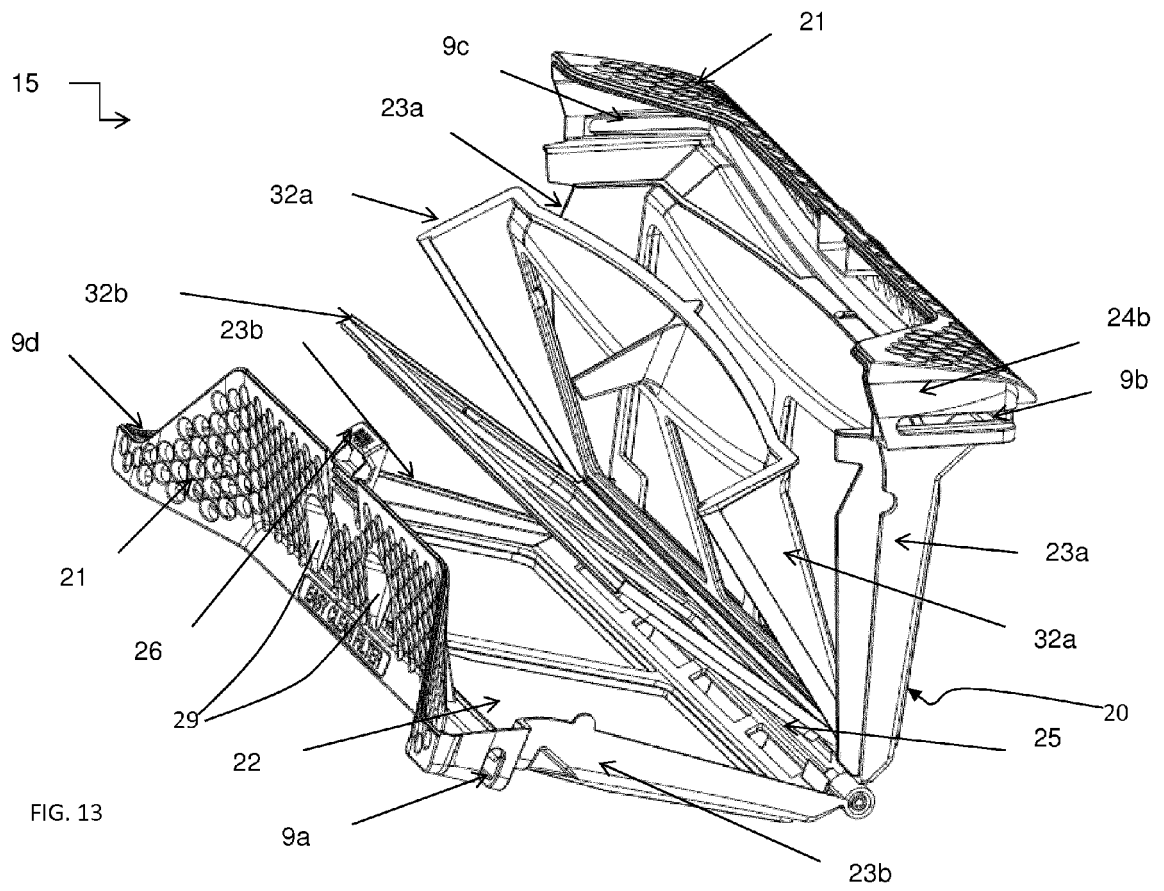


FIG. 13



EUROPEAN SEARCH REPORT

Application Number
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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	US 4 908 959 A (KRETCHMAN GERALD L [US] ET AL) 20 March 1990 (1990-03-20) * column 1, lines 6-9, 55-58; claim 1; figures 1-6 * * column 3, lines 12-14 * * column 3, line 23 - column 4, line 2 * * column 5, lines 18-23 *	1-15	INV. D06F58/04
A	US 2010/088918 A1 (CHUNG YOUNG SUK [KR]) 15 April 2010 (2010-04-15) * paragraphs [0035], [0038], [0039]; figures 1-3 *	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 25 September 2015	Examiner Kirner, Katharina
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 15 17 8403

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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25-09-2015

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