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(54) **Filter for filtering impurities in a dryer and dryer with such a filter**

Filter zum Filtern von Verunreinigungen in einem Trockner sowie Trockner mit einem solchen Filter

Filtre pour filtrer des impuretés dans un séchoir et séchoir avec un tel filtre

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US-A1- 2010 154 241**

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Description

[0001] The present invention relates to a filter for eliminating impurities present in the air jet of a clothes dryer according to the preamble of claim 1. The present invention also relates to a clothes dryer equipped therewith.

[0002] Clothes dryers are per se known, and typically comprise a drum containing laundry to be dried by an air jet generated by a fan and heated by an electric resistor or by a condenser device in a machine fitted with a heat pump.

[0003] The hot air jet flows through the laundry in the drum, thereby subtracting moisture therefrom, and then flows through a filter that eliminates any impurities present in the air jet.

[0004] Said air jet also flows through a heat exchanger, where it cools down through the effect of thermal exchange with colder environmental air, thus condensing and yielding water, which flows into a collection tank usually located in the lower part of the machine; from the collection tank, the water is conveyed by a pump into a removable container typically arranged in the upper part of the machine, in a position easily accessible to a user, who can then periodically remove and empty said container.

[0005] It is clear that the clothes dryers known in the art may not include a collection tank; in such cases, they are only equipped with the container for collecting the condensed water, said container being usually positioned in the lower part of the machine.

[0006] As a consequence, the clothes dryers known in the art comprise:

- a frame that houses a drum for containing laundry to be dried,
- first means for delivering heated air into said drum,
- a filter for eliminating any impurities present in the air jet coming from the drum.

[0007] Furthermore, said clothes dryers may also comprise:

- heat exchanger means crossed by the air coming from the drum,
- at least one container for collecting the condensed water produced by said heat exchanger means.

[0008] In particular, a filter for eliminating air jet impurities is known whose structure contains a filtering element. Such a filter usually has an aperture that makes it easier for the entire air jet coming from the drum to enter the filter, so as to obtain the elimination of any impurities present in said air jet. Moreover, said filter is generally so shaped that it can be placed into a suitable housing of the clothes dryer.

[0009] However, the filters known in the art suffer from some drawbacks, in that it often happens that it is difficult to remove the impurities collected therein.

[0010] A further drawback of prior-art filters is that, even when said filters can be opened in order to remove the collected impurities, such task is often difficult, in particular because it is difficult to separate the closing means used for holding the filters in the closed condition.

[0011] Another drawback of the above-described filters is that, in an attempt to limit the room taken up by the filter inside the clothes dryer, these filters are often difficult to extract from the respective housings.

[0012] In this frame, it is the main object of the present invention to overcome the above-described drawbacks by providing a filter for eliminating impurities present in the air jet of a clothes dryer as well as a clothes dryer equipped therewith, said filter being so designed as to facilitate the task of removing the impurities collected therein.

[0013] It is another object of the present invention to provide a filter for eliminating impurities present in the air jet of a clothes dryer and a clothes dryer equipped therewith which are so designed as to facilitate the task of opening the filter itself.

[0014] It is a further object of the present invention to provide a filter for eliminating impurities present in the air jet of a clothes dryer and a clothes dryer equipped therewith which are so designed as to allow the filter to be easily extracted from the respective housing in the clothes dryer.

[0015] Said objects are achieved through a filter for eliminating impurities present in the air jet of a clothes dryer and a clothes dryer equipped therewith incorporating the features set out in the appended claims, which are intended as an integral part of the present description.

[0016] Further objects, features and advantages of the present invention will become apparent from the following detailed description and from the annexed drawings, which are supplied by way of non-limiting example, wherein:

- Fig. 1 schematically shows a clothes dryer according to the present invention;
- Figs. 2a and 2b respectively show a first and a second perspective views of a filter for eliminating impurities present in the air jet of the clothes dryer of Fig. 1, designed in accordance with the present invention;
- Figs. 3a and 3b are perspective views of a first and a second details, respectively, of the filter of Figs. 2a and 2b.

[0017] With reference to the annexed drawings, in Fig. 1 reference numeral 100 designates as a whole a clothes dryer according to the present invention.

[0018] The clothes dryer 100 comprises a frame 101 that houses a drum 102 adapted to contain laundry (not shown) to be dried, said drum 102 being accessible from the outside through a door 103 usually fitted with sealing gaskets (not shown).

[0019] The clothes dryer 100 also comprises first

means 104, 105 for delivering heated air into said drum 102. In particular, said first means may comprise an electric resistor 104 and a fan 105 (as shown in Fig. 1); or, in the case of a clothes dryer equipped with a heat pump (not shown in the drawings), said first means may comprise a condenser and a fan.

[0020] The clothes dryer 100 further comprises second heat exchanger means 106 crossed by the air coming from the drum 102; preferably, said second means comprise an exchanger 106, where the humid air coming from the drum 102 condenses.

[0021] The clothes dryer 100 also comprises at least one container 107 for collecting the condensed water produced by said second heat exchanger means 106.

[0022] In particular, when exiting the drum 102 the humid air flows through a filter 1 adapted to eliminate the impurities present in the air jet; the hot humid air is then cooled by thermal exchange with colder air (normally at ambient temperature) in said second means 106, said colder air being possibly conveyed by a second fan (not shown in Fig. 1).

[0023] The condensed water present in a collection tank 108 is delivered by a pump 109 towards the container 107, wherein it is collected. It is however clear that the container 107 may also be arranged in a lower part of the clothes dryer 100 according to the present invention; in such a case, the clothes dryer 100 may even lack the collection tank 108 and/or the pump 109.

[0024] The one described above is a basic scheme of a clothes dryer, useful for understanding the operation thereof; in practice, however, the clothes dryer 100 may include additional components which have been omitted in the present description for simplicity.

[0025] Figs. 2a and 2b respectively show a first and a second perspective views of the filter 1 according to the present invention.

[0026] As can be seen in these drawings, the filter 10 comprises a first frame 10 and a second frame 20 which enclose a filtering element F (schematically shown in Fig. 2a only), said first 10 and second 20 frames being connected together along respective first edges 11, 21 adjacent to each other, so that the filter 1 can be opened like a book.

[0027] The connection along said first edges 11, 21 substantially allows said first 10 and second 20 frames to rotate about an axis X, indicated in Fig. 2b by means of a dashed-dotted line.

[0028] The particular shape of the filter 1 according to the present invention facilitates the task of removing the impurities collected inside said filter 1; in fact, the possibility of opening the filter 1 like a book allows the filtering element F to be easily extracted for reconditioning, in particular by removing the impurities trapped therein.

[0029] According to the present invention, the first 10 and second 20 frames comprise respective second edges 12, 22 fitted with straps 13, 23, each one of said straps 13, 23 comprising:

- a hole 14, 24;
- coupling means 15, 25 that allow the filter 1 to be kept in the closed condition.

[0030] In particular, said closed condition of the filter 1 is shown in Fig. 2a, whereas Fig. 2b shows the filter 1 in an open condition. These drawings also show that the first strap 13 comprises a first hole 14 and the second strap 23 comprises a second hole 24.

[0031] The above-described particular design of the filter 1 also facilitates the extraction of the filter 1 from the respective housing in the clothes dryer 100, as well as the tasks of opening the filter 1 and removing the impurities collected inside the filter 1.

[0032] In fact, the holes 14, 24 of said straps 13, 23 allow the user to put his/her fingers into them in order to extract the filter 1 from the clothes dryer 100 and to disengage the coupling means 15, 25 for opening the filter 1. In particular, to open the filter the user will just have to move the holes 14, 24 apart so as to disengage said coupling means 15, 25.

[0033] In particular, said coupling means comprise:

- at least one protuberance 15 associated with the first strap 13 of the first frame 10;
- at least one recess 25 obtained on the second strap 23 of the second frame 20, said recess 25 being adapted to receive the protuberance 15 of the first strap 13 of the first frame 10.

[0034] In Figs. 3a and 3b, which respectively show a perspective top view of the first frame 10 (and of the first strap 13) and a perspective bottom view of the second frame 20 (and of the second strap 23), it is possible to observe more clearly said at least one protuberance 15 and said at least one recess 25.

[0035] In particular, Figs. 2b, 3a and 3b show that said at least one protuberance 15 is associated with a free end 13E of the first strap 13 and said at least one recess 25 is associated with a free end 23E of the second strap 23. Preferably, said at least one protuberance 15 is obtained on a top face 13S of the first strap 13, in particular near said free end 13E of the first strap 13; in a complementary manner, said at least one recess 25 is obtained on a bottom face 23I of said second strap 23, in particular near said free end 23E of the second strap 23.

[0036] It is clear that said first 13 and second 23 straps may comprise a plurality of protuberances 15 and/or recesses 25; moreover, each one of said first 13 and second 23 straps may comprise one or more protuberances 15 and/or one or more recesses 25.

[0037] In a preferred embodiment, said first 13 and second 23 straps comprise abutment means 16, 26 that ensure the correct alignment between the first 10 and the second 20 frames when the filter 1 is in the closed condition (as shown in Fig. 2a). In particular, said abutment means comprise:

- a window 16 obtained on the first strap 13, in particular near said free end 13E of the first strap 13;
- a tooth 26 obtained on the second strap 23, adapted to enter into said window 16, in particular said tooth 26 being obtained near said free end 23E of the second strap 23.

[0038] In addition, said first 13 and second 23 straps may be made in one piece with said first 10 and second 20 frames, respectively, e.g. when moulding said first 10 and second 20 frames, which are usually made of plastic material; as an alternative, said first 13 and second 23 straps may be manufactured separately from the first 10 and second 20 frames and then associated therewith.

[0039] Preferably, said first 13 and second 23 straps are positioned substantially perpendicular to said first 10 and second 20 frames.

[0040] In a preferred embodiment, the free ends 13E, 23E of said first 13 and second 23 straps are wavy, so as to increase the area of mutual contact. Furthermore, each one of said straps 13, 23 has a plurality of slots 17, 27, in particular for the purpose of allowing an adequate flow of air from the drum 102 of the clothes dryer 100.

[0041] Preferably, the filter 1 substantially has a V-shaped cross-section, i.e. it is so designed as to be widest at said second edges 12, 22 and/or at said straps 13, 23, said filter 1 then getting progressively narrower to a minimum value at said first edges 11 and 21.

[0042] To this end, the first 10 and/or the second 20 frames preferably have side walls 18, 28 (which are visible in particular in Figs. 2b, 3a and 3b) getting narrower in the proximity of said first edges 11, 21.

[0043] In the annexed drawings, the straps 13, 23 are associated with said first 10 and second 20 frames at the ends opposite to the first edges 11, 21; it is however apparent that it is not necessary that said second edges 12, 22 correspond to the ends of said first 10 and second 20 frames which are opposite to the first edges 11, 21. As a consequence, it is clear that the straps 13, 23 may be associated with different points with respect to the ends of said first 10 and second 20 frames.

[0044] As can be seen in particular in Fig. 1, the filter 1 is positioned underneath the door 103 of the clothes dryer 100, so that it can be easily reached by a user after opening said door 103; preferably, said filter 1 is housed in a duct C for recirculating air inside the clothes dryer 100.

[0045] The advantages of a filter 1 for eliminating impurities present in the air jet of a clothes dryer 100 and of a clothes dryer 100 equipped therewith according to the present invention are apparent from the above description. In particular, one of such advantages is that the peculiar design of the filter 1 according to the present invention facilitates the extraction of the filter 1 from the respective housing in the clothes dryer 100.

[0046] Furthermore, such a design facilitates the tasks of removing the impurities collected inside the filter 1 and of opening the filter 1 itself.

[0047] In fact, the holes 14, 24 of the straps 13, 23 allow the user to easily extract the filter 1 from the clothes dryer 100 as well as to easily disengage the coupling means 15, 25 to open the filter 1 by simply moving apart the holes 14, 24.

[0048] The filter for eliminating impurities present in the air jet of a clothes dryer and the clothes dryer equipped therewith described herein by way of example may be subject to many possible variations without departing from the novelty spirit of the inventive idea; it is also clear that in the practical implementation of the invention the illustrated details may have different shapes or be replaced with other technically equivalent elements.

[0049] It can therefore be easily understood that the present invention is not limited to the above-described filter for eliminating impurities present in the air jet of a clothes dryer and the clothes dryer equipped therewith, but may be subject to many modifications, improvements or replacements of equivalent parts and elements without departing from the inventive idea, as clearly specified in the following claims.

Claims

1. A filter (1) for eliminating impurities present in the air jet of a clothes dryer (100), said filter (1) comprising a first frame (10) and a second frame (20) which enclose a filtering element (F), said first (10) and second (20) frames being connected together along respective first edges (11, 21) adjacent to each other, so that the filter (1) can be opened like a book, **characterized in that** said first (10) and second (20) frames comprise respective second edges (12, 22) fitted with straps (13, 23), each one of said straps (13, 23) comprising:

- a hole (14, 24) apt to allow a user to put his fingers into it;
- coupling means (15, 25) that allow the filter (1) to be kept in the closed condition,

said coupling means comprising:

- at least one protuberance (15) associated with the first strap (13) of the first frame (10);
- at least one recess (25) obtained on the second strap (23) of the second frame (20), said recess (25) being adapted to receive the protuberance (15) of the first strap (13) of the first frame (10);

said at least one protuberance (15) being associated with a free end (13E) of the first strap (13) and said at least one recess (25) being associated with a free end (23E) of the second strap (23); said free ends (13E, 23E) of said first (13) and second (23) straps being wavy.

2. A filter (1) according to claim 1, **characterized in that** said at least one protuberance (15) is obtained on a top face (13S) of the first strap (13), in particular near said free end (13E) of the first strap (13). 5
3. A filter (1) according to claim 1, **characterized in that** said at least one recess (25) is obtained on a bottom face (231) of said second strap (23), in particular near said free end (23E) of the second strap (23). 10
4. A filter (1) according to one or more of the preceding claims, **characterized in that** said first (13) and second (23) straps are made in one piece with said first (10) and second (20) frames, respectively. 15
5. A filter (1) according to one or more of the preceding claims, **characterized in that** said first (13) and second (23) straps are positioned substantially perpendicular to said first (10) and second (20) frames. 20
6. A filter (1) according to one or more of the preceding claims, **characterized in that** said first (13) and second (23) straps comprise abutment means (16, 26) that ensure the correct alignment between the first (10) and the second (20) frames when the filter (1) is in the closed condition. 25
7. A filter (1) according to one or more of the preceding claims, **characterized in that** each one of said straps (13, 23) has a plurality of slots (17, 27). 30
8. A filter (1) according to one or more of the preceding claims, **characterized in that** said filter (1) substantially has a V-shaped cross-section, in particular the first (10) and/or the second (20) frames having side walls (18, 28) getting narrower near said first edges (11, 21). 35
9. A filter (1) according to one or more of the preceding claims, **characterized in that** said filter (1) is positioned underneath a door (103) of the clothes dryer (100). 40
10. A filter (10) according to one or more of claims 1 and 8, **characterized in that** said filter (1) is housed in a duct (C) for recirculating air inside the clothes dryer (100). 45
11. A clothes dryer (100) comprising a filter (1) for eliminating impurities present in the air jet in accordance with one or more of the preceding claims 1 to 10. 50

Patentansprüche 55

1. Filter (1) zum Beseitigen von Verunreinigungen, die sich in dem Luftstrahl eines Wäschetrockners (100)

befinden, wobei der Filter (1) einen ersten Rahmen (10) und einen zweiten Rahmen (20) aufweist, die ein Filterelement (F) umschließen, wobei der erste Rahmen (10) und der zweite Rahmen (20) entlang jeweiligen einander benachbarten ersten Rändern (11, 21) miteinander verbunden sind, so dass der Filter (1) wie ein Buch geöffnet werden kann,

dadurch gekennzeichnet, dass

der erste Rahmen (10) und der zweite Rahmen (20) jeweilige zweite Ränder (12, 22) aufweisen, die mit Bändern (13, 23) ausgestattet sind, wobei ein jedes der Bänder (13, 23) aufweist:

- ein Loch (14, 24), das dazu ausgelegt ist, einem Benutzer zu ermöglichen, seine Finger hineinzustecken;
- Kupplungsmittel (15, 25), die erlauben, dass der Filter (1) im geschlossenen Zustand bleibt,

wobei die Kupplungsmittel aufweisen:

- zumindest einen Vorsprung (15), der dem ersten Band (13) des ersten Rahmens (10) zugeordnet ist;
- zumindest eine Vertiefung (25), die an dem zweiten Band (23) des zweiten Rahmens (20) vorgesehen ist, wobei die Vertiefung (25) dazu ausgelegt ist, den Vorsprung (15) des ersten Bands (13) des ersten Rahmens (10) aufzunehmen;

wobei der zumindest eine Vorsprung (15) einem freien Ende (13E) des ersten Bands (13) zugeordnet ist und zumindest eine Vertiefung (25) einem freien Ende (23E) des zweiten Bands (23) zugeordnet ist; wobei die freien Enden (13E, 23E) des ersten Bands (13) und des zweiten Bands (23) wellig sind.

2. Filter (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** der zumindest eine Vorsprung (15) an einer Oberseite (13S) des ersten Bands (13) vorgesehen ist, insbesondere nahe dem freien Ende (13E) des ersten Bands (13).
3. Filter (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** die zumindest eine Vertiefung (25) an einer Unterseite (231) des zweiten Bands (23) vorgesehen ist, insbesondere nahe dem freien Ende (23E) des zweiten Bands (23).
4. Filter (1) nach einem der mehreren der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** das erste Band (13) und zweite Band (23) jeweils mit dem ersten Rahmen (10) und dem zweiten Rahmen (20) einstückig hergestellt sind.
5. Filter (1) nach einem oder mehreren der vorhergehenden Ansprüche, **dadurch gekennzeichnet,**

dass das erste Band (13) und das zweite Band (23) im Wesentlichen senkrecht zu dem ersten Rahmen (10) und zweiten Rahmen (20) angeordnet sind.

6. Filter (1) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** das erste Band (13) und das zweite Band (23) Stützmittel (16, 26) aufweisen, welche die korrekte Ausrichtung zwischen dem ersten Rahmen (10) und dem zweiten Rahmen (20) sicherstellen, wenn der Filter (1) im geschlossenen Zustand ist. 5
7. Filter (1) nach einem oder mehreren der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** jeder der Bänder (13, 23) eine Mehrzahl von Schlitzten (17, 27) aufweist. 10
8. Filter (1) nach einem oder mehreren der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** der Filter (1) einen im Wesentlichen V-förmigen Querschnitt hat, wobei insbesondere der erste Rahmen (10) und/oder der zweite Rahmen (20) Seitenwände (18, 28) aufweist, die nahe den ersten Rändern (11, 21) schmaler werden. 15
9. Filter (1) nach einem oder mehreren der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** der Filter (1) unterhalb eines Bodens (103) des Wäschetrockners (100) angeordnet ist. 20
10. Filter (1) nach einem oder mehreren der Ansprüche 1 und 8, **dadurch gekennzeichnet, dass** der Filter (1) in einer Leitung (C) zum Rückführen von Luft in den Wäschetrockner (100) aufgenommen ist. 25
11. Wäschetrockner (100), der einen Filter (1) zum Beseitigen von in dem Luftstrahl vorhandenen Verunreinigungen gemäß einem oder mehreren der vorangehenden Ansprüche 1 bis 10 aufweist. 30

Revendications

1. Filtre (1) pour éliminer les impuretés présentes dans le jet d'air d'un séchoir à linge (100), ledit filtre (1) comprenant une première structure (10) et une seconde structure (20), lesquelles enferment un élément de filtration (F), lesdites première (10) et seconde (20) structures étant raccordées ensemble le long de premiers bords respectifs (11, 21) adjacents l'un à l'autre, de telle sorte que le filtre (1) peut être ouvert comme un livre, **caractérisé en ce que** lesdites première (10) et seconde (20) structures comportent des seconds bords respectifs (12, 22) assemblés avec des bandes de fixation respectives (13, 23), chacune desdites bandes (13, 23) comprenant : 45

- un trou (14, 24) conçu pour permettre à l'utilisateur d'y insérer le doigt ;
- des moyens de couplage (15, 25) qui permettent au filtre (1) d'être maintenu dans l'état fermé ;

lesdits moyens de couplage comportant .

- au moins une protubérance (15) associée à la première bande (13) de la première structure (10) ;
- au moins un évidement (25) réalisé sur la seconde bande (23) de la seconde structure (20), ledit évidement (25) étant adapté pour recevoir la protubérance (15) de la première bande (13) de la première structure (10) ;

ladite au moins une protubérance (15) étant associée à une extrémité libre (13E) de la première bande (13) et ledit au moins un évidement (25) étant associé à une extrémité libre (23E) de la seconde bande (23) ; lesdites extrémités libres (13E, 23E) desdites première (13) et seconde (23) bande étant ondulées.

2. Filtre (1) selon la revendication 1, **caractérisé en ce que** ladite au moins une protubérance (15) est formée sur une face de dessus (13S) de la première bande (13), en particulier à proximité de ladite extrémité libre (13E) de la première bande (13). 25
3. Filtre (1) selon la revendication 1, **caractérisé en ce que** ledit, au moins un, évidement (25) est formé sur une face de dessous (231) de ladite seconde bande (23), en particulier à proximité de ladite extrémité libre (23E) de la seconde bande (23). 30
4. Filtre (1) selon l'une ou plusieurs des revendications précédentes, **caractérisé en ce que** lesdites première (13) et seconde (23) bandes sont fabriquées en une pièce avec lesdites première (10) et seconde (20) structures, respectivement. 35
5. Filtre (1) selon l'une ou plusieurs des revendications précédentes, **caractérisé en ce que** lesdites première (13) et seconde (23) bandes sont positionnées essentiellement de façon perpendiculaire aux dites première (10) et seconde (20) structures. 40
6. Filtre (1) selon l'une ou plusieurs des revendications précédentes, **caractérisé en ce que** lesdites première (13) et seconde (23) bandes comportent des moyens de butée (16, 26) qui assurent l'alignement correct entre les première (10) et seconde (20) structures lorsque le filtre (1) se trouve dans l'état fermé. 45
7. Filtre (1) selon l'une ou plusieurs des revendications précédentes, **caractérisé en ce que** chacune des- 50

dites bandes (13, 23) présente une pluralité de fentes (17, 27).

8. Filtre (1) selon l'une ou plusieurs des revendications précédentes, **caractérisé en ce que** ledit filtre (1) présente essentiellement une section transversale configurée en forme de V, en particulier la première (10) et/ou la seconde (20) structure(s) comportant des parois latérales (18, 28) devenant plus étroites à proximité desdits premiers bords (11, 21). 5 10
9. Filtre (1) selon l'une ou plusieurs des revendications précédentes, **caractérisé en ce que** ledit filtre (1) est positionné au-dessous d'une porte (103) du séchoir à linge (100). 15
10. Filtre (1) selon l'une ou plusieurs des revendications 1 et 8, **caractérisé en ce que** ledit filtre (1) est logé dans un conduit (C) permettant de recycler l'air à l'intérieur du séchoir à linge (100). 20
11. Séchoir à linge (100) comprenant un filtre (1) permettant d'éliminer les impuretés présentes dans le jet d'air selon l'une ou plusieurs des revendications précédentes 1 à 10. 25

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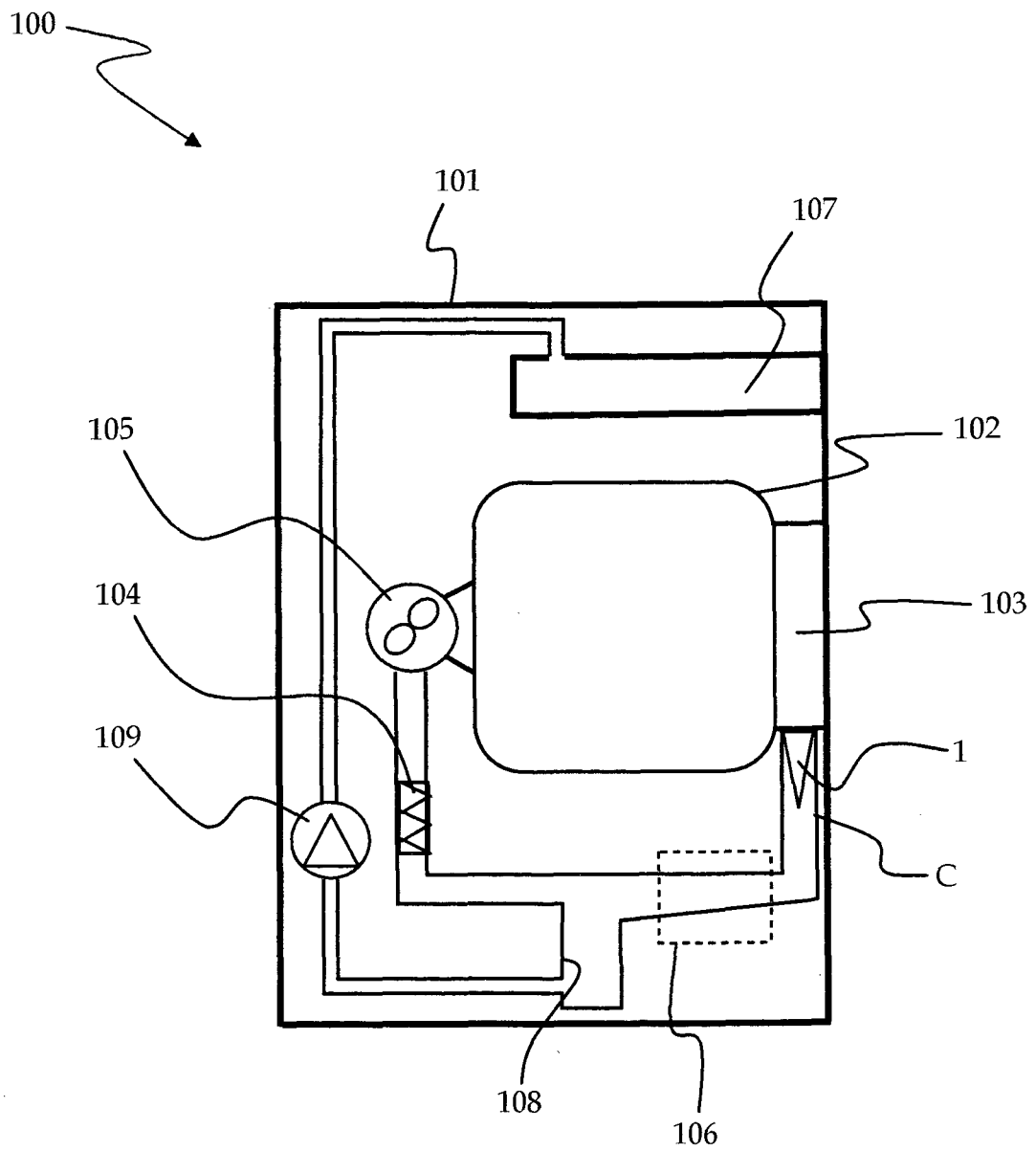


Fig. 1

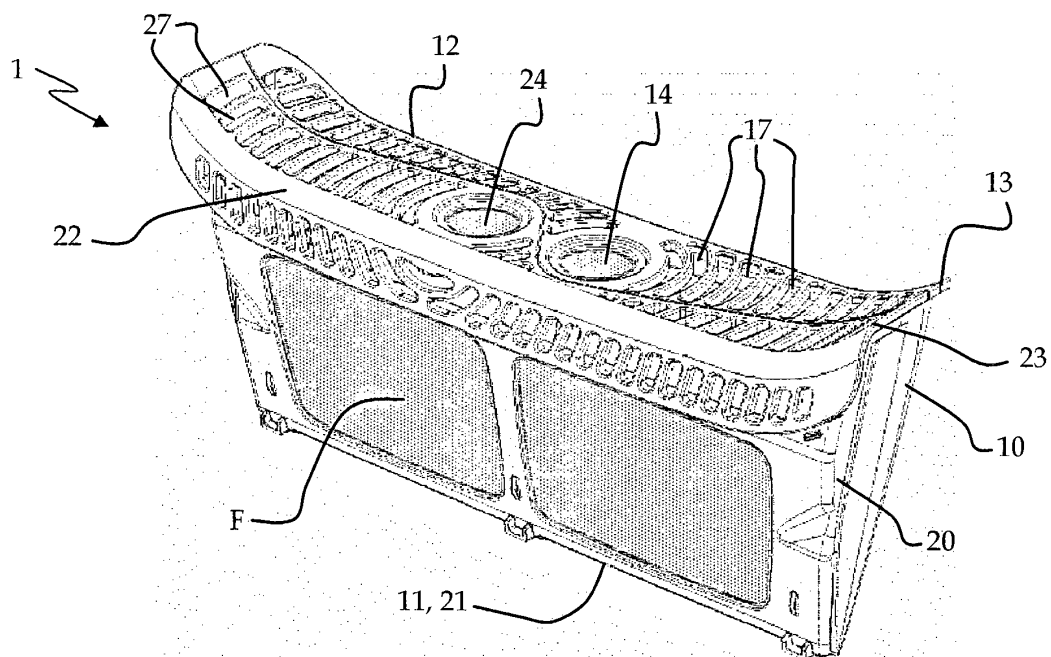


Fig. 2a

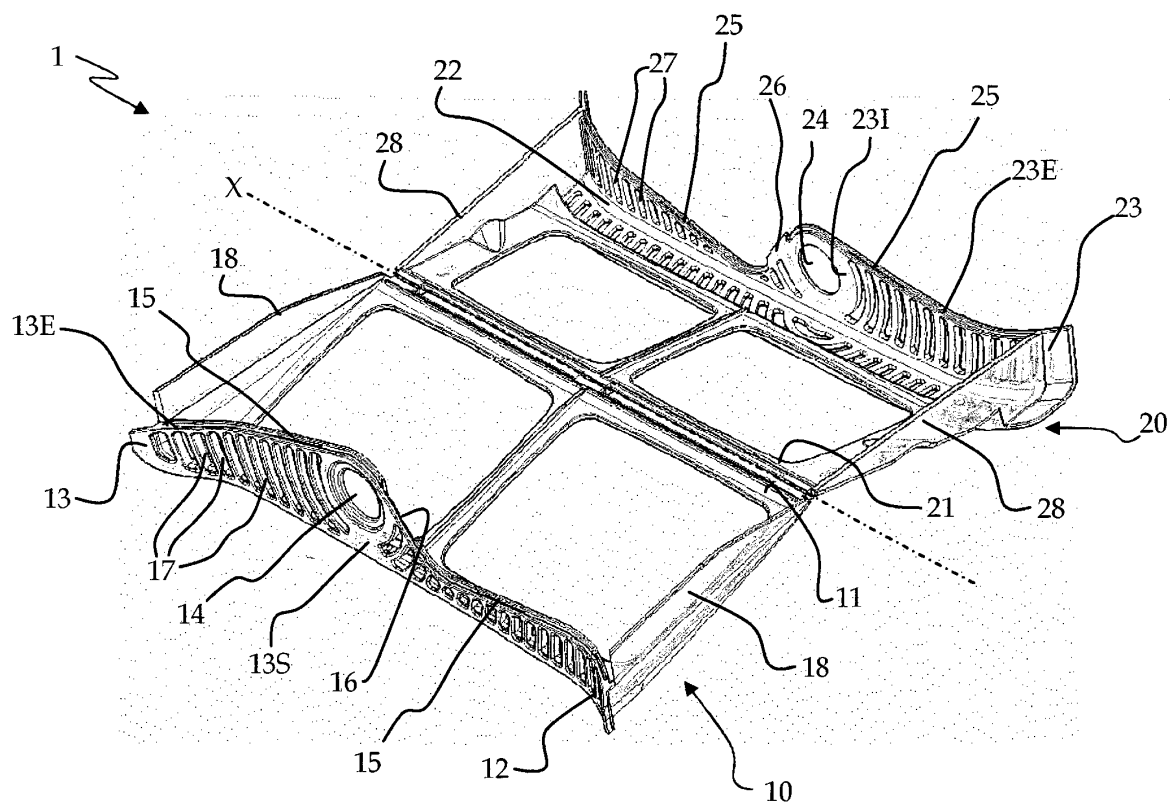


Fig. 2b

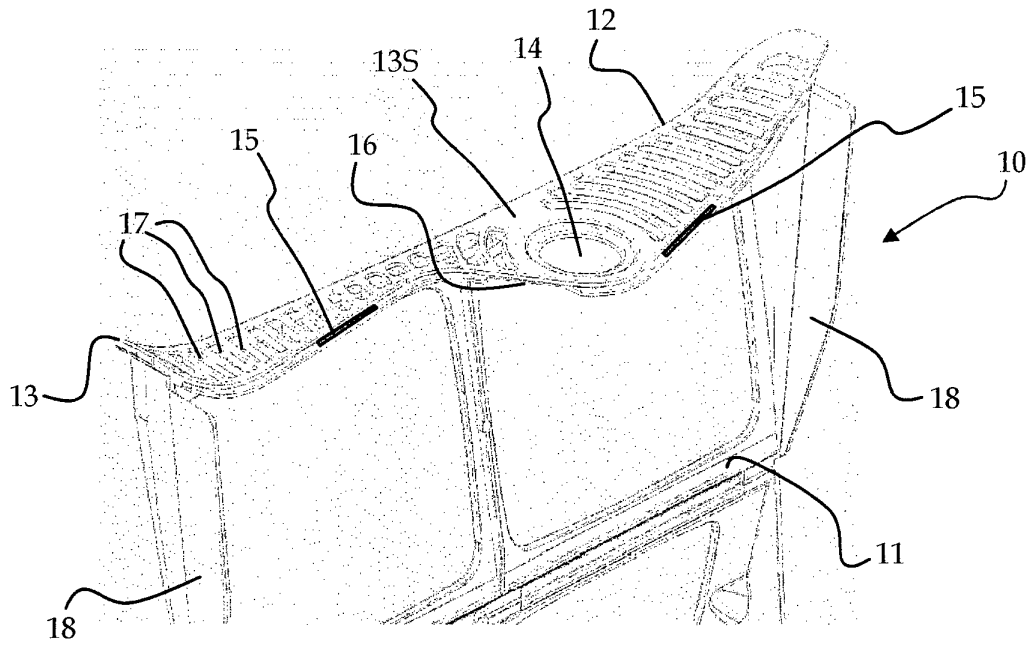


Fig. 3a

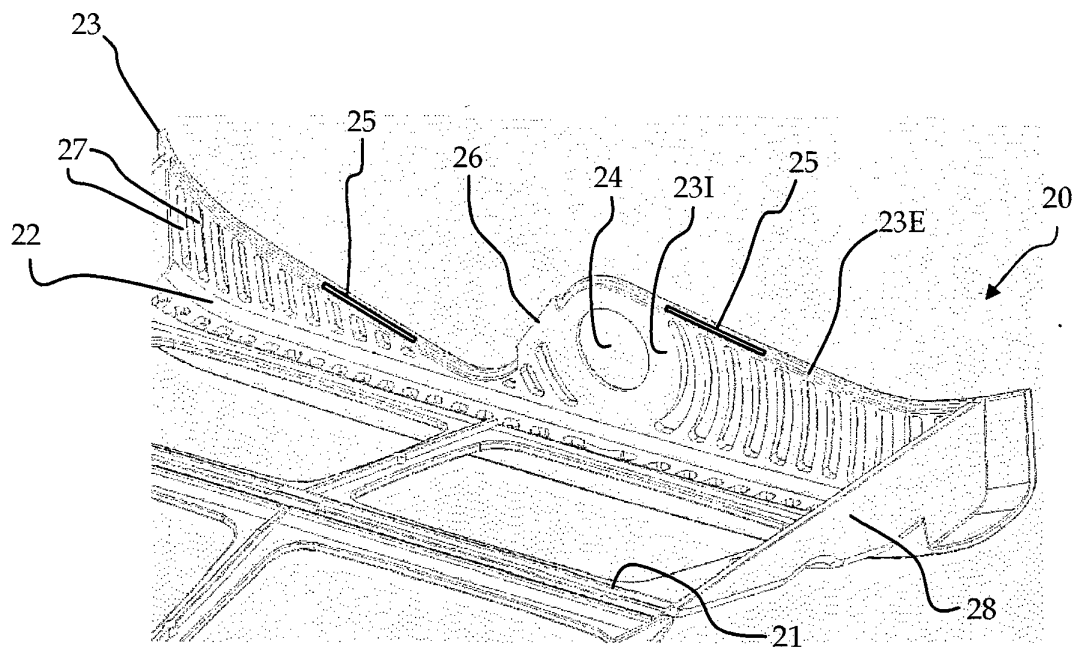


Fig. 3b