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(54) CLIMATIZATION CONTAINER

(57) A climatization container (1) comprising a compartment (2) for storing products, a duct (11), a fan (12) configured to draw air from the compartment into the duct (11), a cooling system including an evaporator (14) located in the duct (11) and at least one air guide (18) located in the duct (11). The evaporator (14) is narrower than the duct (11) in a plane defined by a surface of the evaporator (14), the air guide (18) directing air drawn from the compartment (2) such that it passes over a surface of the evaporator (14).

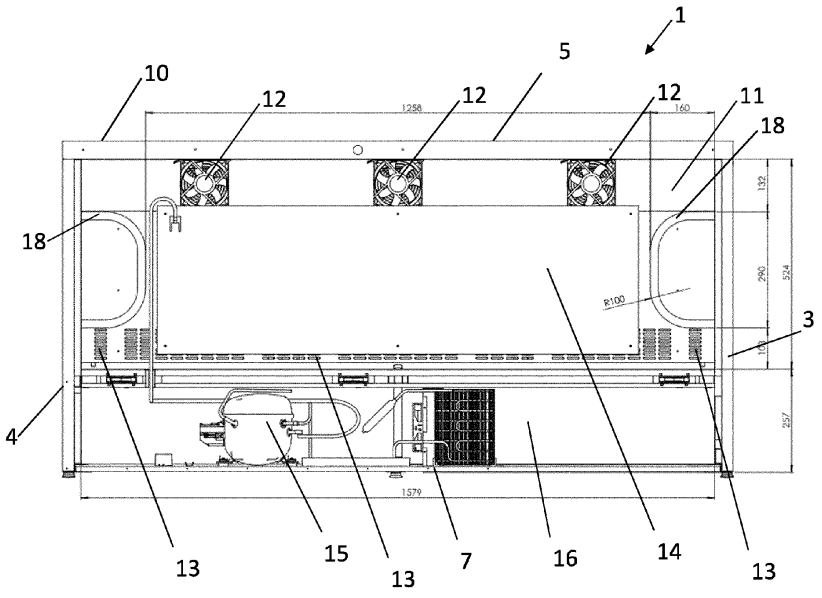

Fig. 3

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Description

TECHNICAL FIELD

[0001] The present invention relates to a climatization container, for instance a refrigerator or a freezer.

BACKGROUND

[0002] A climatization container comprises a container suitable for keeping contents stored therein under particular climatic conditions, for instance within a predetermined temperature or humidity range. Climatization containers are commonly used for storing products such as food and beverages. Particular examples include refrigerators and freezers where the primary requirement is to store food and beverages within a predetermined temperature range. Where in the present document reference is made to a particular example of a climatization container, for instance a refrigerator or freezer, this should be understood to include all types of climatization containers unless the context requires that it is limited to the particular example.

[0003] A climatization container may comprise a compartment defined by walls and closable by a door, one or more drawers or a combination of both. Within the compartment is a shelf support, or series of shelf supports, supporting one or more shelves. On each shelf products, for instance food and beverage products, may be stored.

[0004] A climatization container typically requires air to be distributed around a compartment, and for this a fan is provided to draw air in from one part of the compartment, channel the air through a duct, and expel air to another part of the compartment. The fan intake and outlet may be spaced apart to encourage air flow around the compartment. For the example of a refrigerator or freezer, a cooling system will also be provided to cool the air, and the fan may be provided upstream or downstream of the cooling system. Particularly, the cooling system includes an evaporator within the duct such that air passing through the duct passes over the evaporator to cool the air before being expelled back into the compartment. The shape and disposition of the evaporator within such a duct, and the shape of the duct itself, can have significant impact on the efficiency of the cooling system.

[0005] It is an aim of certain examples of the present invention to increase the efficiency of a cooling system for a climatization container.

BRIEF SUMMARY OF THE INVENTION

[0006] According to the present invention, there is provided a climatization container according to claim 1.

[0007] Advantageously, for a climatization container according to the present invention, the cooling system may be operated more efficiently because the air guide in the duct directs air over the evaporator, rather than permitting air flow to bypass the evaporator. Accordingly a greater proportion of the air passing through the duct is cooled by the evaporator resulting in more efficient cooling and so the cooling system may be operated for a smaller proportion of the time.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] Examples of the invention are further described hereinafter with reference to the accompanying drawings, in which:

Figure 1 illustrates a climatization container according to an example of the present invention;
Figure 2 illustrates a partially exposed rear view of a climatization container with air guides removed;
Figure 3 illustrates a partially exposed rear view of a climatization container according to an example of the present invention;
Figure 4 illustrates a partially exposed rear-view perspective view of a climatization container according to an example of the present invention;
Figure 5 illustrates a cross section view of a climatization container according to an example of the present invention; and
Figure 6 illustrates alternative forms of air guides according to examples of the present invention.

DETAILED DESCRIPTION

[0009] Referring to figure 1, this illustrates a refrigerator 1 according to an example of the present invention. The refrigerator 1 may be for storing and cooling beverage bottles in a direct sales environment, such as a bar or restaurant. The following description refers to refrigerators as examples of climatization containers according to the present invention. The invention is not limited only to refrigerators.

[0010] The refrigerator 1 includes a product display/cooling compartment. The refrigerator 1 is defined by side walls 3, 4, top wall 5, rear wall 6 and bottom wall 7. The compartment 2 is closable at the front by doors 8, in this example three doors. Alternatively, the front of the compartment 2 may be closed off by one or more drawers. Or there may be a combination of drawers and doors allowing access to products 9 within the refrigerator (in this example, beverage bottles).

[0011] Figure 2 illustrates a reverse view of the refrigerator 1 with a back wall removed to illustrate components of a cooling system. The detail of the cooling system may in most respects be entirely conventional and so will not be described in detail. The refrigerator 1 may be constructed with a double wall surrounding the sides and rear of the compartment 2. That is, the compartment 2 may be defined by walls and the refrigerator 1 may have an outer shell 10. Insulation (not illustrated) may be provided between the compartment walls and the outer

shell 10 surrounding at least part of the compartment 2. At the rear of the compartment 2 a duct 11 is provided between the rear wall of the compartment 2 (an inner wall) and the outer shell 10 (or an intervening wall defining the rear of the duct 11). The duct 11 comprises a vertical channel between the rear wall of the compartment 2 and the outer shell of the refrigerator 1 (or between the rear wall of the compartment 2 and an intervening vertical wall). In the example of figure 2 the duct 11 extends substantially the full width of the refrigerator 1 between walls 3 and 4, and the majority of the height of the refrigerator 1 from the top 5. The duct 11 thus comprises a generally cuboid form that is generally the width of the refrigerator, tall and relatively shallow (as will be apparent from the side view of figure 5 described below). It will be understood that in other examples the duct 11 may be provided upon a side of the compartment 2 instead of the rear of the compartment.

[0012] Figure 2 further illustrates three fans 12 which extend through the rear wall of the compartment 2 so that air may be drawn into the duct 11 from the compartment 2. The number of fans 12 will depend on the width of the refrigerator 1 and the required volume of air to be moved. A slotted grill 13 returns air from the duct into the compartment 2. The grill 13 is an example of a vent or orifice through which air may pass. The particular form of the grill 13 is not essential to the invention. It will be appreciated that the fans 12 may operate in reverse: they may draw air through the duct 11 and expel the air into the compartment 2. Furthermore, the positions of the fans 12 and the slotted grill 13 may be reversed. Positioning the duct 11 behind the product compartment 2 (with fans at the top or bottom) maximises the product display capacity within the compartment relative to positioning the fans and the duct to one side.

[0013] The cooling system further comprises an evaporator 14, which may be referred to as an evaporator plate, and a compressor 15. Briefly, the compressor 15 compresses a refrigerant which is then circulated through the evaporator 14. Heat is transferred from air passing through the duct 11 to the refrigerant as it evaporates such that the air is cooled before it is expelled into the compartment 2 through the slotted grill 13. The compressor 15 (and further unlabelled portions of the cooling system) is located within a cooling system compartment 16 below the duct 11. That is, in a vertical direction, the duct 11 is defined between the top wall 5 of the refrigerator 1 and the cooling compartment 16. Certain components, for instance a drip tray 17, have been removed in figure 2 in order to avoid obscuring features of the duct 11. Drip tray 17 is visible in figures 4. Generally, the fans 12 are located at the top of the duct 11 distributed across the width of the duct 11, and the slotted grill 13 extends across the full width of the duct 11 (and indeed substantially the full width of the refrigerator 1) such that air drawn through the duct 11 by the fans 12 is expelled towards the bottom of compartment 2 across the full width of the compartment 2.

[0014] Evaporator 14 is illustrated as a substantially flat plate, though the exact form may vary significantly in ways that extend beyond the present invention. The evaporator 14 may be disposed in the middle of the duct 11 (along an axis extending from the front to the rear of the refrigerator 1) such that air can flow both in front of and behind the evaporator 14 (which is more clearly visible in the cross-section side view of figure 5). To enable this flow over both sides of the evaporator 14, the evaporator 14 is spaced from the top of the duct (such that the fans 12 are visible in figure 2) and is spaced from the bottom of the duct 11 (such that part of the slotted grill 13 is visible underneath the evaporator 14).

[0015] It is desirable to maximise the heat exchange between air in the duct 11 and the evaporator 14 by maximising the degree to which the air flow passes over the surfaces of the evaporator 14. This increases the efficiency of the evaporator 14, and hence the overall efficiency of the cooling system (resulting in the cooling system being operated for a smaller proportion of the time and the refrigerator 1 as a whole being more energy efficient). However, a competing requirement with energy efficiency is cost. The refrigerator 1 of figure 1 is shown as a three-door refrigerator 1. However, it may be desirable to have a range of refrigerators with different configurations of doors and drawers, and hence different overall widths. To reduce costs it is desirable to standard components across the range of refrigerators as far as possible, including standardising components of the cooling system.

[0016] One option for standardisation is to use an evaporator 14 having a standard width regardless of the width of the refrigerator 1. As illustrated in figure 2, the evaporator 14 is less wide than the overall width of the duct 11 and the refrigerator 1 so that it may also be used in a narrower refrigerator 1 (for instance, one having only two doors). Figure 2 illustrates the situation which would occur, other than for the use of air guides according to the present invention (described and illustrated below in connection with figures 3, 4 and 6). In figure 2 it is possible for air to pass from the outer pair of fans 12 to the outer extremities of the slotted grill 13 without passing over the evaporator 14. That is, a portion of the air flow generated by outer fans 12 passes to the left and to the right of the evaporator 14 in the view of figure 2 as indicated by the dashed lines. This portion of the air flow may either avoid the evaporator entirely or may only partially pass over the surface of the evaporator and so is not cooled effectively. The efficiency of the cooling system is compromised by the use of an evaporator 14 that is less wide than the duct 11. Furthermore, air returning to the compartment 2 through the side portions of the slotted grill 13 may be warmer than air returning through the centre of the slotted grill 13. This may lead to uneven cooling of products within the compartment 2. This compromised efficiency is avoided through the present invention.

[0017] Figures 3 and 4 illustrate the rear portion of a refrigerator 1 with the back portion of the outer shell re-

moved to expose duct 11. As for figure 2, further components have been removed, including any rear wall to the duct 11 other than the refrigerator outer shell, in order to clearly illustrate the duct 11. Figure 4 differs from figure 3 in that a drip tray 17 has been retained. The drip tray 17 runs underneath the evaporator 14 and serves to collect condensate from the evaporator 14. A drain (not highlighted in figure 4) is provided to drain the condensate from the drip tray 17.

[0018] According to the present invention, the refrigerator 1 further comprises one or more air guides 18. Figures 3 and 4 illustrate two air guides 18 positioned either side of the evaporator 14, but the invention is not limited to this. For instance, the evaporator 14 may be positioned to one side of the duct 11 and a larger air guide 18 provided on the other side of the duct 11 (that is, the position of the evaporator 14 may be asymmetrical in the air duct 11). Each air guide 18 serves to close off a portion of the duct 11 to prevent air from flowing through that region. In a depth direction (along an axis extending from the front to the rear of the refrigerator 1) each air guide 11 completely fills the volume between front and rear sides of the duct 11 to block air flow. Figures 3 and 4 show each air guide 18 as rectangular with rounded corners, but the shape will vary significantly according to the particular desired air flow for a given configuration of duct 11, evaporator 14, fans 12 and slotted grill 13. In the example of figures 3 and 4 the air guides 18 are generally thin and loop out from a side wall and return to the side wall of the duct 11. In alternative examples the air guides may fill the enclosed portion of the duct 11. The duct has an inlet and an outlet defining a flow direction therebetween. The evaporator is located in the duct between the inlet and the outlet, the evaporator being narrower than the duct in a direction perpendicular to the flow direction and in a plane defined by a surface of the evaporator, and the air guide is located in the duct to one side of the evaporator in the perpendicular direction such that it directs air through the duct over the surface of the evaporator.

[0019] In the example of figures 3 and 4 the air guides extend fully to the sides of the duct 11 (in addition to filling the full thickness of the duct 11) thereby preventing air flow from passing outside of the air guides 18. However, this is not an essential feature: it may be that an alternative shape of air guide 18 serves to channel air from fans 12 without extending to the sides of the duct 11. For instance, an air guide 18 may extend from a top part of the duct 11 to a bottom part of the duct 11 without reaching to the sides. It is not essential that an air guide 18 necessary reaches any side (or top or bottom) of the duct 11. In an alternative example an air guide may be relatively small compared to the overall size of the duct 11 and other components and positioned close to a fan 12 (or grill 13 if the air flow in the duct 11 is reversed) in order to guide air flow over the evaporator 14 without partially or completely closing off a portion of the duct 11.

[0020] Each air guide 18 serves to direct air flow from the fans 12 to the slotted grill 13 so as to maximise the air flow over the evaporator 14. Accordingly, as shown in figures 3 and 4 the air guides approach close to the evaporator 14 to substantially prevent air from passing to the left or to the right of the evaporator 14 in the view of figure 3. In other examples the or each air guide 18 may touch the evaporator 14. This channelling of air flow through the duct 11 over the evaporator 14 increases the efficiency of heat transfer.

[0021] In the example of figures 3 and 4 the air guides 18 return to the sides of the duct in their lower part so as to permit air flow to reach the full width of slotted grill 13. In other examples, the air guides 18 may be shaped to direct the air flow to any portion of a slotted grill 13 to provide for optimal return of air into the compartment 2. In other examples the air guides 18 may approach close to the fans 12 in their upper part to channel air flow over the evaporator 14.

[0022] In figure 3 dimensions for an example refrigerator 1 and certain components are indicated, in millimetres. The illustrated refrigerator 1 has a horizontal orientation. Similarly the duct 11 and evaporator 14 are horizontally orientated. The duct 11 is 524 mm tall and 1579 mm wide. Each air guide 18 is 290 mm tall and 160 mm wide, with a radius of curvature at each corner of 100 mm. Each air guide 18 may be formed, for instance, from shaped foam which is glued in position within the duct 11, for instance using self-adhesive tape. The thickness of each air guide 18 is not a critical dimension given that the air guide 18 extends to the side of the duct and so entirely closes off a contained portion of the duct 11.

[0023] Turning now to figure 5, this is a cross sectional view through a refrigerator 1. Duct 11 can be seen to be defined between a rear wall 19 of compartment 2 and a rear duct wall 20. The evaporator 14 is positioned midway between walls 19 and 20 such that air passes in front of and behind the evaporator 14, as illustrated by the vertical arrows. Air is drawn into the duct by fan 12 as illustrated by the right arrow and expelled back into compartment 2 through slotted grill 13 as illustrated by the left arrows. The larger, upper left arrow is indicative of a larger volume of air passing in front of evaporator 14 (to the left in figure 5) and a smaller volume of air passing behind evaporator 14 and then under the evaporator 14 to reach slotted grill 13. Air flowing in front of the evaporator 14 may also be higher speed.

[0024] In figure 5 the fan is illustrated as being orientated vertically. However, the fan may be inclined forwards or backwards in order to control the pressure differential across the fan and to direct the flow of air from compartment 2 into duct 11.

[0025] Figure 6 illustrates three different forms of air guide 18. (a) is the same form of air guide illustrated in figures 3 and 4. This may be formed from foam, for instance shaped foam with an adhesive tape backing to reduce mounting time during refrigerator construction. Advantageously, foam and similar materials may be readily formed in any shape for any desired air flow, with

minimal turbulence by avoiding sharp corners. (b) and (c) illustrate alternatives formed from shaped channels which may be made from metal or plastic. The skilled person will realise that the chosen shape will depend on the particular shape and disposition of duct, fans, grill and evaporator, together with the desired air flow. In designing the required shape of air guide, the skilled person will further take account of the specified cooling within the compartment storing products, together with specified air flow volumes between the compartment and the duct. Preferably, an air guide ensures that air within the duct is directed exclusively over the evaporator and then (if required) fans outwards underneath the evaporator to fill the entire width of a slotted grill for returning cooled air to the compartment.

[0026] Each air guide 18 illustrated in figure 6 is vertically symmetrical, though exact symmetry is not essential. Particularly, for an air flow direction such as illustrated in figures 3 to 5, where air flows downwards through the duct 11, the air guide 18 extends from the side wall of the duct 11 at the upper part closest to the fans 12 in order to direct air flow inwards towards and over the evaporator 14. The air guides 18 then return to the side wall of the duct 11. The lower part of each air guide 18 may not directly channel air flow but serves to reduce turbulence in the duct 11.

[0027] In a further example the refrigerator 1, and particularly each of the duct 11 and the evaporator 14 may be vertically orientated (that is, taller than they are wide). In further examples, particularly where a refrigerator is vertically orientated, additional slots or holes may be provided for air to return to the product compartment. For instance, a further slotted grill 13 may be provided partway along the vertical dimension of the duct 11, or even close to the top of the duct 11. Additional air return channels to the product compartment allow for more even product cooling.

[0028] Generally, the air duct 11 described herein is described as a vertically orientated thin box, though it will be appreciated that the shape of the duct may vary significantly. Similarly, the evaporator 14 is generally described as a plate. In certain examples the evaporator 14 may comprise generally parallel sheets joined together periodically by welds, though the exact shape of the evaporator 14 falls outside of the scope of the present invention.

[0029] Throughout this specification, the words "comprise" and "contain" and variations of them mean "including but not limited to", and they are not intended to (and do not) exclude other components, integers or steps. Throughout this specification, the singular encompasses the plural unless the context otherwise requires. In particular, where the indefinite article is used, the specification is to be understood as contemplating plurality as well as singularity, unless the context requires otherwise. Throughout this specification, the term "about" is used to provide flexibility to a range endpoint by providing that a given value may be "a little above" or "a little below" the endpoint. The degree of flexibility of this term can be dictated by the particular variable and can be determined based on experience and the associated description herein.

[0030] Features, integers or characteristics described in conjunction with a particular aspect or example of the invention are to be understood to be applicable to any other aspect or example described herein unless incompatible therewith. All of the features disclosed in this specification, and/or all of the steps of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such features and/or steps are mutually exclusive. The invention is not restricted to the details of any foregoing examples. The invention extends to any novel feature or combination of features disclosed in this specification. It will be also be appreciated that, throughout this specification, language in the general form of "X for Y" (where Y is some action, activity or step and X is some means for carrying out that action, activity or step) encompasses means X adapted or arranged specifically, but not exclusively, to do Y.

[0031] Each feature disclosed in this specification may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly stated otherwise. Thus, unless expressly stated otherwise, each feature disclosed is one example only of a generic series of equivalent or similar features.

[0032] The reader's attention is directed to all papers and documents which are filed concurrently with or previous to this specification in connection with this application and which are open to public inspection with this specification, and the contents of all such papers and documents are incorporated herein by reference.

Claims

1. A climatization container comprising:

a compartment for storing products;
a duct;
a fan configured to draw air from the compartment into the duct;
a cooling system including an evaporator located in the duct; and
at least one air guide located in the duct;
wherein the evaporator is narrower than the duct in a plane defined by a surface of the evaporator, the air guide directing air drawn from the compartment such that it passes over a surface of the evaporator.

2. A climatization container according to claim 1, further comprising an outer shell at least partially surrounding the compartment such that the duct is defined between a wall of the compartment and the outer shell.

3. A climatization container according to claim 1 or claim 2, wherein the duct is positioned behind a rear side of the compartment opposite to a front side of the compartment which opens with a door or a drawer.

4. A climatization container according to any one of the preceding claims, wherein the fan is located in the duct on a first side of the evaporator and a vent between the duct and the compartment is located on a second, opposite side of the evaporator such that air from the compartment flows between the fan and the vent over a surface of the evaporator.

5. A climatization container according to claim 4, wherein the air guide closes off a volume of the duct to prevent air flow between the fan and the vent from passing through that volume.

6. A climatization container according to claim 4 or claim 5, wherein the air guide is positioned to one side of the evaporator in the direction of air flow between the fan and the vent.

7. A climatization container according to claim 6, wherein first and second air guides are provided either side of the evaporator such that substantially all of the air flow between the fan and the vent passes over a surface of the evaporator.

8. A climatization container according to any one of the preceding claims, wherein the climatization container comprises a refrigerator or freezer.

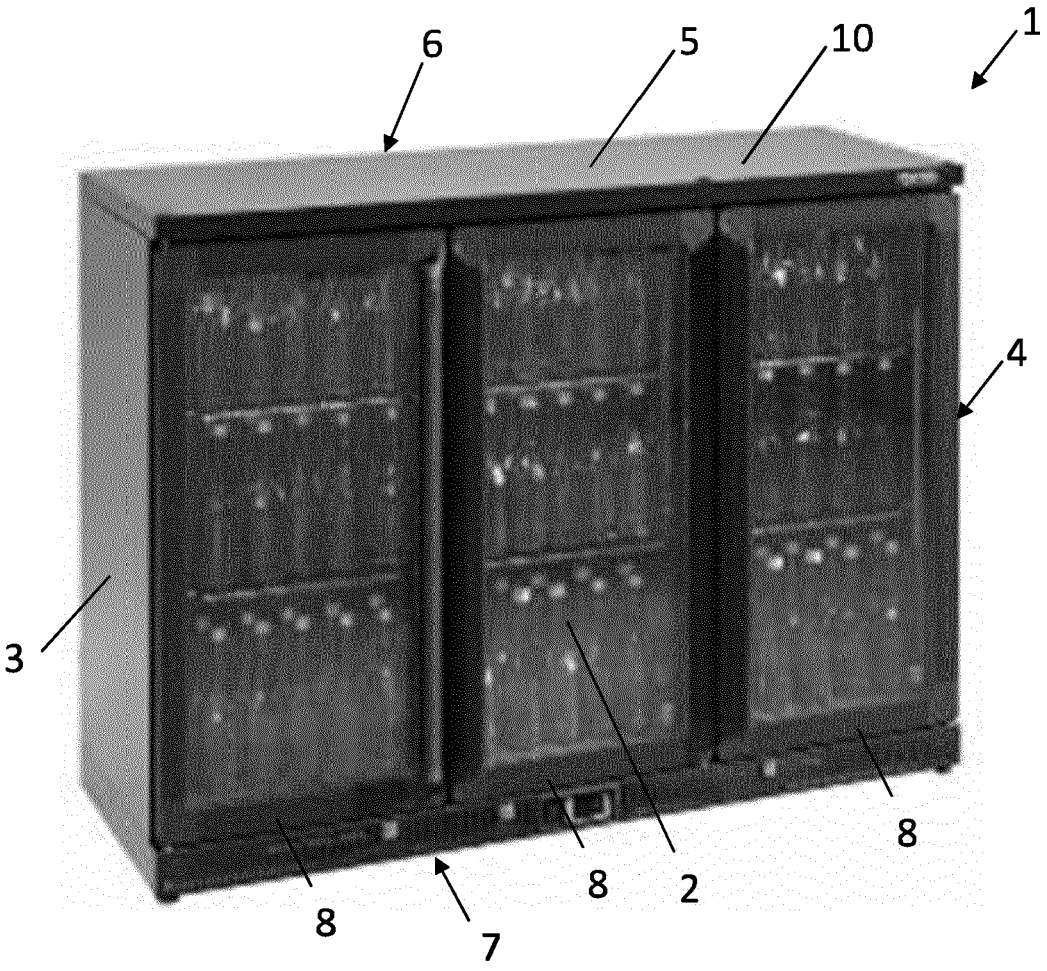

Fig. 1

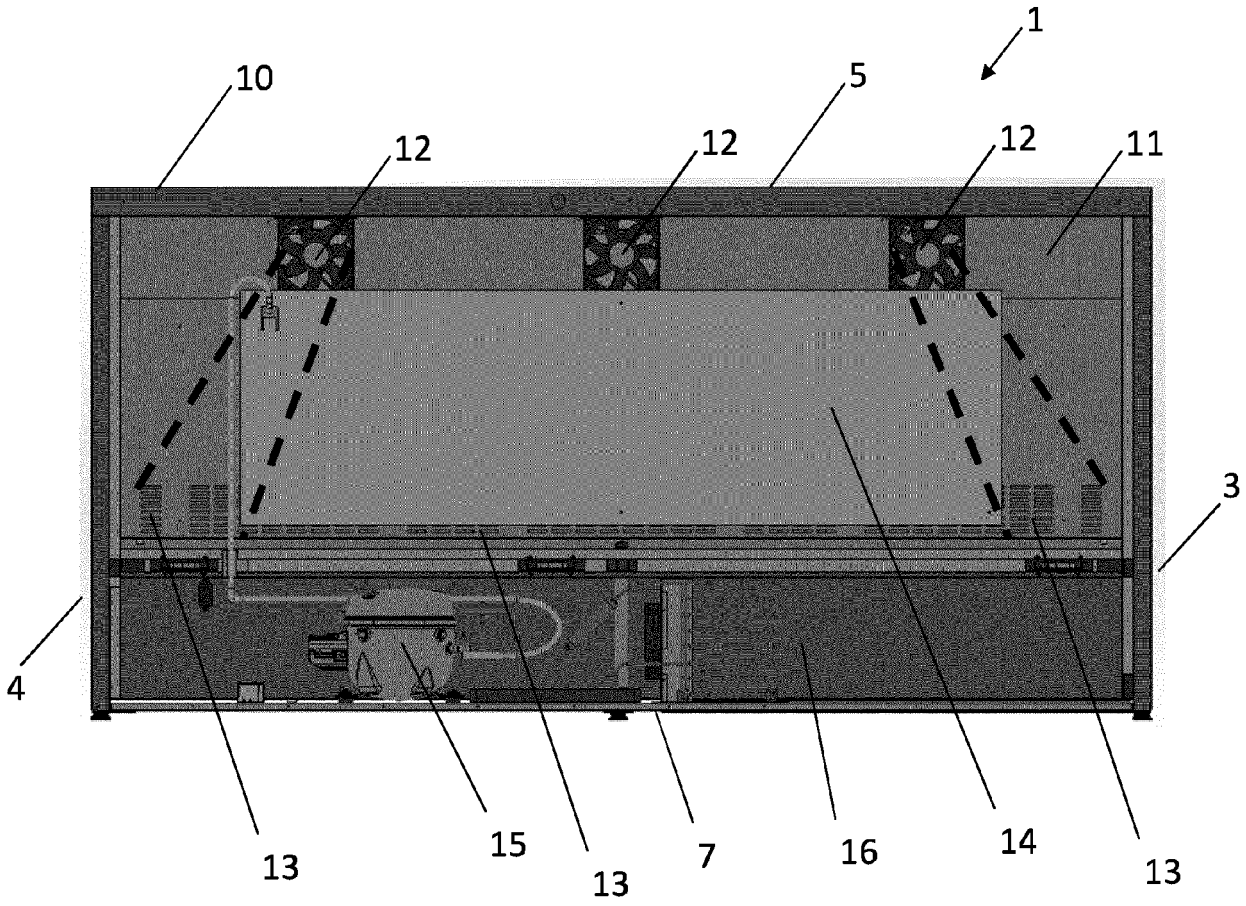

Fig. 2

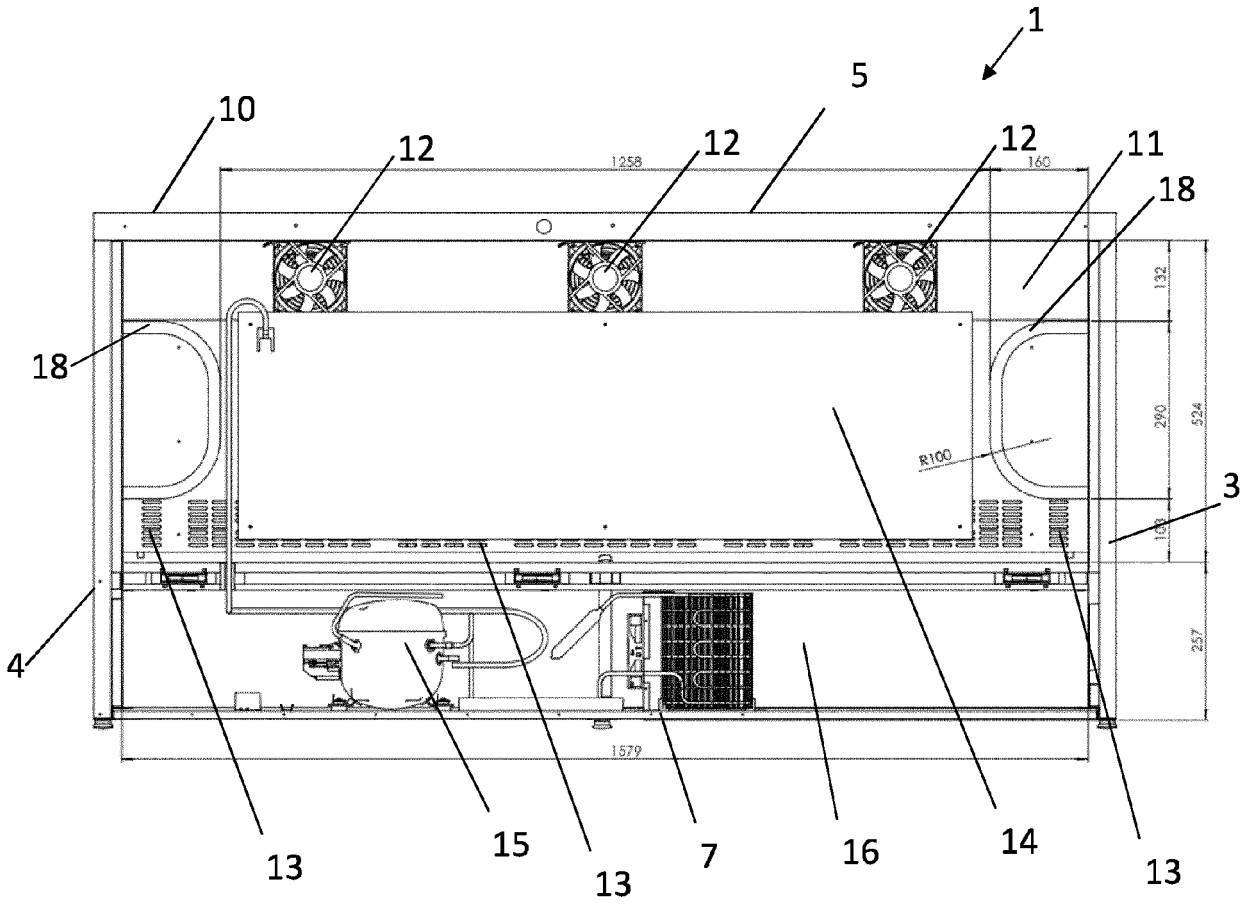
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Fig. 3

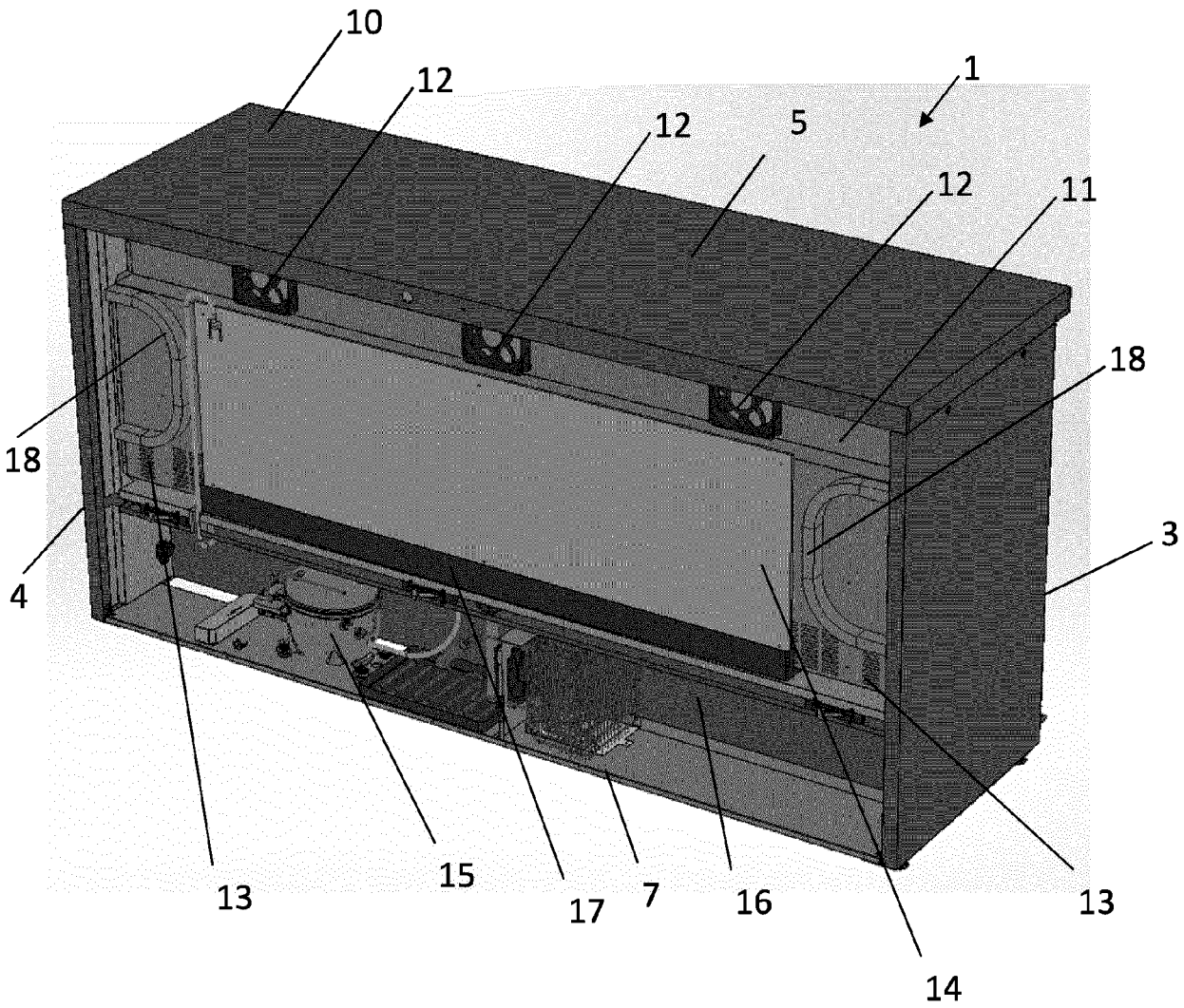

Fig. 4

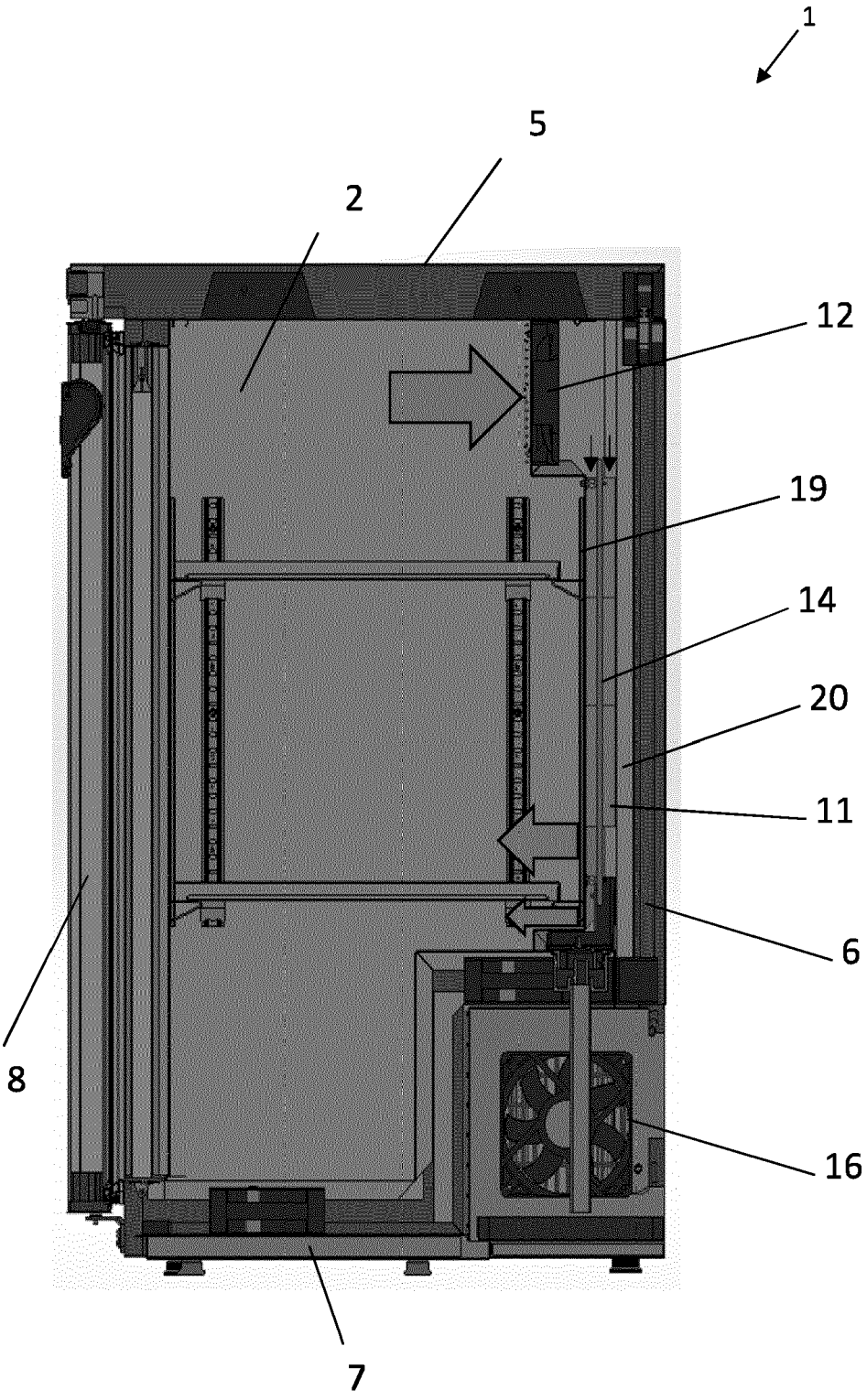

Fig. 5

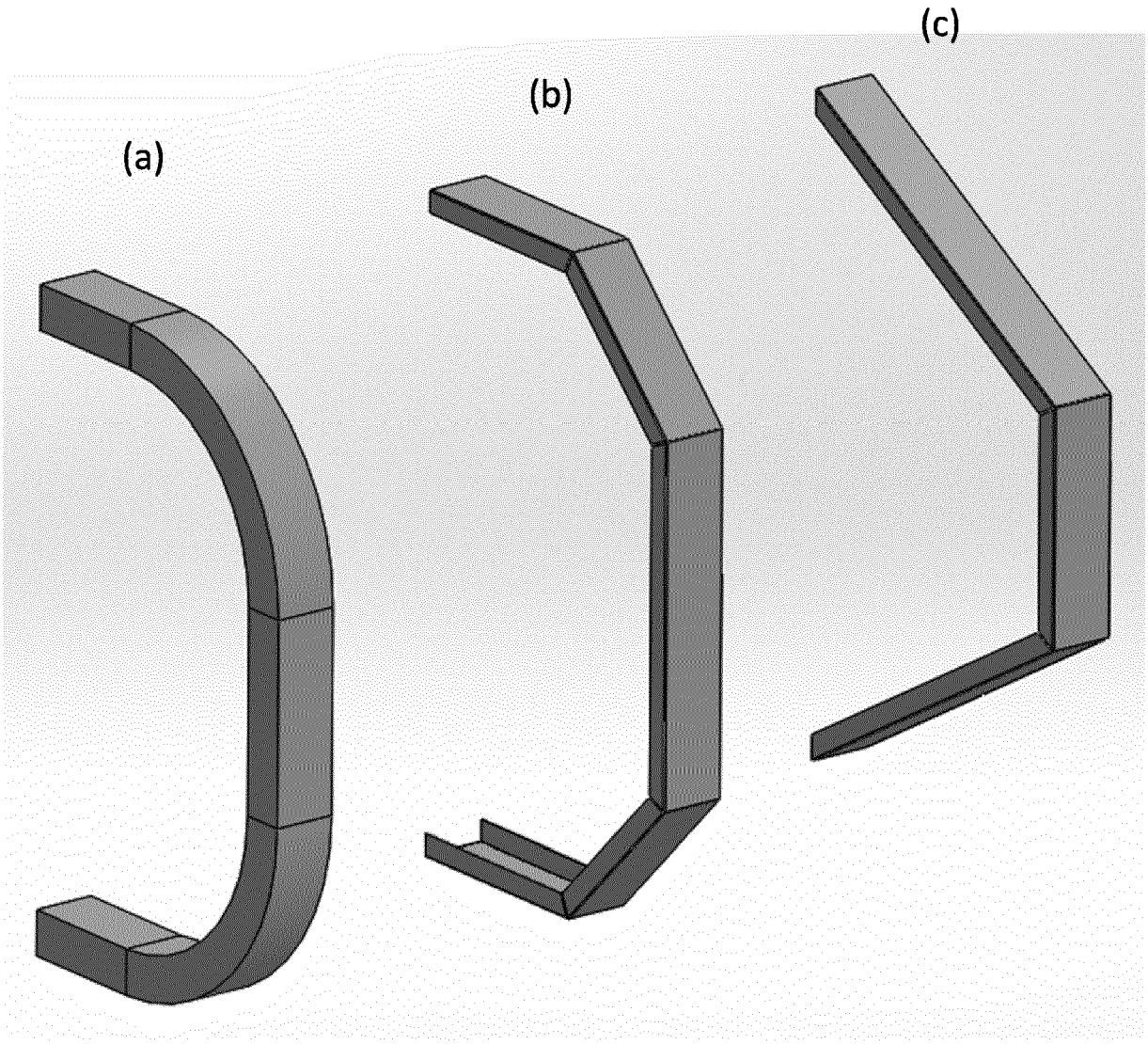

Fig. 6

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EUROPEAN SEARCH REPORT

Application Number
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DOCUMENTS CONSIDERED TO BE RELEVANT

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TECHNICAL FIELDS SEARCHED (IPC)
F25D

1 The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	9 February 2022	Kolev, Ivelin

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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