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(54) LAUNDRY TREATING MACHINE COMPRISING A REMOVABLE DE-FLUFF FILTER

WÄSCHEBEHANDLUNGSMASCHINE MIT EINEM HERAUSNEHMBAREN ENTFLUSUNGSFILTER

MACHINE DE TRAITEMENT DE LINGE COMPRENANT UN FILTRE À PELUCHES AMOVIBLE

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Description

Field of the invention

[0001] The present invention relates to laundry treatment appliances or machines. In more detail, the present invention refers to appliances for drying laundry, both for domestic and professional use. More particularly, the present invention relates to a de-fluff filter.

Background of the invention

[0002] Drying and washing/drying laundry machines - which will be referred to simply as laundry machine in the following - typically comprise a casing substantially parallepiped-shaped. The casing accommodates a laundry treating chamber, comprising a drum, generally rotatable, apt to contain the laundry to be dried, in the case of a washing/drying laundry machine, the drum is rotatably contained in a tub. A front panel of the casing has a loading opening to access the treating chamber for loading/unloading the laundry, and a door is provided for closing the loading opening, particularly during the laundry machine operation.

[0003] The casing also accommodates the electrical, electronic, mechanical, and hydraulic components necessary for the operation of the laundry machine. Particularly, laundry-drying capable machines features an air circuit (comprising, for example, fans, air ducts, a moisture condensing unit, a heating unit, *etc*.) adapted to heat air, blow it into the drum where it removes moisture from the laundry, suck out from the drum the moisturized air, de-moisturize the air and reiterate such actions thereby performing a laundry drying cycle.

[0004] During a washing and/or drying process, the laundry under treatment typically loses lint particles or fluff. The fluff is generally light and tiny, thus it can be brought out from the drum by the hot drying air flowing therein and then into the air circuit.

[0005] Once in the air circuit, the fluff is likely to accumulate therein, thereby possibly obstructing air ducts of the air circuit or negatively affecting the operation of one or more of its components (e.g., fluff may deposit on a fan, to the extent of possibly causing the latter to operate with a lower efficiency or completely stop it). In general, fluff accumulation has a detrimental effect on the laundry drying machine operation.

[0006] Therefore de-fluff filters have been designed for the purpose of retaining the fluff so as to prevent it from damaging the laundry machine components. Nevertheless, the de-fluff filter needs to be periodically cleaned to avoid it to get clogged, event that may reduce the laundry machine efficiency or even cause a laundry drying machine malfunction, at least of the air circuit thereof. To this purpose, the de-fluff filter is usually removably accommodated in a filter seat within the air circuit, for example in a position located at the front of the casing in a top portion thereof, i.e. in positions that are easily reachable by a user.

[0007] Notwithstanding the implementation of meticulous de-fluff filter maintenance, fluff may still amass within the de-fluff filter during the course of a single laundry drying machine operation in a quantity that may affect the efficiency of the laundry machine.

[0008] Particularly, fluff trapped in the de-fluff filter may hinder the flow of air within the air circuit of the laundry drying machine. For example, trapped fluff may reduce a flow rate through the de-fluff filter, thus causing localized pressure peaks and drops in the air circuit and subsequent localized /or temperature rise along the air circuit.

[0009] EP 2 843 103 A1 discloses a laundry machine with a de-fluff filter, which comprises a filter box and a lid defining a hollow chamber within. A filtering mesh is arranged on an outlet portion of the box on a transversal sidewall. The lid comprises air guiding blades protruding from a lower side of the lid towards the inside of the filter box, subdividing the hollow chamber of the filter box in sub-chambers. The sub-chambers have a sectional area that increases along the drying air flow direction path, in such a way to distribute evenly the drying air flow inside the filter box for homogenously directing the drying air flow towards the filtering mesh.

[0010] US 5,651,188 A discloses a lint storage system comprising a lint basket with one hollow chamber therein. The lower and side surfaces of the basket comprise outlet openings covered with filter elements, wherein the size of the outlet openings increases from the air inlet end of the basket to the outlet end of the basket.

[0011] It would be therefore desirable to increase the number of laundry drying processes performable between two subsequent de-fluff filter cleaning operations with a sufficient degree of energy efficiency. In particular, it would be desirable to achieve that goal limiting or even avoiding, the increase of the filter seat.

Summary of invention

[0012] The Applicant has tackled the problem of devising a laundry machine comprising a de-fluff filter arrangement capable to overcome, at least partly, the drawbacks of the prior art.

[0013] The Applicant has devised a de-fluff filter that is easy to insert into, and to remove out of a corresponding housing, and which is able to ensure a substantially homogenous flow rate of air therethrough during the laundry machine operation.

[0014] One aspect of the present invention proposes a laundry machine adapted to dry laundry by means of a flow of drying air is proposed. The laundry machine comprises: a casing; inside the casing, a laundry treating chamber adapted to contain the laundry to be dried; an air circuit in fluid communication with the laundry treating chamber through an inlet opening, and defining an airpath for the flow of drying air between said inlet and outlet openings; a filter housing for removably accommodating

a de-fluff filter, said filter housing being provided in the air-path and being accessible through a housing aperture. The de-fluff filter is arranged for trapping fluff or lint particles carried by the flow of drying air crossing said de-fluff filter, the de-fluff filter comprises a filtering element and a hollow chamber which comprises an inlet aperture and an outlet portion. The de-fluff filter further comprises an airflow diverter which: divides the hollow chamber of the de-fluff filter in a first portion and a second portion, and diverts the flow of drying air entering the de-fluff filter towards the first portion of the hollow chamber or towards the second portion of the hollow chamber according to an amount of fluff currently trapped in the at least one filtering element.

[0015] The airflow diverter comprises at least one filtering element for filtering the flow of drying air entering the first portion of the hollow chamber of the de-fluff filter thereby trapping fluff or lint particles.

[0016] Preferred features of the present invention are set in the dependent claims.

[0017] According to the invention, the majority of drying air flow entering the de-fluff filter is directed to the first portion of the hollow chamber in a first part of a drying process. The airflow diverter is arranged for diverting the flow of drying air entering the de-fluff filter from the first portion of the hollow chamber towards the second portion of the hollow chamber according to an amount of fluff currently trapped in first portion of the hollow chamber.

[0018] In an embodiment of the invention, the first portion and the second portion of the hollow chamber define, for the flow of drying air, two paths causing a different amount of energy losses to the fluid portions entering the first and the second portion respectively.

[0019] In an embodiment of the invention, the amount of energy losses caused by the first portion is lower than the amount of energy losses caused by the second portion.

[0020] In an embodiment of the invention, during a laundry drying process, the progressive accumulation of fluff or lint particles in the first region of the hollow chamber increases the amount of energy losses to the fluid portion entering the first portion up to make such amount greater than the amount of energy losses caused by the second portion.

[0021] In an embodiment of the invention, the airflow diverter traps fluff or lint particles at least up to a threshold amount that causes substantially the whole airflow to divert from the first region to the second region of the hollow chamber.

[0022] In an embodiment of the invention, said threshold amount of fluff or lint particles is a function of at least one among: a size of the first region, a size of the hollow chamber, a size of the airflow diverter and a size of a filtering element provided in the airflow diverter or in the de-fluff filter.

[0023] In an embodiment of the invention, the airflow diverter comprises a peripheral frame and at least one separating element, the peripheral frame and at least one separating element defining two or more filtering elements.

[0024] In an embodiment of the invention, the peripheral frame is integral with the at least one separating element.

[0025] In an embodiment of the invention, the peripheral frame and the at least one separating element comprise a first half and a second half, each half being symmetrical to the other and designed to couple with the other half along a longitudinal symmetry plane of the airflow diverter.

[0026] In an embodiment of the invention, the airflow diverter is removably mounted in the hollow chamber of the de-fluff filter.

[0027] In an embodiment of the invention, the airflow diverter further comprises at least one foot element arranged for coupling with the de-fluff.

[0028] In an embodiment of the invention, the de-fluff filter further comprises at least one foot receptacle. Preferably, the at least one foot element is arranged for coupling with said at least one foot receptacle.

[0029] In an embodiment of the invention, the de-fluff filter further comprises one or more retaining brackets for holding the airflow diverter in a working position within the hollow chamber.

[0030] In an embodiment of the invention, the de-fluff filter further comprises a filter box and a lid hinged to the filter box for pivoting from an opening position to a closed position thereby selectively closing a top aperture of the filter box, the hollow chamber being defined by the filter box and by the lid in the closed position. Preferably, the airflow diverter is arranged for being flush both with the lid and with a bottom wall of the filter box opposite to the lid.

[0031] In an embodiment of the invention, the lid comprises a plurality of lid ridges protruding towards the filter box once the lid is in the closed position. Preferably, the filter box comprises corresponding box ridges protruding towards the lid once the lid is in the closed position, the lid ridges being arranged for interspersing with the box ridges once the lid is in the closed position thereby forming a meandering path capable of hindering the passage of fluff.

[0032] In an embodiment of the invention, the hollow chamber is delimited by a guiding wall and a sidewall, the airflow diverter being arranged therebetween so as to form with at least one of said guiding wall and sidewall a path having a convergent portion along the direction of the flow of air.

[0033] In an embodiment of the invention, the airflow diverter is movable from a first position, in which the airflow is directed into a first portion of the de-fluff filter, to a second position, in which the airflow is directed into a second portion of the de-fluff filter.

[0034] In an embodiment of the invention, the airflow diverter is deformable between a rest configuration, in which the airflow is directed into a first portion of the de-fluff filter, and a deformed configuration, in which the air-

flow is directed into a second portion of the de-fluff filter.

Brief description of the annexed drawings

[0035] These, and others, features and advantages of the solution according to the present invention will be better understood with reference to the following detailed description of some embodiments thereof, provided for illustrative and not restrictive purposes, to be read in conjunction with the attached drawings. In this regard, it is expressly intended that the drawings are not necessarily to scale and that, unless specified otherwise, they simply aim to conceptually illustrate the structures and procedures. In particular:

Figure 1 is a perspective view of a laundry machine according to an embodiment of the present invention;
Figure 2A is a perspective view of the laundry machine of **Figure 1**, showing a top thereof in exploded view;
Figure 2B is a perspective view of a base element of the top of the laundry machine according to an embodiment of the present invention;
Figure 3A is a perspective view of a de-fluff filter according to an embodiment of the present invention;
Figure 3B is a perspective view of a de-fluff filter according to an embodiment of the present invention with its lid;
Figure 3C is a top view of a de-fluff filter according to an embodiment of the present invention shown with a lid and an airflow septum removed;
Figure 3D is a cross-sectional top view along section plane **IIID** of the de-fluff filter of **Figure 3A** according to an embodiment of the present invention shown with a lid removed and the airflow septum inserted,
Figure 4A is a cross-sectional front view along section plane **IVA** of a de-fluff filter according to an embodiment of the present invention;
Figure 4B and **4C** are a close up views of **Figure 4A** showing the coupling between a filter box and a lid of a de-fluff filter according to an embodiment of the present invention;
Figures 5A and **5B** are a side view and a top view, respectively, of an airflow septum according to an embodiment of the invention;
Figure 6 is a chart showing air pressure as a function of time during operation of a laundry machine according to an embodiment of the invention and of a laundry machine known in the art, and
Figure 7 is a chart showing capillary temperature as a function of time during the operation of a laundry machine according to an embodiment of the invention and of a laundry machine known in the art.

Detailed description of preferred embodiments of the invention

[0036] With reference to the drawings, **Figure 1** is a perspective view of a laundry machine, globally denoted as **100**, according to an embodiment of the present invention.

[0037] The laundry machine **100** comprises a laundry treatment chamber **105** for accommodating the items to be dried or washed and dried, such as clothes, garments, linen, and similar laundry items. Preferably, the laundry treatment chamber **105** includes a drum (not shown) rotatably mounted inside a machine cabinet or casing **110**, and in case the laundry machine **100** is a washing/drying laundry machine the drum is arranged within a tub (not shown) housed in the machine casing **110**.

[0038] The casing **110** generally accommodates all the electrical, electronic, mechanical, and hydraulic components necessary for the operation of the laundry machine. The casing **110** has generically a parallelepiped shape, with a front wall **115**, two side walls **120** (only one visible in **Figure 1**), a rear wall (not visible), a basement and a top element, or simply top **125**. The front wall **115** is provided with an opening for accessing the drum and with an associated door **117** for closing the opening. In the upper part of the front wall **115**, a machine control panel **130** is located, and, aside the control panel **130,** a drawer **135** is provided, which is part of a washing treatment products dispensing arrangement, for loading laundry washing treatment products like detergents and softeners. The top **125** closes the casing **110** from above, and defines a worktop.

[0039] In one embodiment of the invention, a de-fluff filter (aesthetic) cover **140** is exposed on the control panel **130** on the front wall **115**, e.g. above the drawer **135**, and flushing therewith.

[0040] Preferably, the de-fluff filter cover **140** may comprise a pushbutton portion **145** for actuating a release of the de-fluff filter **218** from its working position (as described in the following).

[0041] Reference is now made to **Figures 2A** and **2B**, which are a perspective views of the laundry machine **100** with its top **125** in exploded view and a perspective view of a base element **205** of the top **125** with some parts removed.

[0042] In one embodiment of the invention, the top **125** integrates part of an air circuit adapted to circulate drying air across the laundry treating chamber 105 for drying the laundry stored therein (as described below).

[0043] The top **125** comprises the base element **205**, which has an inlet opening **210** and an outlet opening **215**, the inlet opening **210** being in fluid communication with the laundry treatment chamber **105** through a chamber outlet, the outlet opening **215** being in fluid communication with a fan arrangement **216.**

[0044] The fan arrangement **216** comprises a fan and a corresponding fan duct, the fan produces the drying airflow inside the air circuit by sucking drying air from the

outlet opening **215** and blowing the drying air into the laundry treatment chamber **105**, the outlet opening **215** and the laundry treatment chamber **105** being both fluidly connected to the fan arrangement **216**.

[0045] In the region of the base element **205**, preferably near the front-left corner thereof, a filter housing **217** is provided.

[0046] The filter housing **217** is suitable to house a de-fluff filter **218** (described in greater detail below).

[0047] Preferably, the filter housing **217** has roughly a right trapezoid outline in plan view (e.g., similar to a grand piano), with a shorter sidewall **217a** (corresponding to a lesser base of the right trapezoid) in fluid communication with the chamber outlet by means of the inlet opening **210**, and a larger sidewall **217b** (opposite to the shorter sidewall **217a**, and corresponding to a greater base of the right trapezoid) that has a housing aperture **219** opened on the machine front wall **115** preferably in a separating wall **205a** of the base element **205**.

[0048] Preferably, the housing aperture **219** is provided in a separating wall **205a** provided adjacent to the control panel **130**, even more preferably above the drawer **135** for allowing the insertion of the de-fluff filter **218**.

[0049] Moreover, the filter housing **217** comprises a right sidewall **217c** substantially corresponding to a portion of a lateral sidewall of the base element **205** of the top **125** (and corresponding to the right leg of the right trapezoid) and a transversal opened side **217d**, preferably inclined (opposite to the right sidewall **217c** and corresponding to the inclined leg of the right trapezoid).

[0050] In one embodiment of the present invention, the inlet opening **210** is fluidly connected to an adapter element **212**, which is provided to fluidly connect the inlet opening **210** with the filter housing **217** and the de-fluff filter **218** (when inserted in the filter housing **217**).

[0051] Preferably, but not limitatively, the adapter element **212** may be a parallelepiped-shape element adapted to be coupled with the base element **205**. The adapter element **212** further comprises conical or cylindrical passage(s) having two opposite apertures to fluidly connect the inlet opening **210** with the de-fluff filter **218**.

[0052] The adapter element **212** may be made of any suitable material, e.g. a polymeric material, and is coupled with the base element **205** by means of any suitable coupling arrangement, e.g. by tightly fitting (preferably in an airtight manner) a rear portion of the filter housing **217** (adjacent to the shorter sidewall **217a**).

[0053] In a preferred embodiment of the invention, the aperture facing the filter housing **217** of the adapter element **212** is surrounded by a gasket element **212a** which protrudes towards the inside of the filter housing **217**.

[0054] In alternative embodiments of the present invention in which the adapter element **212** is not provided, and an alternative gasket element may be directly provided around the inlet opening **210** for directly coupling with the de-fluff filter **218**.

[0055] In one embodiment of the present invention, the transversal opened side **217d** comprises a frame **220** that defines a plurality of side windows **220a** separated one from the other by separating elements, such as for example mullion elements **220b,** preferably prism-shaped. Preferably, at the frame **220** housing grooves (not visible in **Figures 2A** and **2B**) adapted to house an auxiliary filter **221** are provided.

[0056] Advantageously, a plurality of flap elements **222** may be provided. The flap elements **222** protrude from the frame **220** opposite to the filter housing **217** in order to direct the drying airflow exiting the transversal opened side **217d** towards the rest of the air circuit defined in the top **125.**

[0057] In the central region of the base element **205**, there is accommodated a first heat-exchanging unit, such as a moisture condensing element **225**, for example comprising an evaporator of a heat pump apparatus.

[0058] The moisture condensing element **225** is adjacent to the transversal opened side **217d**, and thus the external surface of the former is in fluid communication with the latter.

[0059] Next to the moisture condensing element **225**, opposite to the filter housing **217**, there is provided a second heat-exchanging unit, such as a drying air heating element **230**, for example comprising a condenser of the heat pump apparatus.

[0060] The moisture condensing element **225** has the function of dehydrating the drying air, by cooling it down; the drying air heating element **230** has instead the function of heating the dehydrated drying air.

[0061] A compressor (not shown) for the heat pump may be attached to the base element **205** in correspondence of the front-right corner thereof, the body of the compressor protruding from below the base element **205**.

[0062] In an alternative embodiment, the compressor may be located in the bottom of the casing **110**, attached to the basement of the laundry machine **100**, and be fluidly connected to the moisture condensing element **225** accommodated in the top **125** by means of flexible pipes that preferably run along a rear corner of the casing **110** or along the laundry treatment chamber **105** of the laundry machine **100**.

[0063] In a different embodiment of the present invention, the laundry machine **100** may comprise an air-air or an air-water heat exchanger apparatus and an electric heater instead of the heat pump apparatus.

[0064] The base element **205** of the top **125** is covered by an inner panel **235**, that covers essentially the moisture condensing element **225**, the drying air heating element **230** and the de-fluff filter **218**.

[0065] The top **125** is completed by an outer (aesthetic) panel **240**.

[0066] The base element **205** and the inner panel **235** define an air-path that conveys the moisture-laden air coming from the laundry treatment chamber **105** (through the inlet opening **210**) towards the de-fluff filter **218,** preventing the moisture-laden air from entering directly the moisture condensing element **225** or the drying air heating element **230** (i.e., before being filtered by the de-fluff

filter **217**), and then the drying airflow follows the air-path from the de-fluff filter **218** to the heating element **230**, passing through the moisture condensing element **225,** and eventually reaching the outlet opening **215.**

[0067] Preferably, the top **125,** once assembled, forms a unit that is ready to be mounted to the casing **110**, simply by placing it in the correct alignment, so that the openings **210** and **215** matches the chamber outlet and an intake of the fan arrangement **216**, respectively, thus realizing a closed air circuit comprising the laundry treatment chamber **105** and the air-path defined by the base element **205** and the inner panel **235,** and the fan arrangement **216**. The top **125** may then be secured to the casing **110** by conventional means (e.g., by means of gluing, screwing or other connecting/fastening means).

[0068] When the laundry machine **100** is operated in dryer mode (i.e., for drying items stored in the drum), drying air (i.e., warm and dry air) is typically caused to flow through the drum **105** inside the laundry treating chamber **105**, where the items to be dried are contained.

[0069] The drying air binds to moisture particles from the laundry and/or dispersed within the laundry treating chamber **105** and carries them away. The drying air may also carry away fluff (e.g., comprised in and/or generated from the laundry during laundry treating processes) from the laundry together with moisture particles.

[0070] After exiting the drum through the chamber outlet, the flow of now moisture-laden drying air passes through the de-fluff filter **218** where substantially any fluff carried by the drying airflow together with moisture particles is caught and remains trapped.

[0071] Instead, the moisture-laden drying air is conveyed towards the moisture condensing element **225**, where the moisture-laden drying air is at least partially dried, i.e. dehydrated, and such dehydrated drying airflow is then heated by the air heating element **230** through which the drying airflows, which heats the drying air up to a drying temperature (e.g., set by a user through the control panel 130 via the selection of a drying program).

[0072] Then the drying air is sucked by the fan through the fan intake and is caused to pass again through the drum **105** drying the laundry therein stored and then repeating the cycle just described.

[0073] Considering now **Figures 3A** to **3D,** they are views of the de-fluff filter **218** according to embodiments of the present invention shown with and without a lid **306**.

[0074] It should be noted that the de-fluff filter **218** is shown with also the aesthetic cover **140** removed in the following figures.

[0075] The de-fluff filter **218** is designed to be inserted inside the filter housing **217** preferably through the housing aperture **219** exposed on the front wall **115**. Preferably, the de-fluff filter **218** is designed such as an extractable drawer.

[0076] The de-fluff filter **218** comprises a filter box **303**, a cover element, such as for example a lid **306**, and in addition it may preferably comprise a closing element, such a swinging bulkhead **309**, an ejection device (not shown), and a locking element (not shown).

[0077] The filter box **303** has a parallelepiped shape, preferably with a roughly rectangular trapezoid base. For example, the filter box **303** of the filter housing **217** may have a shape similar to that of a grand piano, with a rear sidewall **303a,** a front sidewall **303b,** a first transversal sidewall **303c**, a second transversal sidewall **303d**, preferably curved, and a bottom wall **303e.** The sidewalls **303a, 303b, 303c, 303d** delimit a top aperture **303t** of the filter box **303.** The filter box **303** may be made in any suitable material, such as for example a suitable polymer (e.g., Polypropylene PP).

[0078] Preferably (as can be appreciated in **Figure 2B**), the filter box **303** is designed in such a way that, once the de-fluff filter **218** is inserted into the filter housing **217**, the former substantially tightly fits the latter. Even more preferably, the sidewalls **303a** and **303c** are adapted to substantially flank the sidewalls **217a** and **217c**, respectively, of the filter housing **217** and may contact them, while the front sidewall **303b** substantially closes the housing aperture **219** and the second transversal sidewall **303d** faces the transversal opened side **217d** of the filter housing 217, preferably remaining separated therefrom.

[0079] Preferably, the filter box **303** is designed in such a way that its second transversal sidewall **303d** remains spaced apart from the transversal opened side **217d** of the filter housing **217,** thus defining a gap between the second transversal sidewall **303d** and the transversal opened side **217d**. Within the gap a housing for receiving, preferably in a sliding manner, the auxiliary filter **221** (the housing being not detailed in the **Figures**).

[0080] The second transversal sidewall **303d** operates substantially as a filtering portion and as an outlet portion of the de-fluff filter **218**. The second transversal sidewall **303d** comprises a frame **318** that encloses a plurality of filtering windows **318a** separated from each other by separating elements, such as for example box mullion elements **318b**, preferably parallelepiped shaped. The box mullion elements **318b** extend from a lower portion of the frame **318** (at the bottom wall **303b**) of the filter box **303** up to a higher portion of the frame **318** (at the top aperture **303t**). Advantageously, the box mullion elements **318b** are designed to align with the mullion elements **220b** of the transversal opened side **217d** (once the de-fluff filter **218** is inserted into the filter housing **217**), in such a way to not to hinder the drying airflow.

[0081] The filter box **303** further comprises a filtering element, such as for example a filtering mesh (not shown in the figures for simplicity).

[0082] The filtering mesh is preferably substantially rectangular in shape and is sized with a length and a height substantially equal to a length and a height of the second transversal sidewall **303d.**

[0083] Preferably, the filtering mesh is coupled with the second transversal sidewall **303d** covering the apertures of the filtering windows **318a** in such a way to filter the drying airflow passing therethrough (as will be described

in greater detail in the following).

[0084] The filtering mesh is preferably coupled with the second transversal sidewall **303d** on an internal face thereof (i.e., facing the inside of the filter box **303**).

[0085] The filtering mesh may be made in any suitable material, such as for example a suitable polymer (e.g., Polyethersulfone or "PES") that may be over-injected onto the internal face of the second transversal sidewall **303d.**

[0086] Alternatively, the filtering mesh may be attached to the frame **318** of the second transversal sidewall **303d** in any other suitable manner (e.g., by gluing together the filtering mesh and the second transversal sidewall **303d**) or, conversely, may be removably coupled with the frame **318** (e.g., by providing suitable snap-fit engage elements). Alternatively, a plurality of smaller filtering meshes may be provided each one adapted to be coupled with a respective filtering window **318a**.

[0087] It should be noted that the mullion elements **318b**, along enhancing the structural strength of the frame **318** also enhance a robustness of the filtering mesh preventing deformation of the filtering mesh that the airflow may provoke, e.g. a bending of the central portion of the filtering mesh in the direction of the flow of air that could cause a concentration of trapped fluff in such bent central portion.

[0088] The filter box **303** preferably also comprises a cover support **324** attached to (or, alternatively, formed integral with) the front sidewall **303b.**

[0089] The cover support **324** is designed to protrude outwards from the aperture **219** in the larger sidewall **217b** in order to support the de-fluff filter cover **140.**

[0090] For example, the de-fluff filter cover **140** may be coupled with the cover support **324** by means of one or more snap-fit elements (not shown), each fitting a corresponding coupling element, such as holes **324a**, provided on the cover support element **324**.

[0091] Preferably, the cover support **324** comprises a tab 327 protruding substantially transversal to the front sidewall **303b** and extending towards the rear sidewall **303a** on an end of the cover support **324**.

[0092] In other embodiments according to the present invention, a tab may be placed in a different position and/or more than just a tab may be provided.

[0093] The tab **327** is advantageously provided in order to prevent incorrect insertions of the de-fluff filter **218** into the filter housing **217**.

[0094] For example, the de-fluff filter **218** is designed to inserted in the filter housing **217** only if the tab **327** is inserted inside a tab slot **230** (visible in **Figure 2B**) that is provided on the separating wall **205a** of the base element **205**, which substantially separates the control panel **130** from the inner portion of the top **125**, preferably in a position close to the aperture **219.**

[0095] In different embodiments of the present invention, the cover support **324**, the front sidewall **303b** and/or the de-fluff filter cover **140** may be either formed as different elements that can be engaged one another in any suitable known manner, or as a one-piece element.

[0096] In alternative embodiments of the present invention, an alternative cover element may be provided featuring a grasping element (such as for example a handle).

[0097] The rear sidewall **303a** of the filter box **303** comprises an inlet aperture **330** which is adapted to receive the drying airflow coming from the laundry treatment chamber **105** through the inlet opening **210** in the shorter sidewall **217a**.

[0098] Preferably the outlet portion, i.e. the second transversal sidewall 303d, has a greater extension than the inlet aperture **330**, such that the filtering mesh arranged on the outlet portion **303d** may have a wide extension.

[0099] Preferably, the rear sidewall **303a** is also provided with a protruding frame **333** that surrounds the inlet aperture **330** and protrudes from a border of the filter box **303** surrounding the inlet aperture **330** towards the outside of the filter box **303.** The protruding frame **333** is adapted to engage with the gasket element **212a** of the adapter element **212** preferably in an airtight manner (thus fluidly connecting the de-fluff filter **218** with inlet opening **210**).

[0100] Advantageously, the swinging bulkhead **309** is provided at the inlet aperture **330**. The swinging bulkhead **309** has a shape, e.g. substantially rectangular, adapted to close, preferably seal, the inlet aperture **330.** The swinging bulkhead **309** is designed to have a weight such that a kinetic force of the drying airflow from the laundry treatment chamber **105** is able to swing the bulkhead towards the inside of the filter box **303** (thus, clearing the inlet aperture **330**). The swinging bulkhead **309** may be made in any suitable material, e.g. a polymer.

[0101] Preferably, the swinging bulkhead **309** is hinged to the first transversal sidewall **303c** and to the second transversal sidewall **303d** close to the rear sidewall **303a**. For example, the swinging bulkhead **309** may be provided with two protruding pins **309a** on opposite shortest sides (at top corners thereof), which are adapted to be inserted into two matching rear bores **336**, a first one provided in the first transversal sidewall **303c** and a second one provided in the second transversal sidewall **303d.**

[0102] Preferably, at the inlet aperture **330** an abutment element (not shown) is provided. Advantageously, the abutment element is adapted to prevent the swinging bulkhead **309** from swinging towards the outside of the filter box **303** (i.e., the swinging bulkhead **309** is allowed to swing only towards the inside of the filter box **303**).

[0103] Thanks to the swinging bulkhead **309** and the abutment element it is possible to prevent, or substantially reducing, any spurious flow of air from the de-fluff filter **218** towards the inlet opening **210** (i.e., opposite to the direction desired for the flow of drying air).

[0104] Preferably, in the bottom wall **303e** a niche **339** is formed (as can be seen in the **Figure 3D**). The niche **339** is adapted to operatively house a blocking/ejecting

device (not shown in the drawings) that allows both (mechanincally) blocking and ejecting the de-fluff filter **218** from its housing **217.**

[0105] Advantageously, thanks to the blocking/ejecting device a user can easily unlock the de-fluff filter **218** from its housing **217** simply by pressing the pushbutton portion **145** of the aesthetic cover **140** of the de-fluff filter **218**.

[0106] Even more preferably, the blocking/ejecting device allows the de-fluff filter **218** to be at least slightly ejected from the filter housing **217** so as to be easily grasped by a user.

[0107] In an inner portion of the filter box **303** a guiding wall **354** may be preferably provided in order to guide the drying airflow from the inlet aperture **330** to the second transversal sidewall **303d**.

[0108] For example, the guiding wall **354** may be a curved wall connecting the first transversal sidewall **303c** with an end of the second transversal sidewall **303d** adjacent to the front sidewall **303b.**

[0109] Generally, the guiding wall **354** is designed in such a way to provide the best fluid-dynamic behaviour for the drying airflow inside the filter box **303** (e.g., adapted to effectively direct the drying airflow homogenously towards the whole second transversal sidewall **303d** generating the lowest turbulence in the drying airflow as possible).

[0110] Even more preferably, the guiding wall **354** may comprise a bent (or slanted) portion **354a** at the intersection with the bottom wall **303e** of the filter box 303. The bent portion **354a** of the guiding wall **354** is designed for provide the best fluid-dynamic behaviour for the drying airflow inside the filter box **303** (as generally the whole the guiding wall **354**) and also avoids fluff stockpiling facilitated by sharp angles (e.g., substantially at 90°) at the intersection between the guiding wall **354** and the bottom wall **303e.**

[0111] The top aperture **303t** of the filter box **303** is closed by the lid **306**, preferably in an airtight manner. The lid **306** may be preferably made of a suitable polymer.

[0112] More preferably the lid **306** is made of a bi-component plastic using over-injection technology. For example, a lid frame **357,** preferably comprising peripheral portion **357a** and internal (reinforcing) ribs **357b,** may be made of Acrylonitrile Butadiene Styrene (ABS). Conversely, transparent panes **360** provided enclosed by the lid frame **357**, preferably with each transparent pane **360** provided in position delimited by ribs **357b** and/or the peripheral portion **357a** of the lid frame **357**, may be made of Polycarbonate (PC). The transparent panes **360** allow a user to verify the presence, and the quantity, of fluff trapped inside the filter box 303 without the need of opening it.

[0113] As can be best appreciated from Figures 4A to 4C, on the lid frame 357, a sealing border 357c is preferably provided.

[0114] The sealing border 357c protrudes from the lid frame 357 from a lower side thereof (i.e., towards the inside of the filter box 303 when the lid 306 closes the top aperture 303t of the latter), and preferably along positions of the lid frame 357 that corresponds to the rear sidewall **303a**, the second transversal sidewall **303d**, the guiding wall **354** and a portion of the first transversal sidewall **303c** of the filter box **303**.

[0115] For example, the sealing border **357c** comprises a plurality of lid ridges **363** protruding downwards (i.e., towards the filter box **303** once the lid **306** is coupled therewith).

[0116] Correspondingly, on a topmost portion of the rear sidewall **303a**, the second transversal sidewall **303d,** the guiding wall **354** and a portion of the first transversal sidewall **303c** of the filter box **303** corresponding box ridges **367.** The box ridges **367** protrude upwards (i.e., towards the lid **306** once the filter box **303** is coupled therewith).

[0117] The lid ridges **363** and the box ridges **367** are arranged for intersperse once the lid **306** is coupled with the filter box **303t** in the closed position.

[0118] Thanks to the lid ridges **363** and the box ridges **367,** the sealing border **357c** and the top portion of the sidewalls **303a**, **303c,** and **303d** are adapted to hinder the passage to fluff by forming a meandering path (or 'maze' as can be appreciated in **Figures 4A** to **4C**).

[0119] In summary, the sealing border **357c** is designed to substantially seal the top aperture **303t** of the filter box **303,** when the lid **306** is in a closed position, thus allowing air entering and/or exiting a hollow chamber **361** within the de-fluff filter **218** (i.e., defined by the filter box **303** and the lid **306** in closed position in which trapped fluff remains confined) only through the inlet aperture **330** and the filtering windows **318a** in the second transversal sidewall **303d.**

[0120] In an embodiment of the invention, the sealing border **357c** and the top portion of the sidewalls **303a**, **303c,** and **303d** may be designed in such a way to couple together by substantially a snap-fit engagement.

[0121] In a further embodiment of the present invention, as an alternative or an addition, the sealing border **357c** may also be provided with a gasket and/or the lid ridges **363** and the box ridges **367** may be formed in a resilient material (e.g., a rubber-like material which may be, e.g., overmoulded on the material of the filter box **303**) in order to obtain an improved airtight coupling with the filter box **303.**

[0122] In order to allow a user easily opening (i.e., decouple) the lid **306** from the filter box **303**, one or more grasping portions may be provided, such as for example one or more opening flaps **357d**, preferably at ends of the peripheral portion **357a** of the lid frame **357** corresponding to the first transversal sidewall **303c** and the second transversal sidewall **303d** in the proximity of the rear sidewall **303a** of the filter box **303.**

[0123] In order to be pivotally coupled with the filter box **303,** the lid **306** comprises a couple of hinges **366**, preferably protruding substantially at opposite ends of a front side of the lid **306** (i.e., corresponding to the front

sidewall **303b** of the filter box **303**).

[0124] Each hinge **366** protrudes from the lid frame **357** transversally thereto and has a pin **366a** in its turn protruding from the center of a flat portion **366b** transversally thereto, with the flat portion **366b** that is preferably substantially circular.

[0125] Each pin **366a** is adapted to engage a matching front bore **369** provided on the first transversal sidewall **303c** and on the second transversal sidewall **303d** in a location adjacent to the front sidewall **303b.**

[0126] According to the present invention, the de-fluff filter **218** further comprises an airflow diverter.

[0127] The airflow diverter is arranged to divert, at least partly, the flow of air within the hollow chamber **361** defined within the filter box **303** closed by the lid **306** during the laundry machine **100** operation.

[0128] Even more preferably, the airflow diverter is arranged for dynamically diverting the airflow within the filter box **218.**

[0129] According to the invention, the airflow diverter is arranged for diverting the airflow within the filter box **218** according to a quantity of fluff trapped therein.

[0130] According to an embodiment of the invention, the airflow diverter comprises a septum **370**, which is adapted to be coupled with the filter box **218.**

[0131] Preferably, the septum **370** is designed to be coupled with the filter box **303,** as can be seen in Figures **3B, 3D** and **4A.**

[0132] The septum **370,** as can be appreciated in **Figures 5A** and **5B** (which are a side view and a top view thereof, respectively), has substantially a rectangular shape.

[0133] The septum **370** comprises a peripheral frame **370a** that defines a plurality (e.g., five in the example of the figures) of septum filtering windows **370b** together with corresponding separating elements, such as for example (septum) mullion elements **370c,** which separate each septum filtering window **370b** from adjacent septum filtering windows **370b.**

[0134] Preferably, the septum mullion elements **370c** are integral with the peripheral frame **370a**.

[0135] In one embodiment of the invention, the structure formed by the peripheral frame **370a** and the mullion elements **370c** comprises two halves, i.e. a first structure half **375a** and a second structure half **375b**.

[0136] Preferably, each structure halves **375a** and **375b** are symmetrical one to the other, and each structure half **375a** and **375b** defines a respective side of the septum **370.**

[0137] For example, a first side of each structure half **375a** and **375b** defines a lateral side of the septum **370** and a second side is designed to couple (e.g., by snap-fit, bayonet mounting, through the use of fastening/clamping means, *etc.*) with a second side of the other structure half **375b** or **375a**. In other words, the structure halves **375a** and **375b** couple one with the other along a longitudinal symmetry plane **VI** of the septum **370**.

[0138] The septum **370** further comprises a filtering element, such as for example a septum filtering mesh (not shown in the figures for simplicity).

[0139] The septum filtering mesh is preferably substantially rectangular in shape and is sized with a length and a height substantially equal to a length and a height of the septum **370.**

[0140] Preferably, the septum filtering mesh is coupled with the peripheral frame **370a** and the mullion elements **370c** in order to being exposed at the septum filtering windows **370b.**

[0141] For example, the filtering mesh is suited to be inserted between the structure halves **375a** and **375b** of the septum 370 and being maintained in a working position once the structure halves **375a** and **375b** are coupled together.

[0142] The septum **370** further comprises feet elements **380a** and **380b** arranged for coupling with the filter box **300** and maintaining the septum **370** in a working position within the de-fluff filter **218**.

[0143] In one embodiment of the invention, each foot element **380a** and **380b** comprises a disc element protruding from the peripheral frame **370a** and transversally therethrough (e.g., with each structure half **375b** or **375a** comprising a half of the disc).

[0144] Preferably, each foot element **380a** and **380b** is provided in correspondence of a respective mullion element **370c** of the septum **370.**

[0145] The feet elements **380a** and **380b** are arranged for coupling with corresponding feet receptacles **385a** and **385b** provided in the bottom wall **303e.**

[0146] For example, each foot receptacle **385a** and **385b** may comprise a discoidal dent adapted to receive a foot element **380a** and **380b.** In an embodiment of the invention a diameter of the feet receptacles **385a** and **385b** is slightly smaller than a diameter of the feet elements **380a** and **380b** in order to provide an interference fitting of the feet receptacles **385a** and **385b** with the feet elements **380a** and **380b.**

[0147] In alternative or in addition, as can be appreciated in **Figure 4A** each foot receptacle **385a** and **385b** may comprise a peg element **405** protruding from the bottom wall **303e** of the filter box **303.** Correspondingly, each foot element **380a** and **380b** comprises a peg receptacle **410** arranged for receiving the peg element **405.**

[0148] In one embodiment of the invention, the peg element **405** is arranged for snap-fitting with the peg receptacle **410.**

[0149] Preferably, a pair of (terminal) retaining brackets **390a** and **390b** in the filter box **303** for maintaining the septum **370** in its working position.

[0150] In one embodiment of the invention, the retaining brackets **390a** and **390b** protrude from the bottom wall **303e** of the filter box **303** towards the top aperture **303t.**

[0151] Each retaining bracket **390a** is preferably arranged for removably receiving a free end of the septum **370** in such a way to prevent excessive oscillations thereof during the operation of the laundry machine **100.**

[0152] For example, the retaining brackets **390a** and **390b** has substantially a "C" shaped in top view defining respective concave spaces that are suited for receiving the opposite ends of the septum **370.**

[0153] Preferably, the septum **370** is coupled with the filter box **303** by inserting the opposite ends of the septum **370** in concave spaces of the retaining brackets **390a** and **390b** and pushing the septum **370** towards the bottom wall **303e** of the filter box **303** until the feet elements **380a** and **380b** engage with the feet receptacles **385a** and **385b.**

[0154] Once the septum **370** is in its working position inside the filter box **303** the inner space delimited by the filter box **303** (and thus also the hollow chamber **361** defined within the filter box **303** closed by the lid **306**) results substantially subdivided in two different regions **395a** and **395b.**

[0155] Preferably, the septum **370** is designed for substantially being flush with the bottom wall **303e** of the filter box **303** and for reaching the lid **306**, preferably contacting the latter, once the lid **306** is in its closed position (as can be appreciated in **Figure 4A**).

[0156] According to the invention, during operation of the laundry machine **100,** the septum **370** is arranged for diverting the flow of air from a first region **395a** to a second region **395b** of the two different regions **395a** and **395b.** The septum **370** is arranged for diverting the flow of air from the first region **395a** to the second region **395b** in a substantially automatic manner. The septum **370** diverts the airflow from the first region **395a** to the second region **395b** trigger by an amount of fluff collected within the hollow chamber **361** of the de-fluff filter **218** during the operation thereof.

[0157] In the exemplary embodiment at issue, initially the airflow carrying moisture and fluff accessing the hollow chamber **361** of the de-fluff filter **218** through the inlet aperture **330** and is mainly driven into the first region **395a** by the shape of the hollow chamber **361** (thanks to the shape of the guiding wall **354**) of the de-fluff filter **218.**

[0158] Preferably, the septum **370** is arranged inside the hollow chamber **361** of the de-fluff filter **218** in such a way to define, together with the guiding sidewall **354,** the first region **395a** having a decreasing transversal section along the direction defined by the flow of air (i.e., substantially from the inlet aperture **330** towards the front sidewall **303b).**

[0159] In other words, the septum **370** together with the de-fluff filter **218** defines a path having at least one convergent portion along the direction of the flow of air. Advantageously, flow of air is guided towards an end of the first region **395a**, i.e. at the intersection between the septum **370** and the guiding wall **354,** and then crosses the septum filtering windows **370b.**Therefore, substantially the whole (or a majority of the) airflow crossing the de-fluff filter **218** is initially filtered by the septum filtering windows **370b** of the septum **370.** Accordingly, the fluff is substantially mainly confined in the first region **395a**, while the airflows reaches second region **395b** beyond the septum **370** and the leaves the hollow chamber **361** of the de-fluff filter **218** through the second transversal sidewall **303d.**

[0160] During the proceeding of the operation of the laundry machine **100** fluff accumulates more and more in the first region **395a** and, accordingly, a flow rate through the septum filtering windows **370b** of the septum **370** progressively reduces.

[0161] In the considered embodiment, the reduction of the flow rate through the septum filtering windows **370b** is due to accumulation of fluff at the septum filtering windows **370b** of the septum **370** pushed by the airflow thereagainst.

[0162] Therefore, the airflow entering the hollow chamber **361** of the de-fluff filter **218** is progressively diverted from the first region **395a** to the second region **395b** as the flow rate through the septum filtering windows **370b** of the septum **370** progressively drops.

[0163] The accumulation of fluff at the septum filtering windows **370b** of the septum **370** may reduce the flow rate through the septum **370** to the point that substantially all the airflow is diverted from the first region **395a** to the second region **395b** of the hollow chamber **361.**

[0164] It should be noted that a threshold amount of fluff that provokes the diversion of the airflow is a function of the size of the de-fluff filter **218,** of the first region **395a** of the hollow chamber **361,** of the septum **370** and of the septum filtering windows **318a**.

[0165] The fluff in the airflow diverted for entering directly in the second region **395b** is filtered by the septum filtering windows **318a** of the second transversal sidewall **303d** before exiting the de-fluff filter **218.**

[0166] It should be noted that the filtering windows **318a** are substantially free of fluff at this point of the drying process and thus ensure an unreduced flow rate of the airflow therethrough.

[0167] For example, in an initial phase of the laundry machine **100** operation the flow of air is mainly filtered by the septum filtering window **370b** closer to the guiding wall **354** (i.e., the farthest from the inlet aperture **330**) which, as the process the laundry machine **100** operation, is firstly clogged by fluff filtered from the flow of air crossing the septum **370.**

[0168] The flow of air is progressively diverted from the septum filtering window **370b** closer to the guiding wall **354** to the septum filtering window **370b** adjacent thereto, and so on until all the septum filtering windows **370b** are substantially clogged (i.e., the flowrate of air flowing through each septum filtering window **370b** is substantially reduced by the trapped fluff).

[0169] Once all the septum filtering windows **370b** of the septum **370** are substantially clogged causes the air flow to be diverted to the second region **395b** of the hollow chamber **361** where the unclogged filtering windows **318a** of the second transversal sidewall **303d** ensure an higher flowrate.

[0170] In other words, the septum **370** divides the hollow chamber **361** in two regions, i.e. the first region **395a**

and the second region **395b**, which define, for the flow of drying air, two paths causing a different amount of pressure drops, and accordingly energy losses (e.g., due to friction), to the portions of fluid (e.g. moisture and fluff-laden air) travelling through the first region **395a** and the second region **395b.**

[0171] Preferably, the flow of air inside the de-fluff filter **218** follows a path through the first region **395a** or through the second region **395b** of the hollow chamber 361 which currently offers the lowest pressure drop, or the lowest energy losses. Particularly, initially the amount of energy losses caused by the first portion **395a** of the hollow chamber **361** to the airflow is lower than the amount of energy losses caused by the second portion **395b** thereto in an initial phase of the laundry machine **100** operation (i.e., when the septum filtering windows **370b** are unclogged).

[0172] Successively, as the septum filtering windows **370b** progressively clog, the energy losses along a path of the flow of air through the first region **395a** of the hollow chamber start to rise until a path for the flow of air through the second region **395b** result to provoke lower energy losses to the airflow than the path of the flow of air through the first region **395a**.

[0173] Thanks to the septum **370** of the de-fluff filter **218** according to an embodiment of the present invention, a flow rate of the airflow exiting the de-fluff filter **218** remains substantially constant for longer periods during the operation of the laundry machine **100** even in the occurrence of large amounts of fluff collected in the de-fluff filter **218**, as can be appreciated in **Figure 6** that is a chart showing air pressure as a function of time during operation of the laundry machine **100** according to an embodiment of the invention and of a laundry machine known in the art.

[0174] In detail, a first air-pressure curve **605** is a measurement of the air pressure (measured in mmH_2O) as a function of time during operation of a laundry machine **100** comprising the de-fluff filter **218** according to an embodiment of the present invention and a second air-pressure curve **610** is a measurement of air pressure as a function of time during the operation of a laundry machine known in the art.

[0175] It should be noted that the first air-pressure curve **605** remains substantially constant for a longer extent of time than the second air-pressure curve **610.** Moreover, the rise in pressure exhibited by the first air-pressure curve **605** is substantially linear and with a very low angular coefficient, while the rise in pressure exhibited by the second air-pressure curve **610** result to be steeper with a non-linear trend and reaches a maximum value (at the end of the operation) substantially higher than the maximum value reached by the first air-pressure curve **605**.

[0176] This ensures a more stable air pressure in the whole air circuit of the laundry machine **100** that entails high efficiency of the laundry machine operation.

[0177] Thanks to the substantially stable pressure during the operation of the laundry machine **100** ensured by the de-fluff filter **218** according to embodiments of the present invention lead to a substantially homogeneous operation of the heat pump of the air circuit of the laundry machine **100**.

[0178] For example, a compressor (not shown) comprised in the heat pump may operate with a substantial constant number of round per minute, or with a limited variations of rounds per minute.

[0179] Moreover, a capillary temperature results to be lower during the operation of the laundry machine **100** as can be appreciated in **Figure 7** that is a chart showing capillary temperature as a function of time during the operation of a laundry machine **100** according to an embodiment of the invention and of a laundry machine known in the art.

[0180] In detail, a first temperature curve **705** is a measurement of temperature (measured in Celsius degrees) as a function of time during operation of a laundry machine **100** comprising the de-fluff filter **218** according to an embodiment of the present invention and a second temperature curve **610** is a measurement of temperature as a function of time during the operation of a laundry machine known in the art.

[0181] It should be noted that the first temperature curve **705** remains equal to or lower than the second temperature curve**710** during the whole considered time. In addition, the first temperature curve **705,** apart for limited variations, remains substantially constant once reached a steady value of temperature during the operation of the laundry machine **100,** while the second curve **710** exhibits a substantially linear increase in temperature during the operation of the laundry machine after an initial steep increase.

[0182] In other embodiments of the invention (not shown), different airflow diverters may be implemented.

[0183] For example, airflow diverters may be arranged for automatically swinging from a first position, in which the airflow is directed into a first portion of the de-fluff filter, to a second position, in which the airflow is directed into a second portion of the de-fluff filter, according to a quantity of fluff currently trapped in the de-fluff filter. The airflow diverter could be hinged to the bottom wall of the filter box in such a way to swing from the first position to the second position as above described. The movement of such diverters being caused by the airflow itself or by a driving device.

[0184] Alternatively, a deformable airflow diverter (e.g., manufactured in a resilient material) may be arranged for having a rest configuration, in which the airflow is directed into a first portion of the de-fluff filter, and is arranged for shift to a deformed configuration, in which the airflow is directed into a second portion of the de-fluff filter, according to a quantity of fluff currently trapped in the de-fluff filter. The deformation of such diverter being caused by the airflow itself or by a deformation inducing device.

[0185] It should be noted that the laundry machine **100**

may operate also without the auxiliary de-fluff filter **221** and/or the septum **370** in their working positions, i.e. with only the filtering mesh of the second transversal sidewall **303d** of the de-fluff filter **218** filtering the airflow coming from the laundry treatment chamber **105.**

[0186] Indeed, in alternative embodiments of the present invention, the auxiliary filter **221** and its housing may be omitted.

Claims

1. A laundry machine (**100**) adapted to dry laundry by means of a flow of drying air, comprising:

a casing (**110**);
inside the casing, a laundry treating chamber (**105**) adapted to contain the laundry to be dried;
an air circuit in fluid communication with the laundry treating chamber through an inlet opening (**210**) and through an outlet opening (**215**), and defining an air-path for the flow of drying air between said inlet (**210**) and outlet (**215**) openings;
a filter housing (**217**) for removably accommodating a de-fluff filter (**218**), said filter housing (**217**) being provided in the air-path and being accessible through a housing aperture (**219**);
the de-fluff filter (**218**) being arranged for trapping fluff or lint particles carried by the flow of drying air crossing said de-fluff filter (**218**), the de-fluff filter (**218**) comprising a filtering element (**318**) and a hollow chamber (**361**) which comprises an inlet aperture (**330**) and an outlet portion (**303d**), wherein the filtering element (**318**) is arranged on the outlet portion (**303d**); and
the de-fluff filter (**218**) further comprising an airflow diverter (**370**) which is adapted to divide the hollow chamber (**361**) of the de-fluff filter (**218**) in a first portion (**395a**) and a second portion (**395b**),
characterized in that
the airflow diverter (**370**) comprises at least one filtering element (370b) for filtering the flow of drying air entering the first portion (**395a**) of the hollow chamber (**361**) of the de-fluff filter (**218**) thereby trapping fluff or lint particles, and
the airflow diverter (370) is adapted to divert the flow of drying air entering the de-fluff filter (**218**) towards the first portion (**395a**) of the hollow chamber (**361**) or towards the second portion (**395b**) of the hollow chamber (**361**) according to an amount of fluff currently trapped in the at least one filtering element (**370b**), wherein the airflow entering the hollow chamber (**361**) of the de-fluff filter (**218)** is progressively diverted from the first portion (**395a**) to the second portion (395b) as the flow rate through the at least one filtering element (**370b**) progressively drops due to accumulation of fluff at the least one filtering element (**370b**).

2. The laundry machine (**100**) according to claim 1, wherein the hollow chamber (361) of the de-fluff filter (218) is shaped to direct the majority of drying air flow entering the de-fluff filter (**218**) to the first portion (**395a**) of the hollow chamber (**361**) in a first part of a drying process when the filtering elements (370b) of the airflow diverter (370) are free of fluff and ensure an unreduced flow rate of the airflow therethrough.

3. The laundry machine (**100**) according to any preceding claim, wherein the first portion (**395a**) and the second portion (**395b**) of the hollow chamber (**361**) define, for the flow of drying air, two paths causing a different amount of energy losses to the fluid portions entering the first and the second portion (**395a, 395b**) respectively.

4. The laundry machine (**100**) according to claim 3, wherein the amount of energy losses caused by the first portion (**395a**) is lower than the amount of energy losses caused by the second portion (**395b**) in an initial phase of the laundry machine (100) operation.

5. The laundry machine (**100**) according to claim 3 or 4, wherein, during a laundry drying process, the progressive accumulation of fluff or lint particles in the first portion (**395a**) of the hollow chamber (**361**) increases the amount of energy losses to the fluid portion entering the first portion (**395a**) up to make such amount greater than the amount of energy losses caused by the second portion (**395b**).

6. The laundry machine (**100**) according to claim 5, wherein the airflow diverter (**370**) traps fluff or lint particles at least up to a threshold amount that causes substantially the whole airflow to divert from the first portion (**395a**) to the second portion (**395b**) of the hollow chamber (**361**).

7. The laundry machine (**100**) according to claim 6, wherein said threshold amount of fluff or lint particles is a function of at least one among: a size of the first portion (**395a**), a size of the hollow chamber (**361**), a size of the airflow diverter (**370**) and a size of a filtering element (**370b, 318a**) provided in the airflow diverter (**370**) or in the de-fluff filter (**218**).

8. The laundry machine (**100**) according to any one of the preceding claims, wherein the airflow diverter (**370**) is removably mounted in the hollow chamber (**361**) of the de-fluff filter (**218**).

9. The laundry machine (**100**) according to any one of the preceding claims, wherein the de-fluff filter (**218**)

further comprises one or more retaining brackets (**390a, 390b**) for holding the airflow diverter (**370**) in a working position within the hollow chamber (**361**).

10. The laundry machine (**100**) according to any one of the preceding claims, wherein the de-fluff filter (**218)** further comprises a filter box (**303**) and a lid (**306**) hinged to the filter box (**303**) for pivoting from an opening position to a closed position thereby selectively closing a top aperture of the filter box (**303**), the hollow chamber (**361**) being defined by the filter box (**303**) and by the lid (**306**) in the closed position, and
wherein the airflow diverter (**370**) is arranged for being flush both with the lid (**306**) and with a bottom wall (**303e**) of the filter box (**303**) opposite to the lid (**306**).

11. The laundry machine (**100**) according to claim 10, wherein the lid (**306**) comprises a plurality of lid ridges (**363**) protruding towards the filter box (**303**) once the lid (**306**) is in the closed position, and
wherein the filter box (**303**) comprises corresponding box ridges (**367**) protruding towards the lid (**306**) once the lid (**306**) is in the closed position, the lid ridges (**363**) being arranged for interspersing with the box ridges (**367**)) once the lid (**306**) is in the closed position thereby forming a meandering path capable of hindering the passage of fluff.

12. The laundry machine (**100**) according to any one of the preceding claims wherein the hollow chamber (**361**) is delimited by a guiding wall (**354**) and a sidewall (**303d**), the airflow diverter (**370**) being arranged therebetween so as to form with at least one of said guiding wall (**354**) and sidewall (**303d**) a path having a convergent portion along the direction of the flow of air.

13. The laundry machine (**100**) according to any one of the preceding claims wherein the airflow diverter is movable from a first position, in which the airflow is directed into a first portion (**395a**) of the de-fluff filter, to a second position, in which the airflow is directed into a second portion (**395b**) of the de-fluff filter (**218**).

14. The laundry machine (**100**) according to any one of the preceding claims wherein the airflow diverter is deformable between a rest configuration, in which the airflow is directed into a first portion (**395a**) of the de-fluff filter, and a deformed configuration, in which the airflow is directed into a second portion (**395b**) of the de-fluff filter (**218**).

Patentansprüche

1. Wäschebehandlungsmaschine (100) zum Trocknen von Wäsche mittels eines Trocknungsluftstroms, umfassend:

ein Gehäuse (110);
im Innern des Gehäuses eine Wäschebehandlungskammer (105), die zur Aufnahme der zu trocknenden Wäsche angepasst ist;
einen Luftkreislauf, der über eine Einlassöffnung (210) und eine Auslassöffnung (215) in Fluidverbindung mit der Wäschebehandlungskammer steht und einen Luftweg für den Trocknungsluftstrom zwischen der Einlass- (210) und Auslassöffnung (215) definiert;
ein Filtergehäuse (217) zur abnehmbaren Aufnahme eines Entflusungsfilters (218), wobei das Filtergehäuse (217) in dem Luftweg vorgesehen und durch eine Gehäuseöffnung (219) zugänglich ist;
der Entflusungsfilter (218) zum Auffangen von Flusen- oder Fusselpartikeln angeordnet ist, die durch den den Entflusungsfilter (218) durchquerenden Trocknungsluftstrom mitgeführt werden, wobei der Entflusungsfilter (218) ein Filterelement (318) und eine Hohlkammer (361) umfasst, die eine Einlassöffnung (330) und einen Auslassabschnitt (303d) aufweist, wobei das Filterelement (318) am Auslassabschnitt (303d) angeordnet ist; und
der Entflusungsfilter (218) ferner einen Luftstromumlenker (370) umfasst, der zum Unterteilen der Hohlkammer (361) des Entflusungsfilters (218) in einen ersten Abschnitt (395a) und einen zweiten Abschnitt (395b) angepasst ist,
dadurch gekennzeichnet, dass
der Luftstromumlenker (370) mindestens ein Filterelement (370b) zum Filtern des in den ersten Abschnitt (395a) der Hohlkammer (361) des Entflusungsfilters (218) eintretenden Trocknungsluftstroms umfasst, wodurch Flusen- oder Fusselpartikel aufgefangen werden, und
der Luftstromumlenker (370) dazu angepasst ist, den in den Entflusungsfilter (218) eintretenden Trocknungsluftstrom je nach der derzeit in dem mindestens einen Filterelement (370b) eingeschlossen Menge an Flusen zum ersten Abschnitt (395a) der Hohlkammer (361) oder zum zweiten Abschnitts (395b) der Hohlkammer (361) hin umzulenken, wobei der in die Hohlkammer (361) des Entflusungsfilters (218) eintretende Luftstrom progressiv vom ersten Abschnitt (395a) zum zweiten Abschnitt (395b) umgeleitet wird, wenn die Durchflussrate durch das mindestens eine Filterelement (370b) aufgrund der Ansammlung von Flusen an dem mindestens einen Filterelement (370b) progressiv abnimmt.

2. Wäschebehandlungsmaschine (100) gemäß An-

spruch 1, wobei die Hohlkammer (361) des Entflusungsfilters (218) so geformt ist, dass sie den Großteil des in den Entflusungsfilter (218) eintretenden Trocknungsluftstroms in einem ersten Teil eines Trocknungsvorgangs zum ersten Abschnitt (395a) der Hohlkammer (361) leitet, wenn die Filterelemente (370b) des Luftstromumlenkers (370) flusenfrei sind und eine unverminderte Durchflussrate des Luftstroms durch sie hindurch gewährleisten.

3. Wäschebehandlungsmaschine (100) gemäß einem der vorhergehenden Ansprüche, wobei der erste Abschnitt (395a) und der zweite Abschnitt (395b) der Hohlkammer (361) für den Trocknungsluftstrom zwei Wege definieren, die einen unterschiedlichen Betrag an Energieverlusten für den in den ersten bzw. zweiten Abschnitt (395a, 395b) eintretenden Fluidanteils verursachen.

4. Wäschebehandlungsmaschine (100) gemäß Anspruch 3, wobei der Betrag der durch den ersten Abschnitt (395a) verursachten Energieverluste in einer Anfangsphase des Betriebs der Wäschebehandlungsmaschine (100) geringer als der Betrag der durch den zweiten Abschnitt (395b) verursachten Energieverluste ist.

5. Wäschebehandlungsmaschine (100) gemäß Anspruch 3 oder 4, wobei während eines Wäschetrocknungsprozesses die fortschreitende Ansammlung von Flusen- oder Fusselpartikeln im ersten Abschnitt (395a) der Hohlkammer (361) den Betrag der Energieverluste im ersten Abschnitt (395a) eintretenden Fluidanteil erhöht, sodass dieser Betrag größer als der Betrag der durch den zweiten Abschnitt (395b) verursachten Energieverluste ist.

6. Wäschebehandlungsmaschine (100) gemäß Anspruch 5, wobei der Luftstromumlenker (370) Flusen- oder Fusselpartikel mindestens bis zu einer Schwellenmenge einfängt, die bewirkt, dass im Wesentlichen der gesamte Luftstrom aus dem ersten Abschnitt (395a) zum zweiten Abschnitt (395b) der Hohlkammer (361) umgelenkt wird.

7. Wäschebehandlungsmaschine (100) gemäß Anspruch 6, wobei die Schwellenmenge an Flusen- oder Fusselpartikeln von mindestens einem des Folgenden abhängt: einer Größe des ersten Abschnitts (395a), einer Größe der Hohlkammer (361), einer Größe des Luftstromumlenkers (370) und einer Größe eines im Luftstromumlenker (370) oder im Entflusungsfilter (218) vorgesehenen Filterelements (370b, 318a).

8. Wäschebehandlungsmaschine (100) gemäß einem der vorhergehenden Ansprüche, wobei der Luftstromumlenker (370) herausnehmbar in der Hohlkammer (361) des Entflusungsfilters (218) angebracht ist.

9. Wäschebehandlungsmaschine (100) gemäß einem der vorhergehenden Ansprüche, wobei der Entflusungsfilter (218) ferner eine oder mehrere Halteklammern (390a, 390b) umfasst, um den Luftstromumlenker (370) in einer Arbeitsstellung innerhalb der Hohlkammer (361) zu halten.

10. Wäschebehandlungsmaschine (100) gemäß einem der vorhergehenden Ansprüche, wobei der Entflusungsfilter (218) ferner einen Filterkasten (303) und einen an dem Filterkasten (303) angelenkten Deckel (306) umfasst, um von einer geöffneten Stellung in eine geschlossene Stellung zu schwenken, wodurch eine obere Öffnung des Filterkastens (303) selektiv geschlossen wird, wobei die Hohlkammer (361) durch den Filterkasten (303) und durch den Deckel (306) in der geschlossenen Stellung definiert wird, und
wobei der Luftstromumlenker (370) so angeordnet ist, dass er sowohl mit dem Deckel (306) als auch mit einer gegenüber dem Deckel (306) liegenden Bodenwand (303e) des Filterkastens (303) bündig ist.

11. Wäschebehandlungsmaschine (100) gemäß Anspruch 10, wobei der Deckel (306) eine Vielzahl von Deckelrippen (363) umfasst, die zum Filterkasten (303) hin vorstehen, sobald sich der Deckel (306) in der geschlossenen Stellung befindet, und
wobei der Filterkasten (303) entsprechende Kastenrippen (367) umfasst, die zum Deckel (306) hin vorstehen, wenn sich der Deckel (306) in der geschlossenen Stellung befindet, wobei die Deckelrippen (363) so angeordnet sind, dass sie sich mit den Kastenrippen (367) überlagern, sobald sich der Deckel (306) in der geschlossenen Stellung befindet, wodurch ein mäanderförmiger Weg gebildet wird, der in der Lage ist, den Durchgang von Flusen zu behindern.

12. Wäschebehandlungsmaschine (100) gemäß einem der vorhergehenden Ansprüche, wobei die Hohlkammer (361) durch eine Führungswand (354) und eine Seitenwand (303d) begrenzt ist, wobei der Luftstromumlenker (370) dazwischen so angeordnet ist, dass er mit mindestens einer der Führungswand (354) und der Seitenwand (303d) einen Weg mit einem konvergierenden Abschnitt entlang der Richtung des Luftstroms bildet.

13. Wäschebehandlungsmaschine (100) gemäß einem der vorhergehenden Ansprüche, wobei der Luftstromumlenker von einer ersten Stellung, in der der Luftstrom in einen ersten Abschnitt (395a) des Entflusungsfilters geleitet wird, in eine zweite Stellung bewegbar ist, in der der Luftstrom in einen zweiten

Abschnitt (395b) des Entflusungsfilters (218) geleitet wird.

14. Wäschebehandlungsmaschine (100) gemäß einem der vorhergehenden Ansprüche, wobei der Luftstromumlenker zwischen einer Ruheausbildung, in der der Luftstrom in einen ersten Abschnitt (395a) des Entflusungsfilters geleitet wird, und einer deformierten Ausbildung deformierbar ist, in der der Luftstrom in einen zweiten Abschnitt (395b) des Entflusungsfilters (218) geleitet wird.

Revendications

1. Machine de traitement du linge (**100**) adaptée pour sécher du linge au moyen d'un écoulement d'air de séchage, comprenant :

un boîtier (**110**) ;
à l'intérieur du boîtier, une chambre de traitement du linge (**105**) adaptée pour contenir le linge destiné à être séché ;
un circuit d'air en communication fluidique avec la chambre de traitement du linge par le biais d'une ouverture d'entrée (**210**) et par le biais d'une ouverture de sortie (**215**), et définissant un trajet d'air pour l'écoulement d'air de séchage entre lesdites ouvertures d'entrée (**210**) et de sortie (**215**) ;
un boîtier de filtre (**217**) pour recevoir de manière amovible un filtre à peluches (**218**), ledit boîtier de filtre (**217**) étant fourni dans le trajet d'air et étant accessible par le biais d'une ouverture de boîtier (**219**) ;
le filtre à peluches **(218)** étant agencé pour piéger des peluches ou des particules pelucheuses portées par l'écoulement d'air de séchage traversant ledit filtre à peluches (**218**), le filtre à peluches **(218)** comprenant un élément filtrant (**318**) et une chambre creuse **(361)** qui comprend une ouverture d'entrée (**330**) et une partie de sortie (**303d**), dans laquelle l'élément filtrant (**318**) est agencé sur la partie de sortie (**303d**) ; et
le filtre à peluches **(218)** comprenant en outre un déflecteur d'écoulement d'air **(370)** qui est adapté pour diviser la chambre creuse **(361)** du filtre à peluches **(218)** en une première partie **(395a)** et une seconde partie (**395b**),
caractérisée en ce que
le déflecteur d'écoulement d'air **(370)** comprend au moins un élément filtrant (**370b**) pour filtrer l'écoulement d'air de séchage entrant dans la première partie **(395a)** de la chambre creuse **(361)** du filtre à peluches **(218)** piégeant ainsi des peluches ou des particules pelucheuses, et le déflecteur d'écoulement d'air **(370)** est adapté pour dévier l'écoulement d'air de séchage entrant dans le filtre à peluches **(218)** vers la première partie (**395a**) de la chambre creuse **(361)** ou vers la seconde partie **(395b)** de la chambre creuse **(361)** en fonction d'une quantité de peluches actuellement piégées dans l'au moins un élément filtrant (**370b**), dans laquelle l'écoulement d'air entrant dans la chambre creuse (**361**) du filtre à peluches **(218)** est progressivement dévié de la première partie **(395a)** vers la seconde partie (**395b**) lorsque le débit à travers l'au moins un élément filtrant (**370b**) baisse progressivement en raison d'une accumulation de peluches au niveau de l'au moins un élément filtrant (**370b**).

2. Machine de traitement du linge (**100**) selon la revendication 1, dans laquelle la chambre creuse (**361**) du filtre à peluches **(218)** est formée pour diriger la majorité de l'écoulement d'air de séchage entrant dans le filtre à peluches **(218)** vers la première partie (**395a**) de la chambre creuse **(361)** dans une première partie d'un processus de séchage lorsque les éléments filtrants (**370b**) du déflecteur d'écoulement d'air **(370)** sont exempts de peluches et assurent un débit non réduit de l'écoulement d'air à travers celui-ci.

3. Machine de traitement du linge (**100**) selon l'une quelconque des revendications précédentes, dans laquelle la première partie **(395a)** et la seconde partie **(395b)** de la chambre creuse **(361)** définissent, pour l'écoulement d'air de séchage, deux trajets causant une différente quantité de pertes d'énergie aux parties de fluide entrant dans la première et la seconde partie (**395a, 395b**) respectivement.

4. Machine de traitement du linge (**100**) selon la revendication 3, dans laquelle la quantité de pertes d'énergie causée par la première partie **(395a)** est inférieure à la quantité de pertes d'énergie causée par la seconde partie **(395b)** dans une phase initiale du fonctionnement de la machine de traitement du linge (**100**).

5. Machine de traitement du linge (**100**) selon la revendication 3 ou 4, dans laquelle, pendant un processus de séchage du linge, l'accumulation progressive de peluches ou de particules pelucheuses dans la première partie **(395a)** de la chambre creuse (**361**) augmente la quantité de pertes d'énergie pour la partie de fluide entrant dans la première partie **(395a)** jusqu'à représenter une telle quantité supérieure à la quantité de pertes d'énergie causée par la seconde partie (**395b**).

6. Machine de traitement du linge (**100**) selon la revendication 5, dans laquelle le déflecteur d'écoulement

d'air (**370**) piège des peluches ou des particules pelucheuses au moins jusqu'à une quantité seuil qui amène sensiblement l'ensemble de l'écoulement d'air à être dévié de la première partie **(395a)** vers la seconde partie **(395b)** de la chambre creuse (**361**).

7. Machine de traitement du linge (**100**) selon la revendication 6, dans laquelle ladite quantité seuil de peluches ou de particules pelucheuses dépend d'au moins l'un de : une taille de la première partie (**395a**), une taille de la chambre creuse (**361**), une taille du déflecteur d'écoulement d'air (**370**) et une taille d'un élément filtrant (**370b, 318a**) fourni dans le déflecteur d'écoulement d'air (**370**) ou dans le filtre à peluches (**218**).

8. Machine de traitement du linge (**100**) selon l'une quelconque des revendications précédentes, dans laquelle le déflecteur d'écoulement d'air (**370**) est monté de manière amovible dans la chambre creuse (**361**) du filtre à peluches (**218**)**.**

9. Machine de traitement du linge (**100**) selon l'une quelconque des revendications précédentes, dans laquelle le filtre à peluches (**218**) comprend en outre un ou plusieurs supports de retenue (**390a, 390b**) pour maintenir le déflecteur d'écoulement d'air (**370**) dans une position de travail à l'intérieur de la chambre creuse (**361**).

10. Machine de traitement du linge (**100**) selon l'une quelconque des revendications précédentes, dans laquelle le filtre à peluches (**218**) comprend en outre une boîte à filtre (**303**) et un couvercle (**306**) articulé sur la boîte à filtre (**303**) pour pivoter d'une position ouverte vers une position fermée fermant ainsi de manière sélective une ouverture supérieure de la boîte à filtre (**303**), la chambre creuse (**361**) étant définie par la boîte à filtre (**303**) et par le couvercle (**306**) dans la position fermée, et
dans laquelle le déflecteur d'écoulement d'air (**370**) est agencé pour être aligné à la fois avec le couvercle (**306**) et avec une paroi inférieure (**303e**) de la boîte à filtre (**303**) opposée au couvercle (**306**).

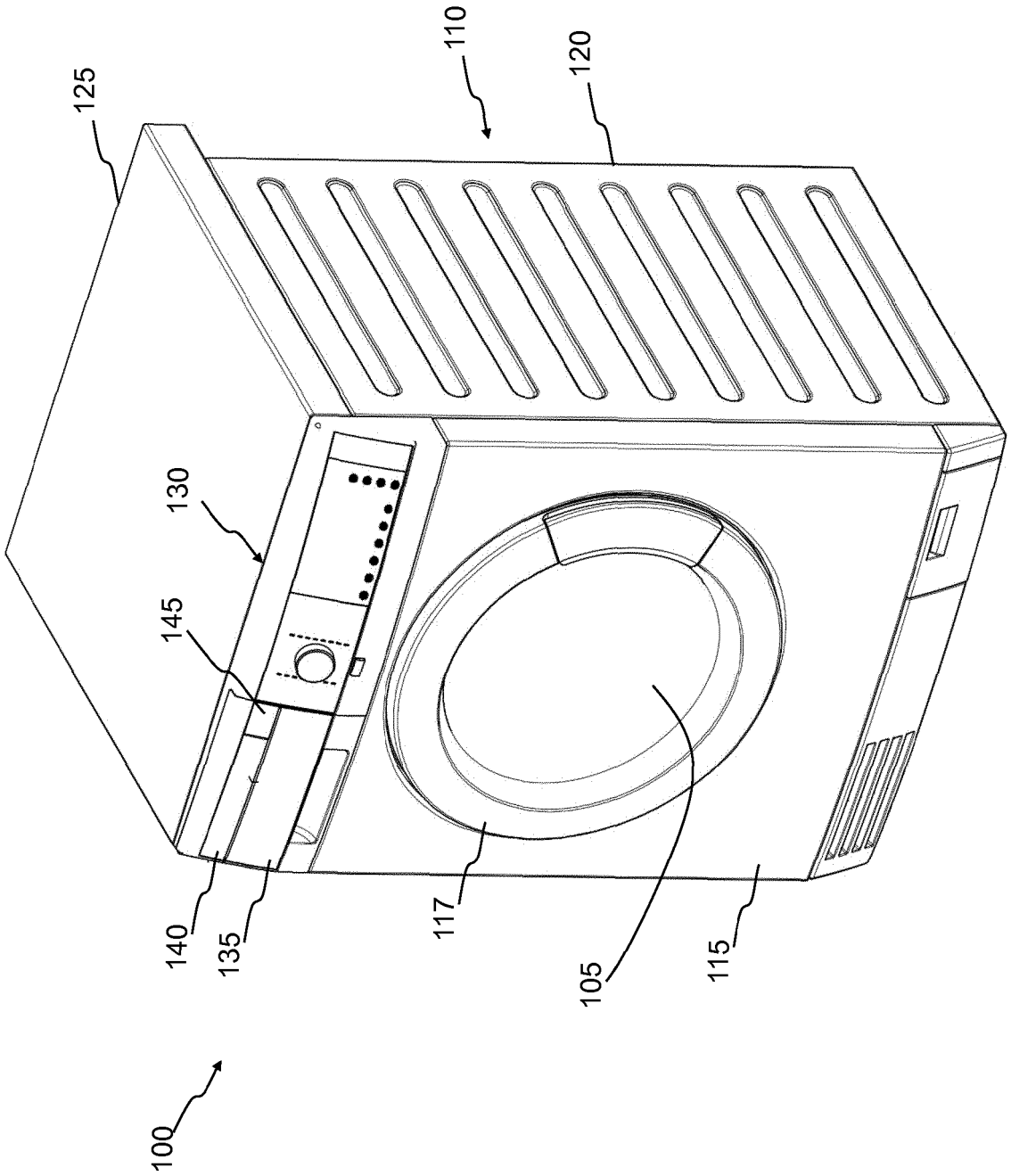
11. Machine de traitement du linge (**100**) selon la revendication 10, dans laquelle le couvercle (**306**) comprend une pluralité d'arêtes de couvercle (**363**) faisant saillie vers la boîte à filtre (**303**) une fois que le couvercle (**306**) est dans la position fermée, et
dans laquelle la boîte à filtre (**303**) comprend des arêtes de boîte correspondantes (**367**) faisant saillie vers le couvercle (**306**) une fois que le couvercle (**306**) est dans la position fermée, les arêtes de couvercle (**363**) étant agencées pour s'intercaler avec les arêtes de boîte (**367**) une fois que le couvercle (**306**) est dans la position fermée formant ainsi un trajet sinueux capable de gêner le passage de peluches.

12. Machine de traitement du linge (**100**) selon l'une quelconque des revendications précédentes dans laquelle la chambre creuse (**361**) est délimitée par une paroi de guidage (**354**) et une paroi latérale (**303d**), le déflecteur d'écoulement d'air (**370**) étant agencé entre elles de manière à former avec au moins l'une desdites paroi de guidage (**354**) et paroi latérale (**303d**) un trajet ayant une partie convergente le long de la direction de l'écoulement d'air.

13. Machine de traitement du linge (**100**) selon l'une quelconque des revendications précédentes dans laquelle le déflecteur d'écoulement d'air est mobile d'une première position, dans laquelle l'écoulement d'air est dirigé vers une première partie **(395a)** du filtre à peluches, vers une seconde position, dans laquelle l'écoulement d'air est dirigé vers une seconde partie **(395b)** du filtre à peluches (**218**).

14. Machine de traitement du linge (**100**) selon l'une quelconque des revendications précédentes dans laquelle le déflecteur d'écoulement d'air est déformable entre une configuration au repos, dans laquelle l'écoulement d'air est dirigé vers une première partie **(395a)** du filtre à peluches, et une configuration déformée, dans laquelle l'écoulement d'air est dirigé vers une seconde partie **(395b)** du filtre à peluches (**218**).

FIG.1



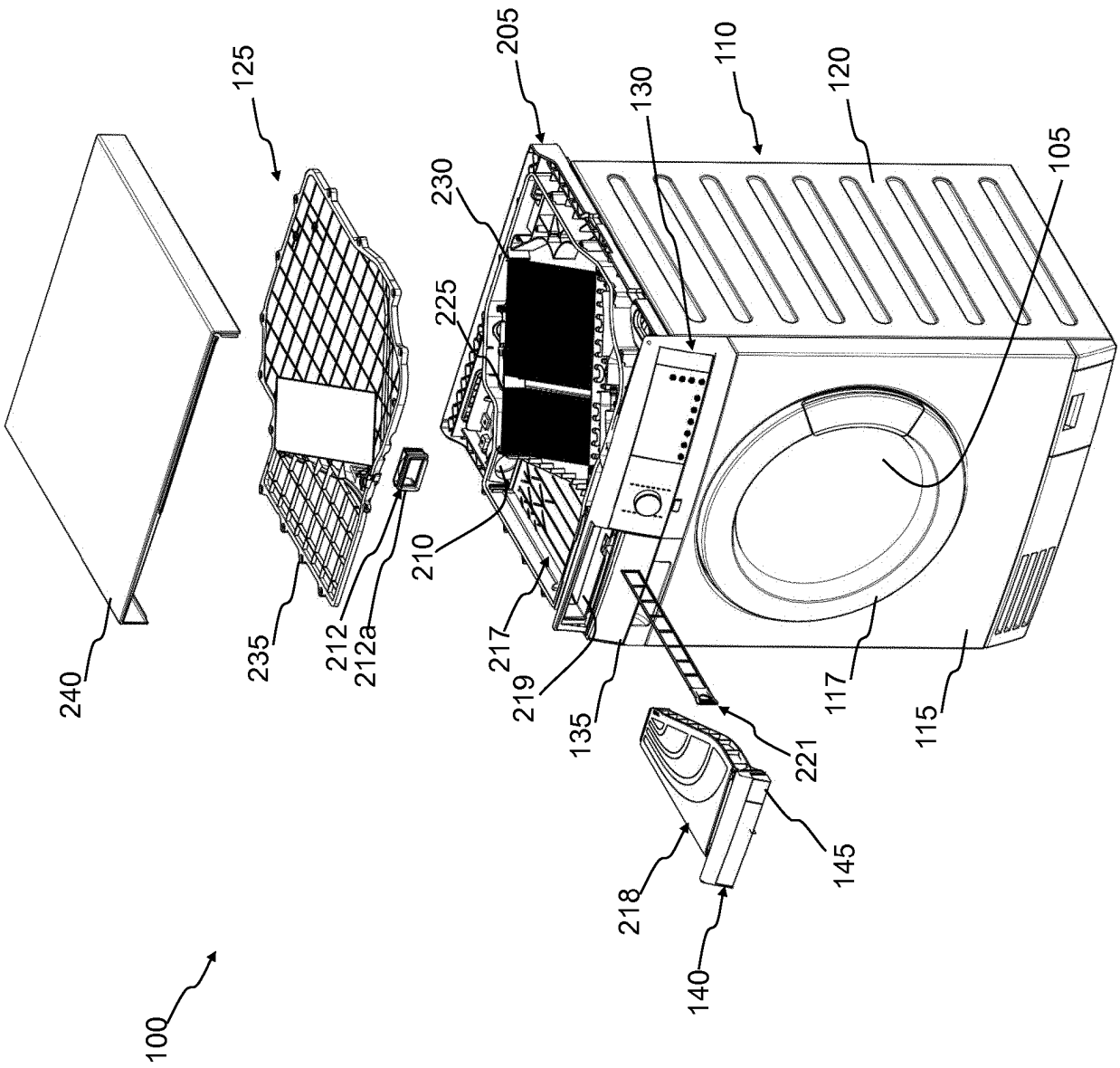
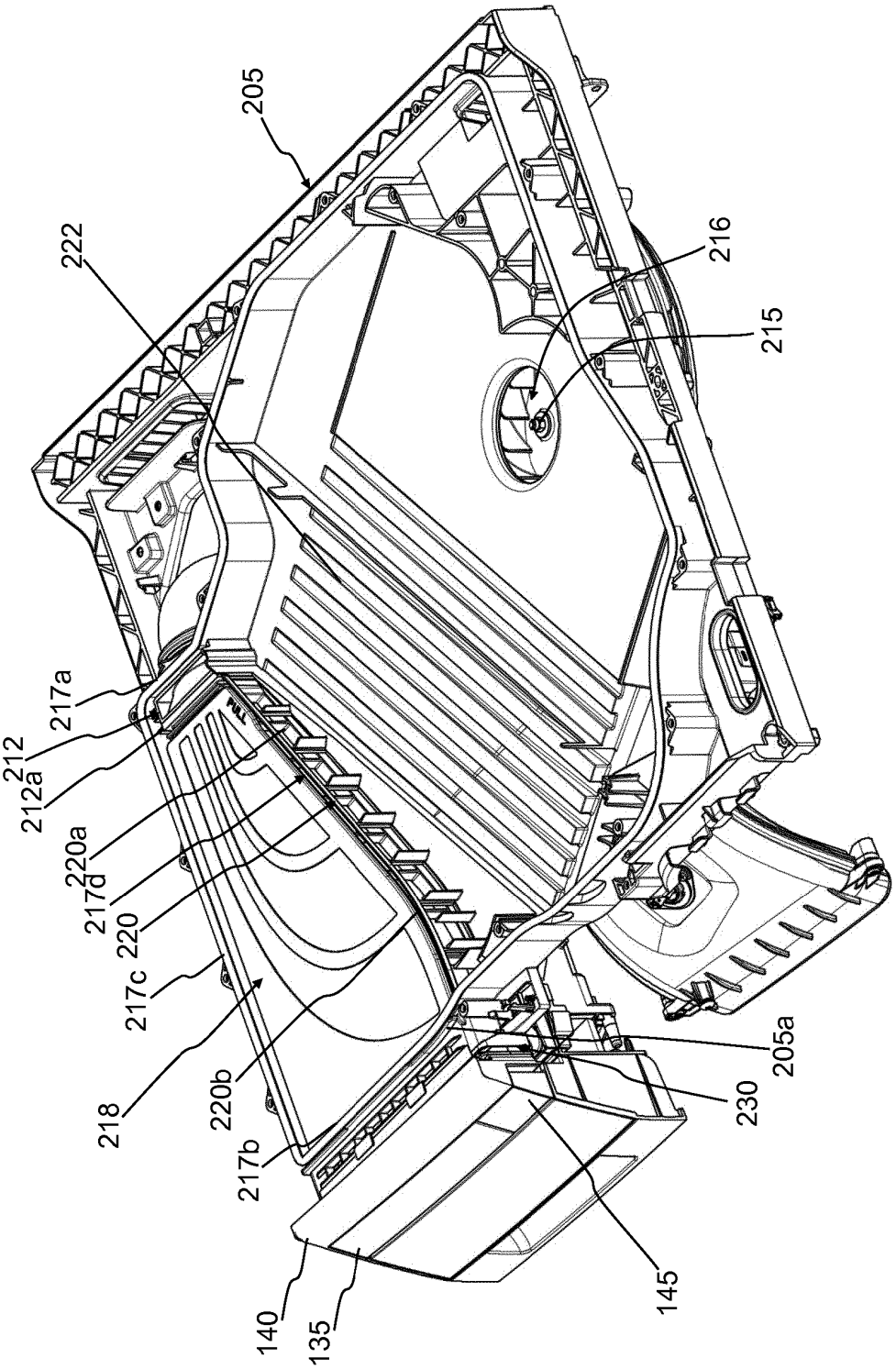

100
240
125
235
212
212a
210
205
230
225
217
219
135
130
110
120
105
117
115
221
145
218
140

FIG.2A

FIG.2B


205
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212
212a
220a
217d
220
217c
218
220b
217b
140
135
145
230
205a

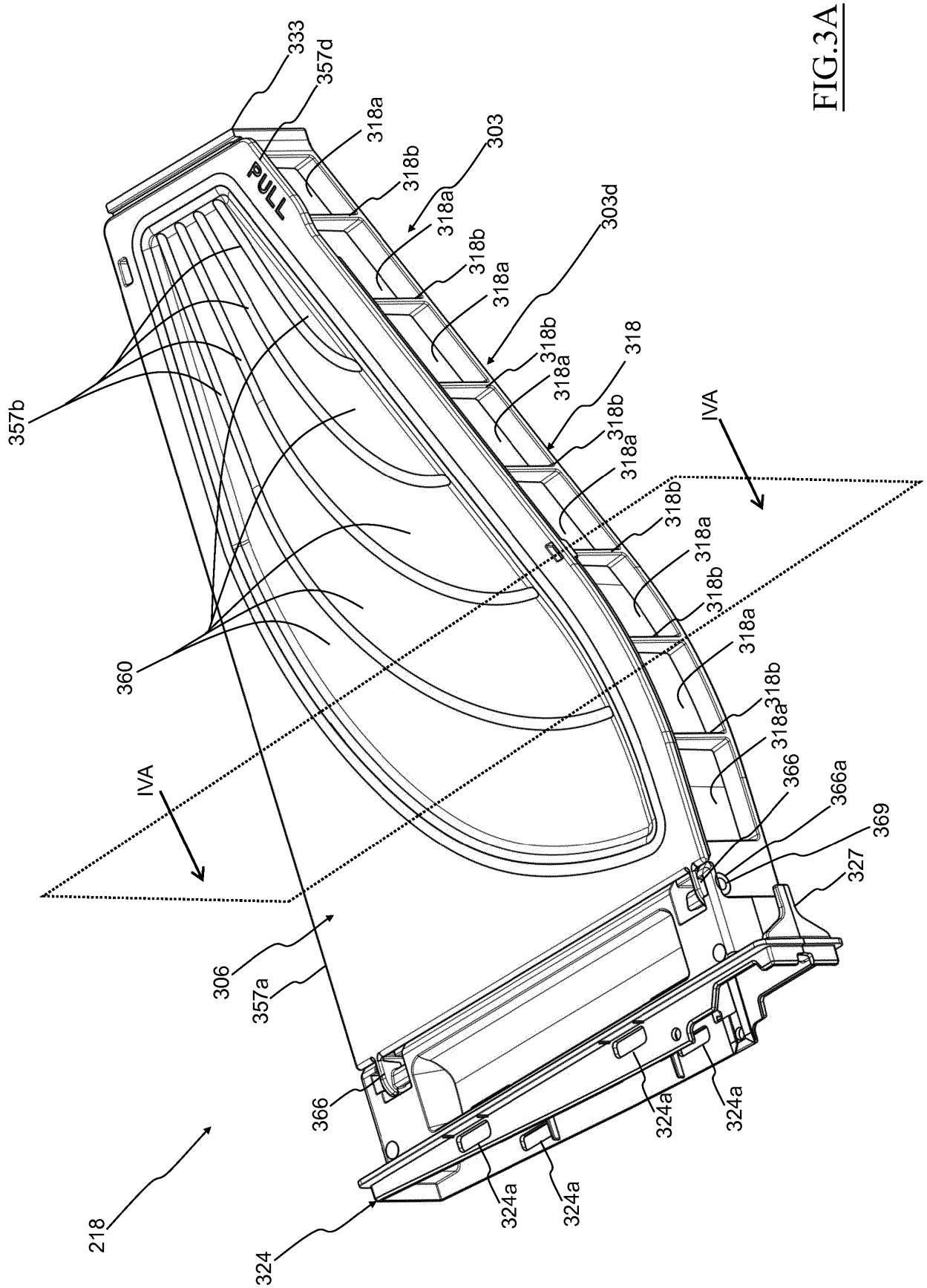
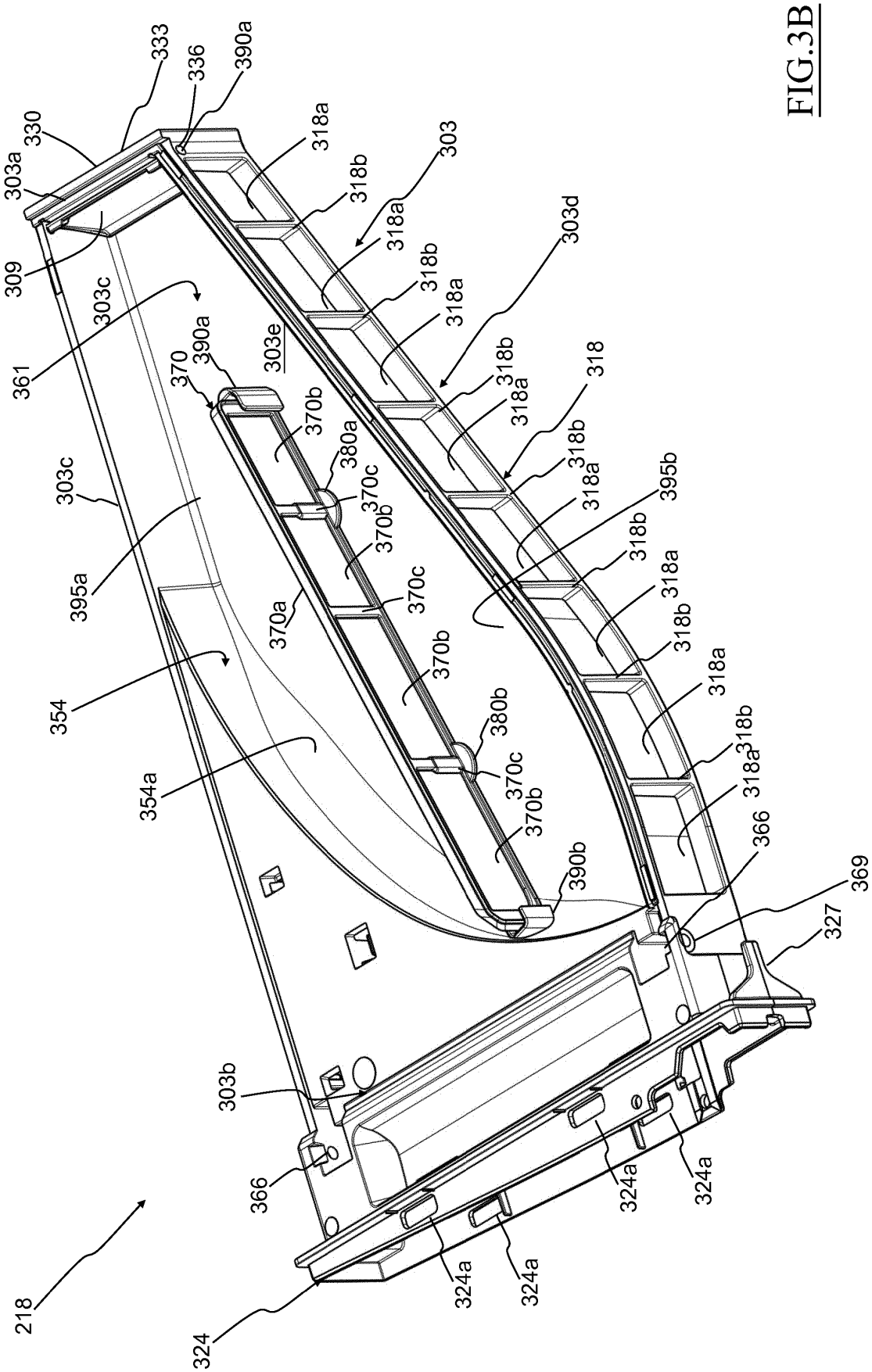

333
357d
318a
318b
303
318a
303d
318b
318a
318
318b
318a
318b
318a
318b
318a
318b
318a
366
366a
369
327
IVA
IVA
357b
360
306
357a
366
218
324
324a
324a
324a
324a

FIG.3A


218
324
324a
324a
324a
324a
303b
366
354
354a
303c
395a
361
309
303a
330
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336
390a
303c
303e
370
390a
370b
380a
370c
370b
370a
370c
370b
380b
370c
370b
390b
318a
318b
303
318a
318b
303d
318a
318b
318
318a
318b
395b
318a
318b
318a
318b
318a
318a
318b
366
369
327

FIG.3B

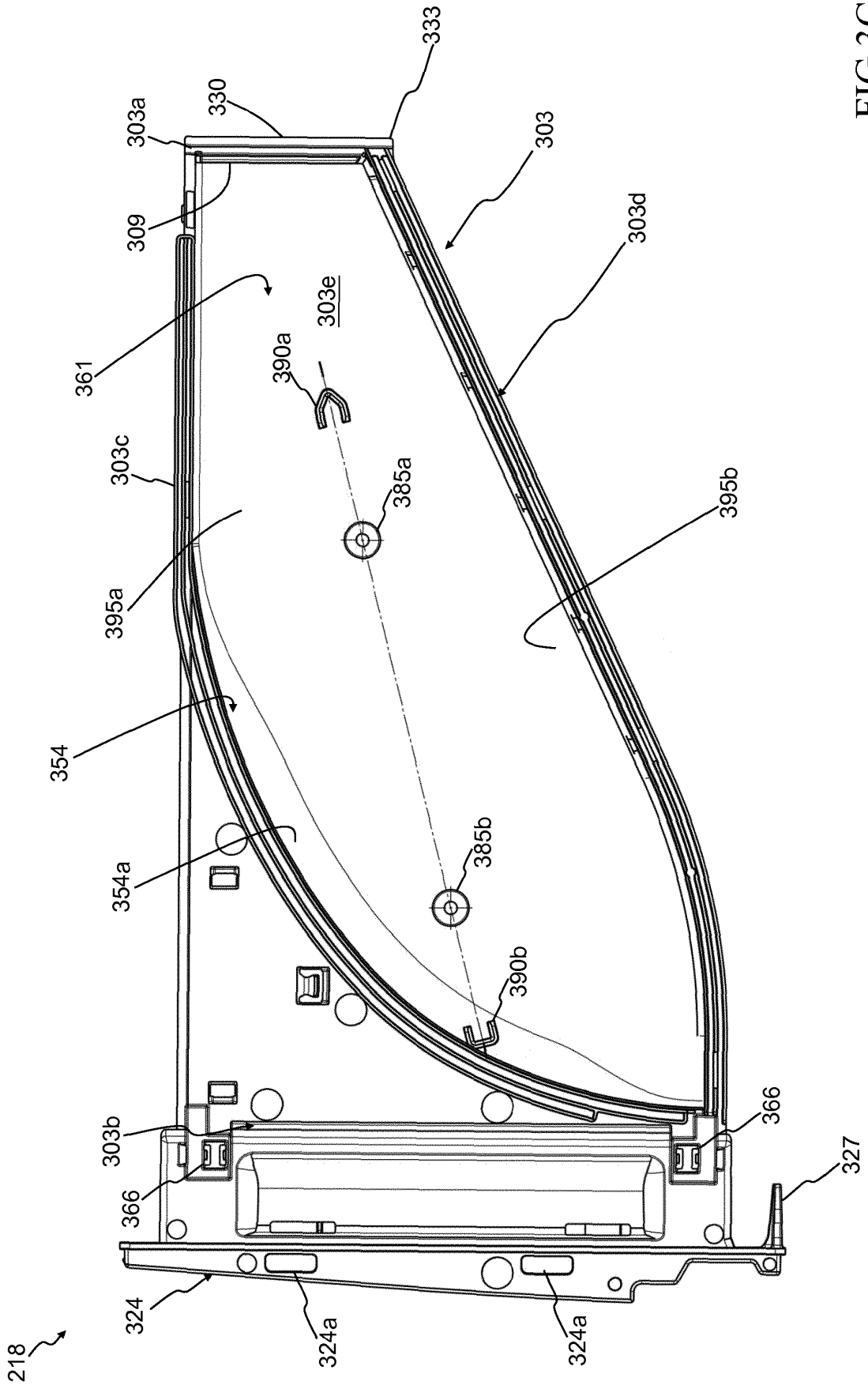

218
324
324a
324a
366
303b
366
327
354a
354
395a
303c
361
309
303a
330
333
303
303d
395b
303e
390a
385a
385b
390b

FIG.3C

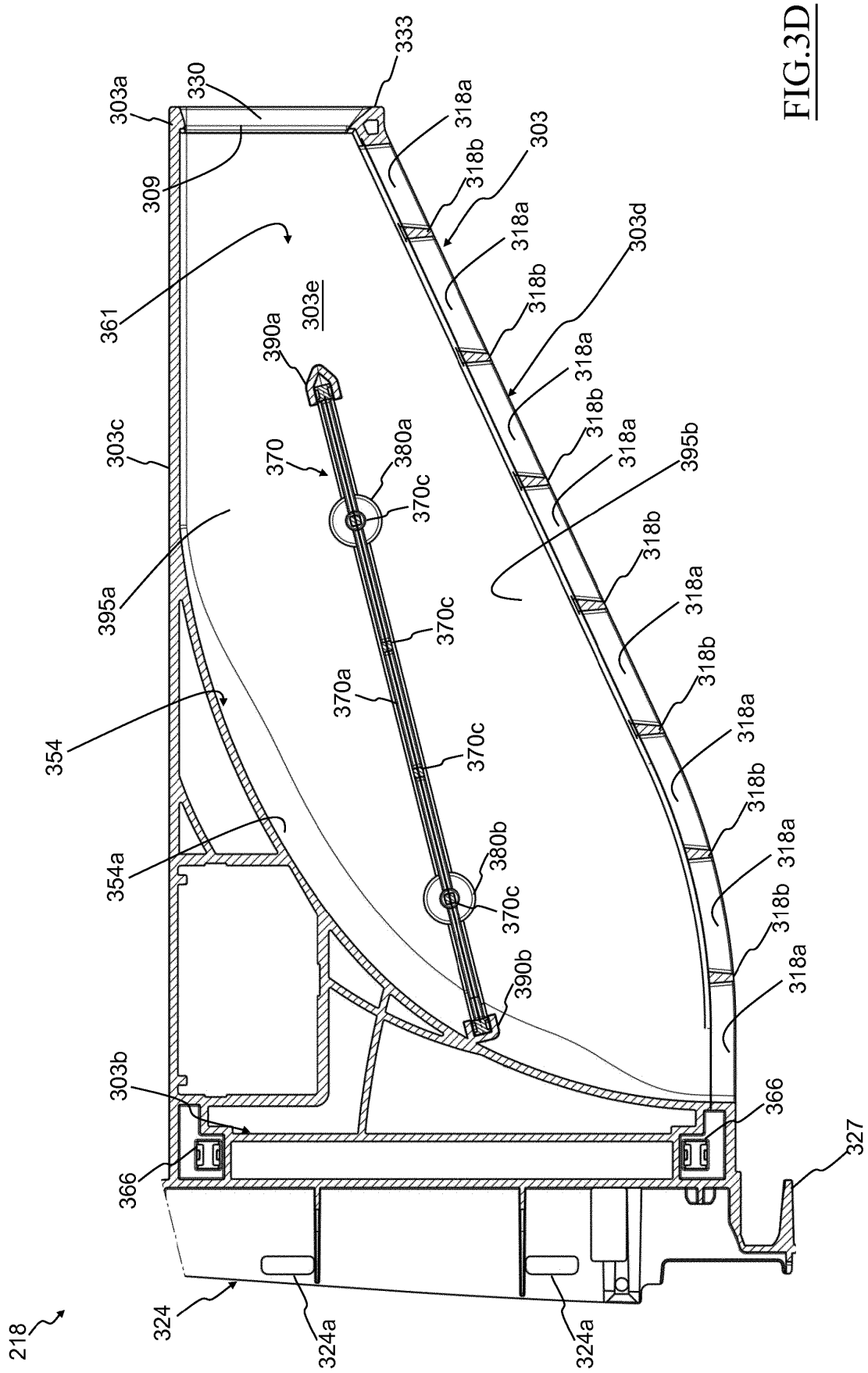

218
324
324a
324a
366
366
303b
303c
303a
330
333
309
361
303e
303
303d
318a
318b
390a
370
380a
370c
370a
380b
390b
395a
395b
354
354a
327

FIG.3D

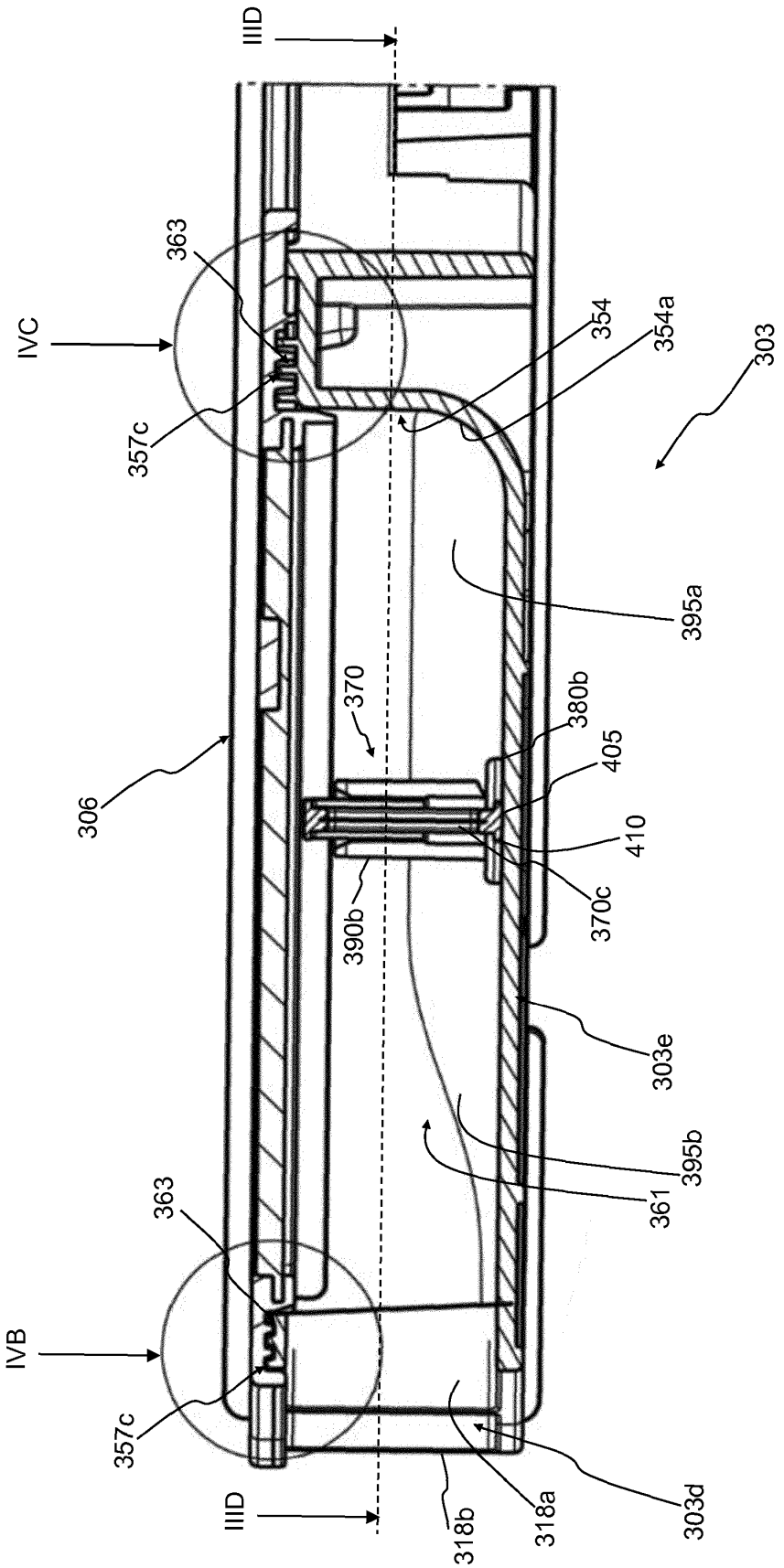

IIID
363
IVC
354
354a
303
357c
395a
370
380b
306
405
410
370c
390b
303e
395b
361
363
IVB
357c
IIID
318b
318a
303d

FIG.4A

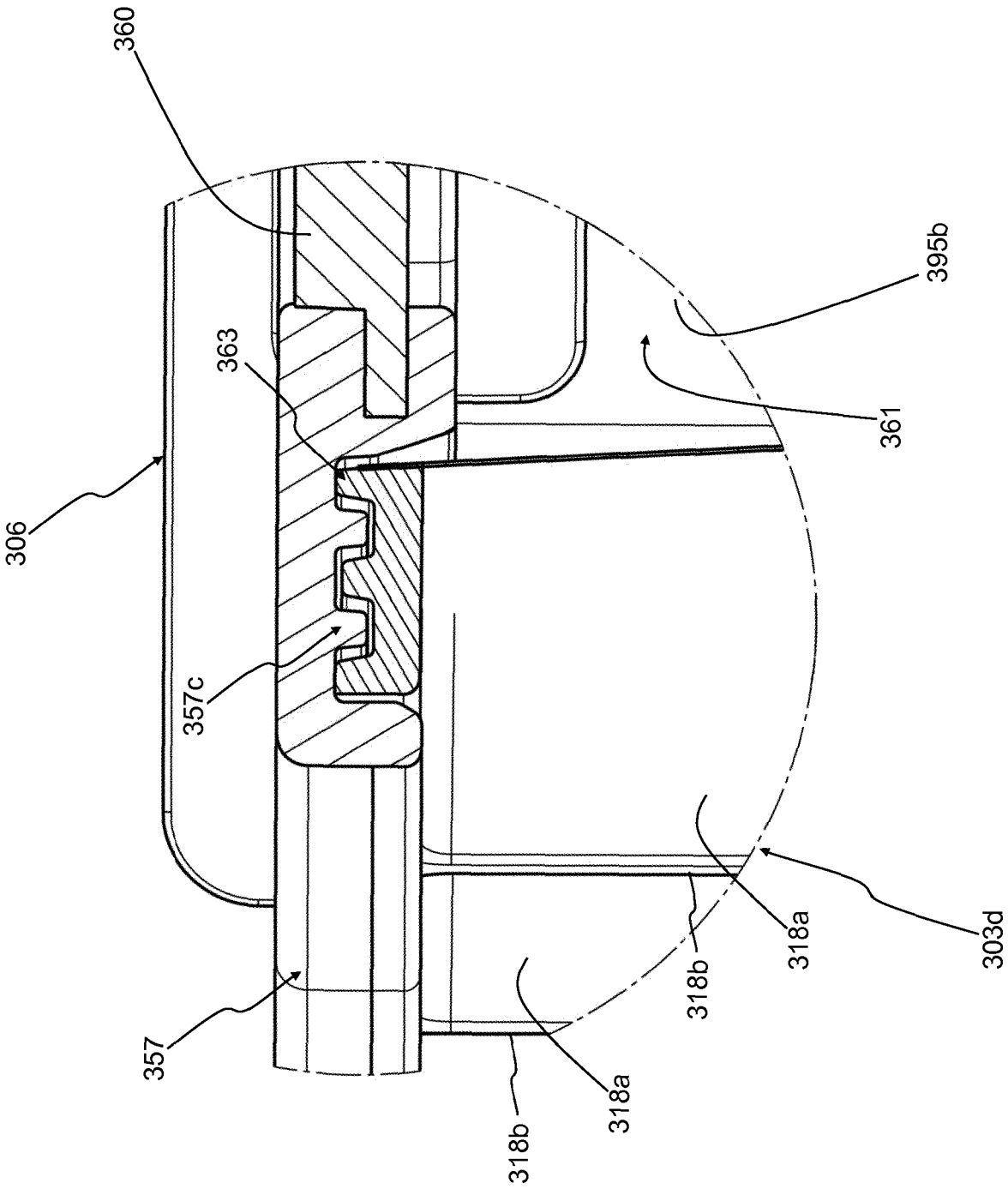


FIG.4B

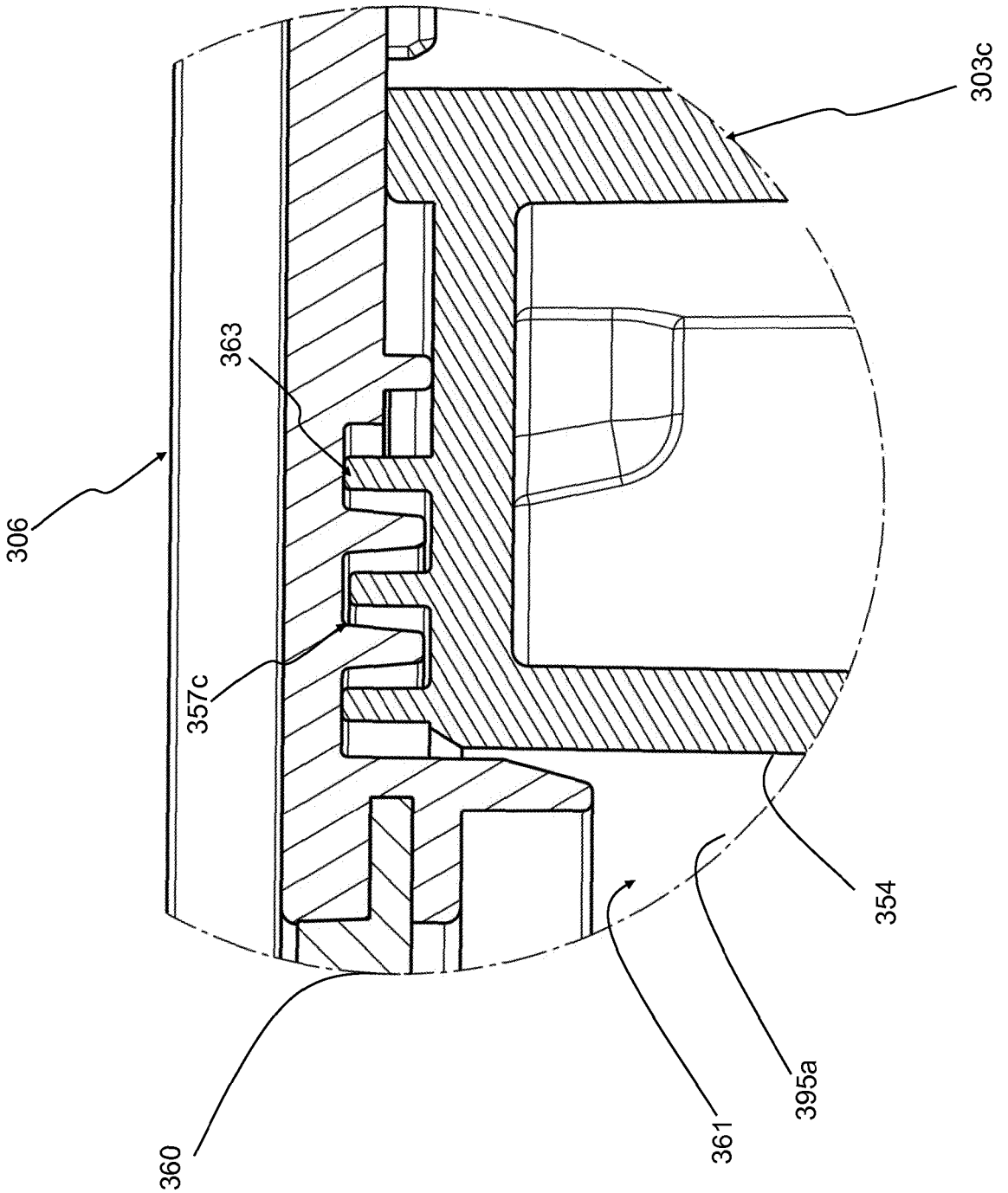


FIG.4C

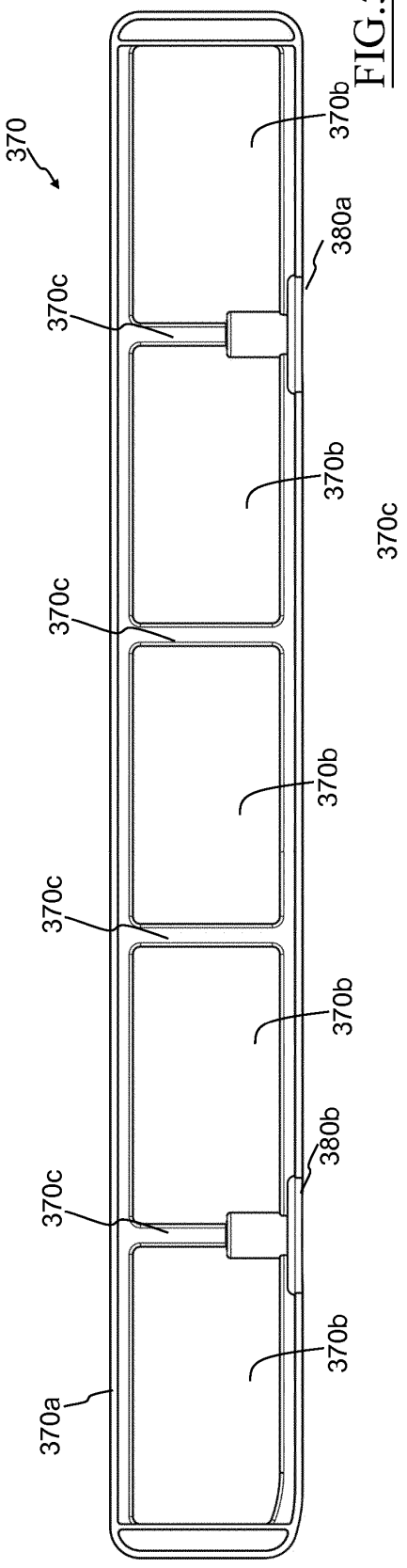

370
370b
380a
370c
370b
370c
370c
370b
370c
370b
380b
370c
370b
370a

FIG.5A

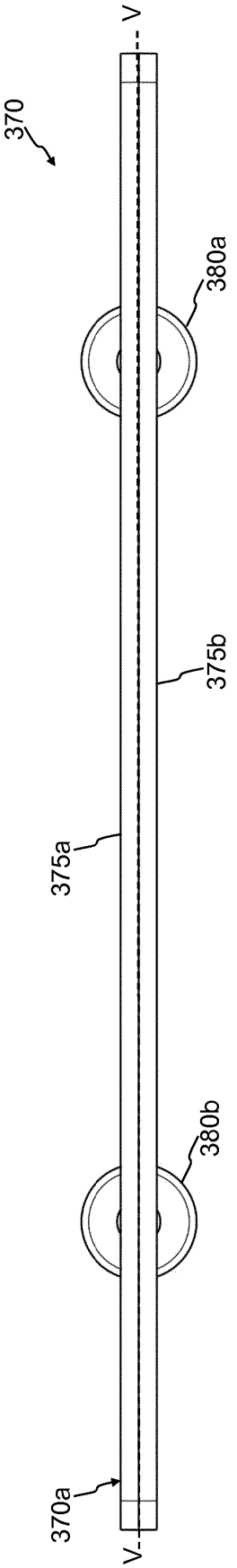

V
370
380a
375b
375a
380b
370a
V

FIG.5B

FIG.6

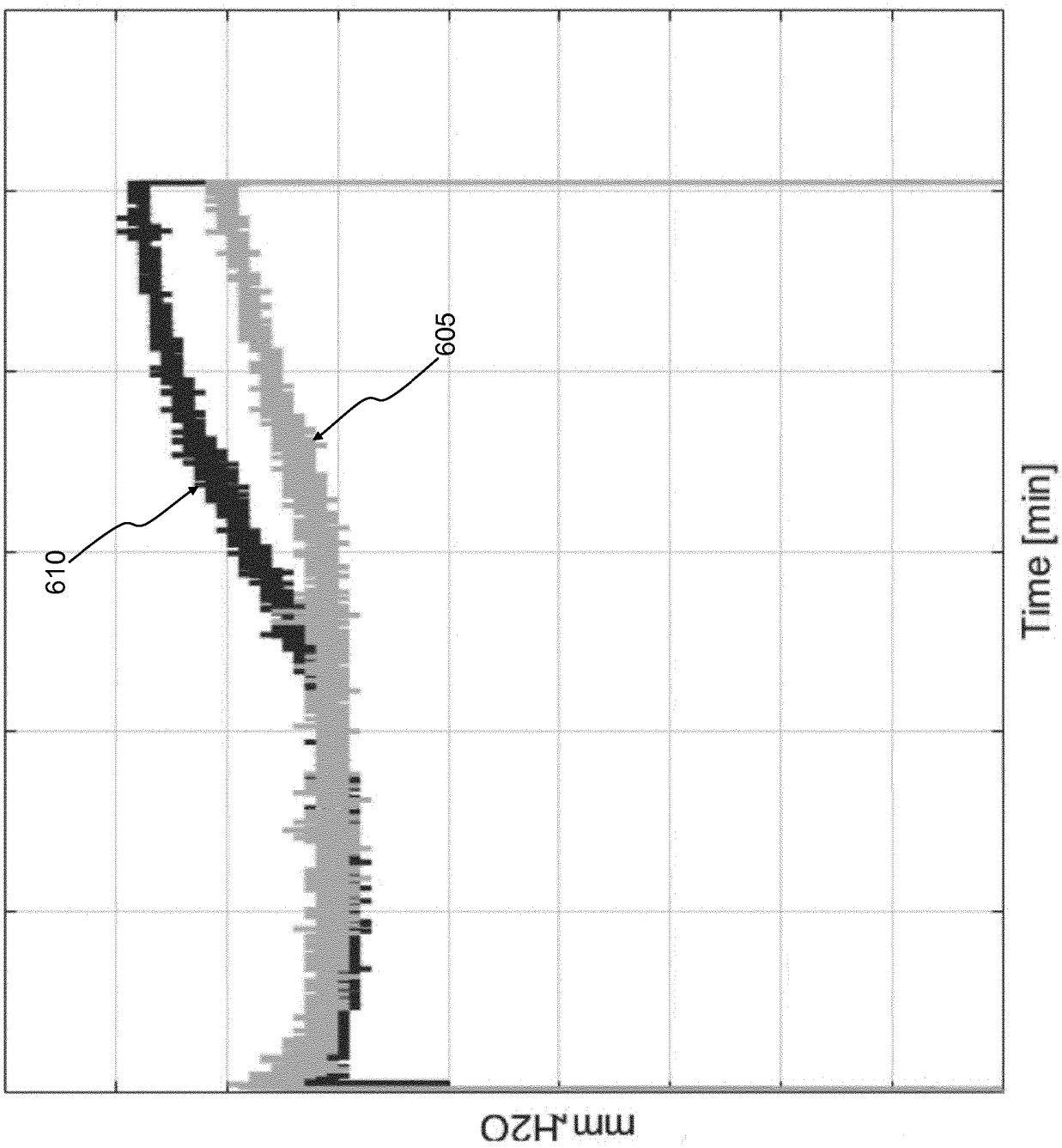
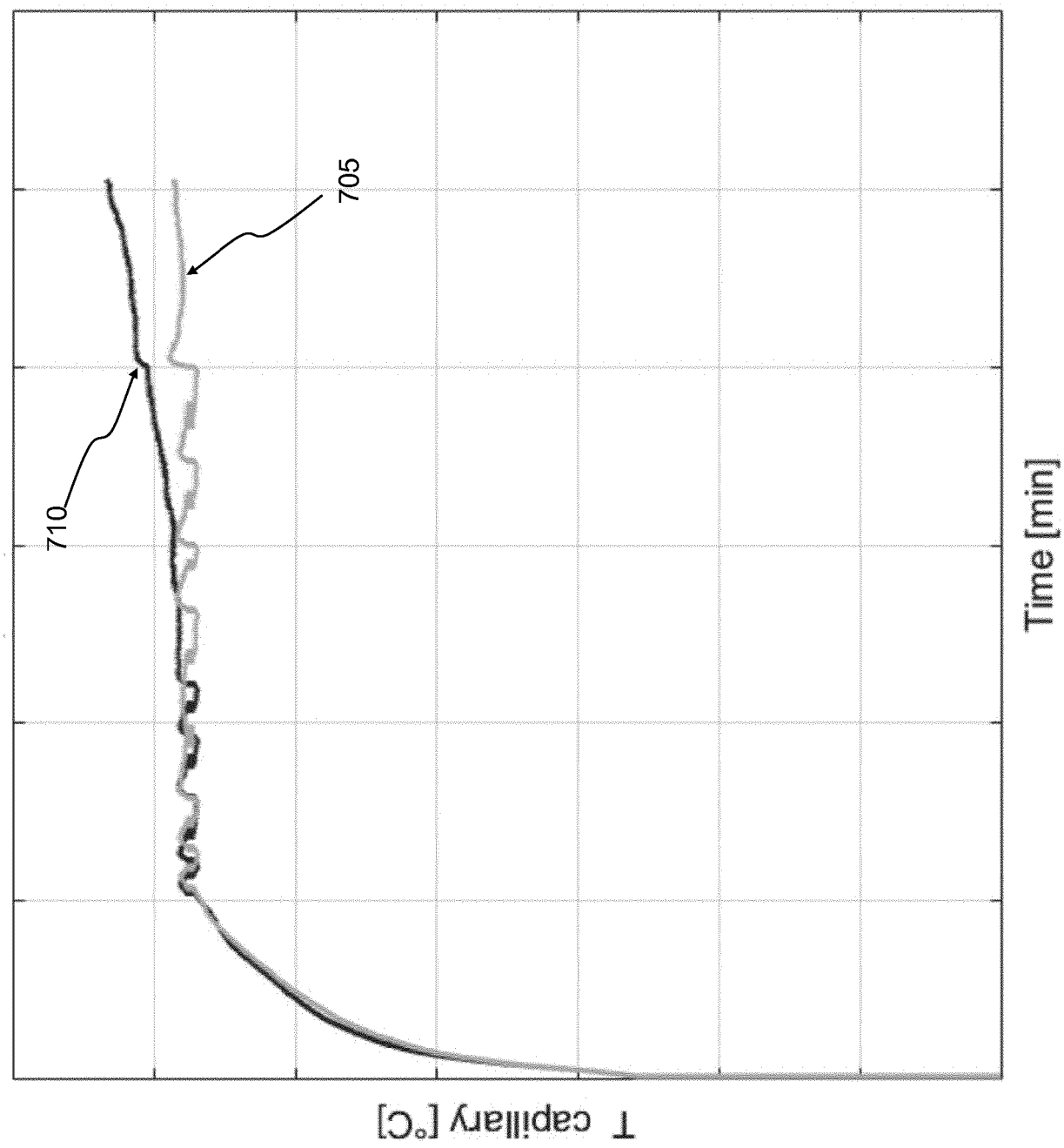


FIG.7



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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- US 5651188 A **[0010]**