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(54) **Refrigerating apparatus with improved air circulation system**

Kühlvorrichtung mit verbessertem Luftzirkulationssystem

Appareil frigorifique avec système de circulation d'air amélioré

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- **Nicola, Roberta**
I-33080 Porcia (PN) (IT)
- **Velli, Vittorio**
I-31021 Mogliano Veneto (TV) (IT)

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(74) Representative: **Electrolux Group Patents et al**
AB Electrolux
Group Patents
105 45 Stockholm (SE)

(73) Proprietor: **Electrolux Appliances Aktiebolag**
105 45 Stockholm (SE)

(72) Inventors:

- **Buosi, Augusto**
I-33080 Porcia (PN) (IT)
- **Beni, Marco**
I-33080 Porcia (PN) (IT)

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Description

Field of the invention

[0001] The present invention generally relates to a refrigerating apparatus, both for domestic and professional use. More particularly, the present invention relates to a refrigerating apparatus having an improved circulation of refrigerating air.

Background of the invention

[0002] A conventional refrigerating apparatus comprises one or more refrigerating compartments, which allow storing and preserving food by refrigeration.

[0003] Food refrigeration is allowed by circulation of refrigerating air within the refrigerating compartments.

[0004] Refrigerating air circulation is of the utmost importance for good food preservation, and is particularly burdensome to design in refrigerating apparatuses integrating refrigerating compartments intended to be at reciprocally different temperatures (or combined refrigerating apparatuses).

[0005] Considering for example a combined refrigerating apparatus integrating two refrigerating compartments (e.g., a lower-temperature refrigerating compartment and a higher-temperature refrigerating compartment), most of the known solutions are substantially based on the common approach of continuously circulating refrigerating air between both the refrigerating compartments. According to such approach, cold refrigerating air from a heat pump evaporator is first fed to the lower-temperature refrigerating compartment, where it warms up by thermal exchange with food, and then to the higher-temperature refrigerating compartment. Thereafter, the relatively warm refrigerating air from the higher-temperature refrigerating compartment is returned to the evaporator for a new cycle.

[0006] In the state of the art, solutions are known aimed at improving refrigerating air circulation efficiency.

[0007] EP0793066 discloses an appliance comprising a lower-temperature refrigerating compartment and a higher-temperature refrigerating compartment separated from each other by a horizontal partition wall. The refrigerating air from an evaporator is circulated through the lower-temperature refrigerating compartment, and reaches the higher-temperature refrigerating compartment via a gap between a front edge of the partition wall and an appliance door.

[0008] GB867292 discloses an appliance comprising a refrigerating compartment, and a fan, arranged at an upper rear thereof, for forcing air downwardly over an evaporator within a rear flue. Part of the refrigerating air from the evaporator flows to a lower part of the refrigerating compartment, and the remainder is diverted by a baffle into a hollow shelf, from which it is discharged, through front apertures, into the refrigerating compartment at the appliance door. Scoops divert some of the

refrigerating air flowing within the shelf into a suspended container.

[0009] DE 11 43 215 B discloses a multi-temperature refrigerator according to the preamble of claim 1.

[0010] DE 25 40 037 discloses a cooling device with an upper cooling compartment which is constructed to allow a continuous extraction of cooled material, such as ice, and with a bottom cooling compartment which accepts a material supply. The two cooling compartments within the common outer housing form between them an air guidance channel, which at one end is connected with the two cooling compartments and at its other end opens into an intake chamber enclosing a blower. This intake chamber is connected with the upper cooling chamber via an upwards directed channel which encloses an upper evaporator. It is connected with the lower cooling compartment via a downwards directed channel which encloses a lower evaporator. The arrangement is such that in operation, there is an air circulation of different temperature in the two cooling compartments.

Summary of invention

[0011] The Applicant has realized that the known solutions are not satisfactory for modern technological requirements.

[0012] In particular, according to the Applicant, the fact that the refrigerating air in each refrigerating compartment (or in each region of a same refrigerating compartment, as for GB867292) directly comes from another refrigerating compartment (or from another region of a same refrigerating compartment, as for GB867292), makes the known solutions affected by problems of non-ideal temperature within the refrigerating compartments. Indeed, the temperature of the refrigerating air flowing into the higher-temperature refrigerating compartment from the lower-temperature refrigerating compartment strongly depends on amount of food stored therein, as well as on user operations (e.g., appliance doors opening for accessing the refrigerating compartments, which causes heat input). This results in food preservation issues, as well as energy issues (as an uncontrollable number of cycles for restoring the desired temperature within the refrigerating compartments is needed).

[0013] As far as EP0793066 is concerned, the refrigerating air from the evaporator, upon being fed to the lower-temperature compartment, is split into different flows, each one directly reaching (through the gap in the horizontal partition wall) the higher-temperature refrigerating compartment at different times and with different temperature (as resulting from different thermal exchange experienced by each flow along the corresponding path). Thus, the higher-temperature refrigerating compartment is affected by a non-uniform, and non-ideal, temperature within it.

[0014] Similarly, as far as GB867292 is concerned, the refrigerating air that, from the evaporator, is split into the lower part of the refrigerating compartment, into the hol-

low shelf and into the suspended container, flows back directly to the upper part of the refrigerating compartment with non-uniform and non-ideal temperature (as resulting from different thermal exchange experienced by each flow along the corresponding path).

[0015] The Applicant has tackled the problem of devising an improved solution able to overcome the above-discussed, as well as other, drawbacks.

[0016] The present invention thus relates to a refrigerating apparatus comprising a cabinet, first and second refrigerating compartments for food storage separate from each other, a first air channel between the cabinet and a first refrigerating compartment wall, and a second air channel between the cabinet and a second refrigerating compartment wall, wherein the first and second air channels are configured for canalizing refrigerating air into the first and second refrigerating compartments, respectively, and wherein the first refrigerating compartment opens out to the second air channel for allowing the refrigerating air within the first refrigerating compartment to flow into the second refrigerating compartment through the second air channel, and the second refrigerating compartment opens out to the first air channel for allowing the refrigerating air within the second refrigerating compartment to flow into the first refrigerating compartment through the first air channel.

[0017] Preferably, the refrigerating apparatus comprises a liner delimiting the first and second refrigerating compartments, the liner having a rear wall comprising said first and second refrigerating compartment walls and being spaced apart from a rear panel of the cabinet so as to define a rear air channel comprising said first and second air channels.

[0018] The liner may comprise, at opposite sides thereof, first and second protruding edges laterally delimiting said rear air channel.

[0019] The refrigerating apparatus may further comprise a partition baffle between the rear wall and the rear panel for partitioning the rear air channel into the first and second air channels, the partition baffle being shaped such that at least one portion of the first air channel extends between the second refrigerating compartment wall and the cabinet and at least one portion of the second air channel extends between the first refrigerating compartment wall and the cabinet.

[0020] The partition baffle is preferably made of a single piece with the liner.

[0021] In a possible embodiment, the partition baffle comprises a U-shaped central portion, and, at the ends thereof, first and second appendices extending towards the first and second protruding edges, respectively.

[0022] Preferably, said at least one portion of the first air channel comprises a first portion delimited from below by the U-shaped central portion, and said at least one portion of the second air channel comprises a second portion delimited by the U-shaped central portion, the first appendix, and the first protruding edge, and a further second portion delimited by the U-shaped central portion,

the second appendix, and the second protruding edge.

[0023] Preferably, the refrigerating apparatus further comprises, at said at least one portion of the first air channel, first liner openings for fluidly connecting the second refrigerating compartment to the first air channel, and at said at least one portion of the second air channel, second liner openings for fluidly connecting the first refrigerating compartment to the second air channel.

[0024] The second liner openings may comprise first and second openings in the second portion and in the further second portion, respectively, of said at least one portion of the second air channel.

[0025] The refrigerating apparatus may further comprise a separator extending substantially horizontally between the rear wall of the liner and the cabinet front for separating the first refrigerating compartment from the second refrigerating compartment, the separator defining at least one air passage fluidly connecting the second refrigerating compartment to the first liner opening to allow air flow from the second refrigerating compartment into the first air channel through the at least one air passage and the first liner opening.

[0026] The separator may comprise a separator top that defines a bottom of the first refrigerating compartment and a separator bottom that defines a top of the second refrigerating compartment, the separator top and the separator bottom being so shaped as to define between them the at least one air passage.

[0027] The separator top and the separator bottom are preferably made of materials capable of providing thermal insulation between the first and second refrigerating compartments.

[0028] The refrigerating apparatus may further comprise, along the rear air channel, at least one heat pump evaporator for properly cooling the refrigerating air down to the intended refrigerating temperature, and a fan for promoting refrigerating air circulation.

[0029] The at least one evaporator preferably comprises first and second evaporators associated with the first and second refrigerating compartments, respectively.

[0030] In a preferred embodiment, the first evaporator is arranged along the first air channel, and the second evaporator and the fan are arranged along the second air channel.

[0031] Advantageously, the first and second refrigerating compartments comprise combinations of fridge, freezer or zero-degree compartments.

[0032] The proposed solution allows achieving ideal temperature within the refrigerating compartments. Indeed, thanks to mechanical separation and thermal insulation between the refrigerating airs in the lower-temperature and higher-temperature refrigerating compartments, the refrigerating air flowing from the higher-temperature refrigerating compartment is channeled to the lower-temperature refrigerating compartment only after having passed a first evaporator, and the refrigerating air flowing from the lower-temperature refrigerating compartment is fed to the higher-temperature refrigerating

compartment only upon channeling thereof (which provides a uniform mixing thereof) and, preferably, only after having passed a second evaporator. This results in very good food preservation, as well as energy saving.

Brief description of the annexed drawings

[0033] These and other features and advantages of the invention will be made apparent by the following description of some exemplary and non limitative embodiments thereof. For its better intelligibility, the following description should be read making reference to the attached drawings, wherein:

Figure 1 schematically shows a cross-sectional side view of a refrigerating apparatus according to an embodiment of the invention;

Figure 2 shows a perspective rear view with partly removed parts of the refrigerating apparatus of **Figure 1** according to an embodiment of the invention, and

Figures 3A-3B show perspective side views of a part of the refrigerating apparatus of **Figure 1** according to an embodiment of the invention.

Detailed description of preferred embodiments of the invention

[0034] Referring now to the drawings, **Figure 1** schematically shows a not-in-scale cross-sectional side view of a refrigerating apparatus **100** according to an embodiment of the invention. For the sake of description ease, such figure will be discussed together with **Figure 2**, which shows a perspective rear view with partly removed parts of the refrigerating apparatus **100** according to an embodiment of the invention, and with **Figures 3A** and **3B**, the latter showing, according to an embodiment of the invention, perspective side views of a part of the refrigerating apparatus **100**.

[0035] The refrigerating apparatus **100** comprises a number of well-known electronic, mechanical and/or electro-mechanical components - however, for the sake of description ease and conciseness, only those being relevant for understanding the invention will be introduced and discussed in the following.

[0036] Preferably, the refrigerating apparatus **100** is of the combined-type, as integrating a number of refrigerating compartments where food can be stored and preserved by refrigeration at different temperatures. In the example at issue, the refrigerating apparatus **100** comprises two refrigerating compartments, namely an upper refrigerating compartment **105_U** and a lower refrigerating compartment **105_L**.

[0037] For example, the upper **105_U** and lower **105_L** refrigerating compartments may comprise combinations of fridge, freezer or zero-degree compartments, which have cooling temperatures over, below or near 0°C, respectively (and typically ranging between 3°C and 7°C,

-18°C and -27°C, and 0°C and 3°C, respectively). In the considered example, the upper refrigerating compartment **105_U** will be assumed operating at higher temperature (hereinafter, higher-temperature refrigerating compartment) than the lower refrigerating compartment **105_L** (hereinafter, lower-temperature refrigerating compartment).

[0038] Shelves and other structures for supporting and storing food articles may be provided within both upper **105_U** and lower **105_L** refrigerating compartments (as partly visible in **Figures 2, 3A** and **3B**).

[0039] The refrigerating apparatus **100** comprises a substantially parallelepiped-shaped cabinet **110**, having a top panel **110_T**, a rear panel **110_R**, a bottom panel **110_B** and side panels (not visible). Upper **115_U** and lower **115_L** doors are hingedly mounted to a cabinet **110** front to provide selective access to the upper **105_U** and lower **105_L** refrigerating compartments, respectively.

[0040] The refrigerating apparatus **100** further comprises a liner **120** having a top wall **120_T**, a rear wall **120_R**, a bottom wall **120_B**. As visible in **Figure 2**, the liner **120** is inwardly spaced apart from the cabinet **110** by means of first **205₁** and second **205₂** protruding edges provided at opposite side ends thereof, on both top and back parts of the apparatus. Upon cabinet **110** mounting, a gap between the liner **120** and the cabinet **110** itself is thus formed by spacing effect of the first **205₁** and second **205₂** protruding edges.

[0041] As can be best appreciated in **Figure 1**, the gap between the liner **120** and the cabinet **110** identifies air channels through which cooling air to and from the upper **105_U** and lower **105_L** refrigerating compartments is made to flow.

[0042] Preferably, a top air channel **A_{CH,T}** is defined between the top wall **120_T** of the liner **120** and the top panel **110_T** of the cabinet **110**, and a bottom air channel **A_{CH,B}** is defined between the bottom wall **120_B** of the liner **120** and the bottom panel **110_B** of the cabinet **110**. As illustrated, the top **120_T** and bottom **120_B** walls of the liner **120** have lower lengths than the top **110_T** and bottom **110_B** panels of the cabinet, respectively, which allows refrigerating air flowing through the top **A_{CH,T}** and bottom **A_{CH,B}** air channels to be fed into the upper **105_U** and lower **105_L** compartments, respectively.

[0043] A rear, substantially straight, air channel **A_{CH,R}** is instead defined between the rear wall **120_R** of the liner **120** and the rear panel **110_R** of the cabinet **110**.

[0044] According to the proposed solution, the rear air channel **A_{CH,R}** comprises, between the cabinet **110** (i.e., the rear panel **110_R** thereof) and an upper refrigerating compartment **105_U** wall (i.e., an upper part of the rear wall **120_R** of the liner **120** associated with, e.g. facing, the upper refrigerating compartment **105_U**, hereinafter upper rear wall **120_{RU}**), a first, e.g. upper, rear air channel **A_{CH,RU}** for canalizing the refrigerating air into the top air channel **A_{CH,T}** (and hence into the upper refrigerating compartment **105_U**), and, between the cabinet **110** (i.e., the rear panel **110_R** thereof) and a lower refrigerating

compartment **105_L** wall (*i.e.*, a lower part of the rear wall **120_R** of the liner **120** associated with, *e.g.* facing, the lower refrigerating compartment **105_L**, hereinafter lower rear wall **120_{RL}**), a second, *e.g.* lower, rear air channel **A_{CH,RL}**, separate from the upper rear air channel **A_{CH,RU}**, for canalizing the refrigerating air into the bottom air channel **A_{CH,B}** (and hence into the lower refrigerating compartment **105_L**).

[0045] Along the rear air channel **A_{CH,R}**, one or more heat pump evaporators are provided for properly refrigerating the refrigerating air down to the intended temperatures, and a fan **F** is provided for promoting refrigerating air circulation.

[0046] In the example at issue, upper **E_U** and lower **E_L** evaporators, associated with the upper **105_U** and lower **105_L** compartments, respectively, are preferably arranged along the upper **A_{CH,RU}** and lower **A_{CH,RL}** rear air channels, respectively. Preferably, also the fan **F** is arranged along the lower rear air channel **A_{CH,RL}**. Even more preferably (as illustrated) the fan **F** is arranged above the lower evaporator **E_L**. Provision of the upper evaporator **E_U**, of the lower evaporator **E_L**, and of the fan **F**, not limiting for the invention, may be achieved by any known housing, mounting and fixing techniques.

[0047] As conceptually illustrated in **Figure 1** (and better discussed in the following), the upper refrigerating compartment **105_U** opens out to (thus, being fluidly connected to) the lower rear air channel **A_{CH,RL}** for allowing the refrigerating air within the upper refrigerating compartment **105_U** to be fed into the lower refrigerating compartment **105_L** through the lower rear air channel **A_{CH,RL}**, and the lower refrigerating compartment **105_L** opens out to (thus, being fluidly connected to) the upper rear air channel **A_{CH,RU}** for allowing the refrigerating air within the lower refrigerating compartment **105_L** to be fed into the upper refrigerating compartment **105_U** through the upper rear air channel **A_{CH,RU}**.

[0048] As will be best understood in the following, separation between the upper **A_{CH,RU}** and lower **A_{CH,RL}** rear air channels allows preventing the refrigerating air from the upper refrigerating compartment **105_U** (and towards the lower rear air channel **A_{CH,RL}**) from mixing with the refrigerating air from the lower refrigerating compartment **105_L** (and towards the upper rear air channel **A_{CH,RU}**).

[0049] Separation between the refrigerating airs in the upper **105_U** and lower **105_L** refrigerating compartments, as well as provision of both upper **E_U** and lower **E_L** evaporators, ensures that the refrigerating air flowing from the upper refrigerating compartment **105_U** is channeled to the lower refrigerating compartment **105_L** only after having passed the lower evaporator **E_L**, and that the refrigerating air flowing from the lower refrigerating compartment **105_L** is fed to the upper refrigerating compartment **105_U** only after having passed the upper evaporator **E_U**. This results in ideal temperature of the refrigerating air fed into the upper **105_U** and lower **105_L** refrigerating compartments, and in very good food preservation.

[0050] However, according to another embodiment,

not shown, only one evaporator, *i.e.* the lower evaporator **E_L** (*i.e.*, only the evaporator associated to the lower-temperature refrigerating compartment), is provided. In this case, the refrigerating air flowing from the lower refrigerating compartment **105_L** would be fed to the upper refrigerating compartment **105_U** only upon channeling thereof (through the upper rear air channel **A_{CH,RU}** and the top channel **A_{CH,T}**). Channeling of the refrigerating air, instead of feeding it directly into the higher-temperature refrigerating compartment (as for the known solutions), provides air mixing and heat distribution, which results in an almost uniform temperature of the refrigerating air.

[0051] As can be best appreciated in **Figure 2**, a partition baffle **210** is preferably provided for partitioning the rear air channel **A_{CH,R}** into said separate upper **A_{CH,RU}** and lower **A_{CH,RL}** rear air channels. In the example at issue, the partition baffle **210** is part of the liner **120**, preferably made of a single piece with it.

[0052] Along a transverse direction (orthogonal to the rear wall **120_R** surface), the partition baffle **210** extends between the rear wall **120_R** of the liner **120** and the rear panel **110_R** of the cabinet **110**, whereas, in a plane parallel to the rear wall **120_R** surface, the partition baffle **210** extends between the first **205₁** and second **205₂** protruding edges of the liner **120**. Thus, complete and effective mechanical separation between the upper **A_{CH,RU}** and lower **A_{CH,RL}** rear air channels is achieved.

[0053] Arrangement and shape of the partition baffle **210** are not limiting for the invention, as depending on sizes of the upper **105_U** and lower **105_L** refrigerating compartments, as well as on other specific design options.

[0054] According to the advantageous illustrated embodiment, the partition baffle **210** is arranged and shaped such that at least one end portion of the upper rear air channel **A_{CH,RU}** extends between the lower refrigerating compartment **105_L** wall (*i.e.*, the lower rear wall **120_{RL}**) and the cabinet **110** (*i.e.*, the rear panel **110_R** part facing the lower rear wall **120_{RL}**), and at least one end portion of the lower rear air channel **A_{CH,RL}** extends between the upper refrigerating compartment **105_L** wall (*i.e.*, the upper rear wall **120_{RU}**) and the cabinet **110** (*i.e.*, the rear panel **110_R** part facing the upper rear wall **120_{RU}**) - see **Figure 2**, showing the partition baffle **210** substantially astride of the upper **105_U** and lower **105_L** refrigerating compartments.

[0055] Preferably, as visible in **Figure 2**, the partition baffle **210** comprises a substantially U-shaped central portion **210_C**, and, at the ends thereof, first **210₁** and second **210₂** appendices extending (*e.g.*, slightly inclined) toward the first **205₁** and second **205₂** protruding edges, respectively. The U-shaped central portion **210_C**, the first appendix **210₁**, and the protruding edge **205₁** on one side, and the U-shaped central portion **210_C**, the second appendix **210₂**, and the protruding edge **205₂** on the other side, delimit respective top end portions of the lower rear air channel **A_{CH,RL}**, whereas the U-shaped central portion **210_C** delimits a bottom end portion of the upper rear

air channel **A_{CH,RU}**. In particular, the two top end portions of the lower rear air channel **A_{CH,RL}** are arranged opposite to each other with respect to the bottom end portion of the upper rear air channel **A_{CH,RU}**, *i.e.* on the opposite lateral sides of such bottom end portion.

[0056] As will be best understood shortly, the illustrated arrangement and shape of the partition baffle **210** is intended to substantially match suitable air openings of the liner **120** (hereinafter, liner openings).

[0057] Indeed, a number of liner openings **215₁, 215₂** are provided in the rear wall **120_R** in correspondence of the top end portions of the lower rear air channel **A_{CH,RL}**, for fluidly connecting the upper refrigerating compartment **105_L** to the lower rear air channel **A_{CH,RL}**. In particular, for each top end portion there can be one opening or one group of liner openings. Preferably, as illustrated, the liner openings **215₁, 215₂** are in the form of gratings, although this should not be construed limitatively.

[0058] Still in the rear wall **120_R**, a number of further liner openings **220₁, 220₂** are provided, in correspondence of the bottom end portion of the upper rear air channel **A_{CH,RU}** for fluidly connecting the lower refrigerating compartment **105_L** to the upper rear air channel **A_{CH,RU}** (as discussed herebelow). As visible in **Figure 2**, in the illustrated embodiment two openings **220₁, 220₂** are provided that are horizontally aligned to each other, but the number of such openings can be lower (*i.e.* only one opening) or higher, so that also in this case it is possible to refer to a group of openings, where the group can be formed by one or more openings.

[0059] The refrigerating apparatus **100** further comprises a separator assembly **130** extending substantially horizontally between the rear wall **120_R** of the liner **120** (for example, as illustrated, at a central part thereof) and the cabinet **110** front, so as to separate from each other and delimit, together with the liner **120**, the upper **105_U** and lower **105_L** refrigerating compartments.

[0060] As visible in **Figures 1, 3A** and **3B**, the separator assembly **130** comprises a separator top **130_T**, that defines a bottom of the upper refrigerating compartment **105_U**, and a separator bottom **130_B**, that defines a top of the lower refrigerating compartment **105_L**. The representation of **Figure 1** is only schematic, whereas in the representation of **Figure 3B** the separator top **130_T** is omitted and only separator bottom **130_B** is shown.

[0061] Preferably, the separator top **130_T** and the separator bottom **130_B** are made of materials capable of providing thermal insulation between the upper **105_U** and lower **105_L** refrigerating compartments.

[0062] The separator top **130_T** and the separator bottom **130_B** are superimposed to each other and are so shaped that one or more (*e.g.*, two) air passages **135₁, 135₂** are defined between them. The air passages **135₁, 135₂** fluidly connect the lower refrigerating compartment **105_L** to the liner openings **220₁, 220₂**, respectively, so that the refrigerating air from the lower refrigerating compartment **105_L** is allowed to flow into the upper rear air channel **A_{CH,RU}** through the air passages **135₁, 135₂**

and the liner openings **220₁, 220₂**. In order to achieve that, the separator bottom **130_B** comprises one or more (*e.g.*, two) grooves **305₁, 305₂** (visible in **Figure 3B**, showing the separator assembly **130** without the separator top **130_T**). The separator top **130_T** is shaped in such a way that, when put on the separator bottom **130_B**, the gap between it and the grooves **305₁, 305₂** defines the corresponding air passages **135₁, 135₂**.

[0063] As shown in **Figures 3A** and **3B**, both the separator top **130_T** and the separator bottom **130_B** preferably have the front side bent downward, so that air from the lower refrigerating compartment **105_L** can easily flow in.

[0064] Moreover, the front side of the separator top **130_T** preferably cooperates with the inner surface of the upper door **115_U** (as shown in **Figure 1**) or of the lower door **115_L** (in a possible different embodiment not shown) when such door is closed, so as to isolate the lower **105_L** and upper **105_U** refrigerating compartments from each other.

[0065] Refrigerating air circulation according to the invention may be summarized as follows.

[0066] Refrigerating air from the upper evaporator **E_U** is first fed, through the top air channel **A_{CH,T}**, into the upper refrigerating compartment **105_U**, where it absorbs heat from food articles thereby allowing refrigeration thereof. Relatively hot refrigerating air within the upper refrigerating compartment **105_U** is then allowed to pass through the liner openings **215₁, 215₂**, and hence, under fan **F** action, into the lower rear air channel **A_{CH,RL}** and the lower evaporator **E_L** housed therein.

[0067] Refrigerating air from the evaporator **E_L** is then fed, through the bottom air channel **A_{CH,B}**, into the lower refrigerating compartment **105_L**, where, upon absorbing heat from food articles for allowing refrigeration thereof, it is fed back to upper rear air channel **A_{CH,RU}** (and hence to the upper evaporator **E_U** housed therein) through the air passages **135₁, 135₂** and the liner openings **220₁, 220₂**.

[0068] Naturally, in order to satisfy local and specific requirements, a person skilled in the art may apply to the solution described above many logical and/or physical modifications and alterations. More specifically, although the present invention has been described with a certain degree of particularity with reference to preferred embodiments thereof, it should be understood that various omissions, substitutions and changes in the form and details as well as other embodiments are possible. In particular, different embodiments of the invention may even be practiced without the specific details (such as the numeric examples) set forth in the preceding description for providing a more thorough understanding thereof; on the contrary, well known features may have been omitted or simplified in order not to obscure the description with unnecessary particulars. Moreover, it is expressly intended that specific elements and/or method steps described in connection with any disclosed embodiment of the invention may be incorporated in any other embodiment as a matter of general design choice.

[0069] Moreover, analogous considerations apply if the refrigerating apparatus has a different structure or comprises equivalent components, or it has other operating features. In any case, any component thereof may be separated into several elements, or two or more components may be combined into a single element; in addition, each component may be replicated for supporting the execution of the corresponding operations in parallel. It should also be noted that any interaction between different components generally does not need to be continuous (unless otherwise indicated), and it may be both direct and indirect through one or more intermediaries.

Claims

1. Refrigerating apparatus (100) comprising:

a cabinet (110),
 within said cabinet, first (105_U) and second (105_L) refrigerating compartments separate from each other and accessible for food storage, wherein
 the refrigerating apparatus (100) comprises a first air channel (A_{CH,RU}) between the cabinet (110) and a first refrigerating compartment wall (120_{RU}), and a second air channel (A_{CH,RL}) between the cabinet (100) and a second refrigerating compartment wall (120_{RL}), said first (A_{CH,RU}) and second (A_{CH,RL}) air channels being configured for canalizing refrigerating air into the first (105_U) and second (105_L) refrigerating compartments, respectively, and
 the first refrigerating compartment (105_U) opens out to the second air channel (A_{CH,RL}) for allowing the refrigerating air within the first refrigerating compartment (105_U) to flow into the second refrigerating compartment (105_L) through the second air channel (A_{CH,RL}), and the second refrigerating compartment (105_L) opens out to the first air channel (A_{CH,RU}) for allowing the refrigerating air within the second refrigerating compartment (105_L) to flow into the first refrigerating compartment (105_U) through the first air channel (A_{CH,RU}),
 wherein the refrigerating apparatus (100) further comprises:

a liner (120) delimiting said first (105_U) and second (105_L) refrigerating compartments, wherein the liner (120) has a rear wall (120_R) comprising said first (120_{RU}) and second (120_{RL}) refrigerating compartment walls and being spaced apart from a rear panel (110_R) of the cabinet (110) so as to define a rear air channel (A_{CH,R}) comprising said first (A_{CH,RU}) and second (A_{CH,RL}) air channels, and

a first and a second heat pump evaporators (E_U, E_L) for properly cooling the refrigerating air down to the intended refrigerating temperature, and a fan (F) for promoting refrigerating air circulation,

wherein

the first evaporator (E_U) is associated with the first (105_U) refrigerating compartment and is arranged along the first air channel (A_{CH,RU});
 the second evaporator (E_L) is associated with the second (105_L) refrigerating compartment and is arranged along the second air channel (A_{CH,RL}), and
 the fan (F) is arranged along the second air channel (A_{CH,RL}),
characterized by the refrigerating apparatus (100) further comprising:

a separation between said first (A_{CH,RU}) and second (A_{CH,RL}) air channels preventing the refrigerating air from the first refrigerating compartment (105_U) and towards the second air channel (A_{CH,RL}) from mixing with the refrigerating air from the second refrigerating compartment (105_L) and towards the first (A_{CH,RU}) air channel.

2. Refrigerating apparatus (100) according to Claim 1, wherein the liner (120) comprises, at opposite sides thereof, first (205₁) and second (205₂) protruding edges laterally delimiting said rear air channel (A_{CH,R}).
3. Refrigerating apparatus (100) according to Claim 1 or 2, further comprising a partition baffle (210) between said rear wall (120_R) and said rear panel (110_R) for partitioning the rear air channel (A_{CH,R}) into said first (A_{CH,RU}) and second (A_{CH,RL}) air channels, the partition baffle (210) being shaped such that at least one portion of the first air channel (A_{CH,RU}) extends between the second refrigerating compartment wall (120_{RL}) and the cabinet (110), and at least one portion of the second air channel (A_{CH,RL}) extends between the first refrigerating compartment wall (120_{RU}) and the cabinet (110).
4. Refrigerating apparatus (100) according to Claim 3, wherein the partition baffle (210) is made of a single piece with the liner (120).
5. Refrigerating apparatus (100) according to Claim 3 when dependent on Claim 2, wherein the partition baffle (210) comprises a U-shaped central portion (210_C), and, at the ends thereof, first (210₁) and second (210₂) appendices extending towards the first (205₁) and second (205₂) protruding edges, respectively.

6. Refrigerating apparatus (100) according to Claim 5, wherein said at least one portion of the first air channel ($A_{CH,RU}$) comprises a first portion delimited from below by the U-shaped central portion (210_C), and said at least one portion of the second air channel ($A_{CH,RL}$) comprises a second portion delimited by the U-shaped central portion (210_C), the first appendix (210₁), and the first protruding edge (205₁), and a further second portion delimited by the U-shaped central portion (210_C), the second appendix (210₂), and the second protruding edge (205₂).
7. Refrigerating apparatus (100) according to any Claim from 3 to 6, further comprising, at said at least one portion of the first air channel ($A_{CH,RU}$), first liner openings (220₁, 220₂) for fluidly connecting the second refrigerating compartment (105_L) to the first air channel ($A_{CH,RU}$), and at said at least one portion of the second air channel ($A_{CH,RL}$), second liner openings (215₁, 215₂) for fluidly connecting the first refrigerating compartment (105_U) to the second air channel ($A_{CH,RL}$).
8. Refrigerating apparatus (100) according to Claim 7 when dependent on Claim 7, wherein said second liner openings (215₁, 215₂) comprise first (215₁) and second (215₂) openings in the second portion and in the further second portion, respectively, of said at least one portion of the second air channel ($A_{CH,RL}$).
9. Refrigerating apparatus (100) according to Claim 7 or 8, further comprising a separator (130) extending substantially horizontally between the rear wall (120_R) of the liner (120) and the cabinet (110) front for separating the first refrigerating compartment (105_U) from the second refrigerating compartment (105_L), the separator (130) defining at least one air passage (135₁, 135₂) fluidly connecting the second refrigerating compartment (105_L) to the first liner opening (220₁, 220₂) to allow air flow from the second refrigerating compartment (105_L) into the first air channel ($A_{CH,RU}$) through the at least one air passage (135₁, 135₂) and the first liner opening (220₁, 220₂).
10. Refrigerating apparatus (100) according to Claim 9, wherein the separator (130) comprises a separator top (130_T) that defines a bottom of the first refrigerating compartment (105_U) and a separator bottom (130_B) that defines a top of the second refrigerating compartment (105_L), the separator top (130_T) and the separator bottom (130_B) being so shaped as to define between them the at least one air passage (135₁, 135₂).
11. Refrigerating apparatus (100) according to any of the preceding Claims, wherein the first (105_U) and second (105_L) refrigerating compartments comprise

combinations of fridge, freezer or zero-degree compartments.

5 Patentansprüche

1. Kühlvorrichtung (100), umfassend:

ein Gehäuse (110),
 ein erstes (105_U) und ein zweites (105_L) Kühlfach in dem Gehäuse, die voneinander getrennt und zur Lebensmittellagerung zugänglich sind, wobei
 die Kühlvorrichtung (100) einen ersten Luftkanal ($A_{CH,RU}$) zwischen dem Gehäuse (110) und einer ersten Kühlfachwand (120_{RU}) und einen zweiten Luftkanal ($A_{CH,RL}$) zwischen dem Gehäuse (100) und einer zweiten Kühlfachwand (120_{RL}) umfasst, wobei der erste ($A_{CH,RU}$) und der zweite ($A_{CH,RL}$) Luftkanal dazu ausgelegt sind, Kühlluft in das erste (105_U) beziehungsweise zweite (105_L) Kühlfach zu leiten, und sich das erste Kühlfach (105_U) in den zweiten Luftkanal ($A_{CH,RL}$) öffnet, um zu ermöglichen, dass die Kühlluft in dem ersten Kühlfach (105_U) durch den zweiten Luftkanal ($A_{CH,RL}$) in das zweite Kühlfach (105_L) strömt, und sich das zweite Kühlfach (105_L) in den ersten Luftkanal ($A_{CH,RU}$) öffnet, um zu ermöglichen, dass die Kühlluft in dem zweiten Kühlfach (105_L) durch den ersten Luftkanal ($A_{CH,RU}$) in das erste Kühlfach (105_U) strömt,
 wobei die Kühlvorrichtung (100) ferner Folgendes umfasst:

eine Auskleidung (120), die das erste (105_U) und das zweite (105_L) Kühlfach begrenzt, wobei die Auskleidung (120) eine hintere Wand (120_R) aufweist, die die erste (120_{RU}) und die zweite (120_{RL}) Kühlfachwand umfasst und von einer hinteren Platte (110_R) des Gehäuses (110) beabstandet ist, um einen hinteren Luftkanal ($A_{CH,R}$) festzulegen, der den ersten ($A_{CH,RU}$) und den zweiten ($A_{CH,RL}$) Luftkanal umfasst, und

einen ersten und einen zweiten Wärmepumpenverdampfer (E_U , E_L), um die Kühlluft ordnungsgemäß auf die vorgesehene Kühlttemperatur abzukühlen, und einen Lüfter (F), um eine Kühlluftzirkulation zu fördern,

wobei

der erste Verdampfer (E_U) zu dem ersten (105_U) Kühlfach zugehörig und entlang dem ersten Luftkanal ($A_{CH,RU}$) angeordnet ist, der zweite Verdampfer (E_L) zu dem zweiten

- (105_L) Kühlfach zugehörig und entlang dem zweiten Luftkanal (**A_{CH,RL}**) angeordnet ist, und der Lüfter (**F**) entlang dem zweiten Luftkanal (**A_{CH,RL}**) angeordnet ist, dadurch gekennzeichnet, dass die Kühlvorrichtung (**100**) ferner Folgendes umfasst:
- 5 eine Trennung zwischen dem ersten (**A_{CH,RU}**) und dem zweiten (**A_{CH,RL}**) Luftkanal, die verhindert, dass Kühlluft, die von dem ersten Kühlfach (105_U) zu dem zweiten Luftkanal (**A_{CH,RL}**) strömt, sich mit der Kühlluft mischt, die von dem zweiten Kühlfach (105_L) zu dem ersten Luftkanal (**A_{CH,RU}**) strömt.
2. Kühlvorrichtung (**100**) nach Anspruch 1, wobei die Auskleidung (**120**) auf sich gegenüberliegenden Seiten derselben eine erste (205₁) und eine zweite (205₂) vorstehende Kante umfasst, die den hinteren Luftkanal (**A_{CH,R}**) seitlich begrenzen.
3. Kühlvorrichtung (**100**) nach Anspruch 1 oder 2, ferner umfassend eine Trennwand (210) zwischen der hinteren Wand (120_R) und der hinteren Platte (110_R), um den hinteren Luftkanal (**A_{CH,R}**) in den ersten (**A_{CH,RU}**) und den zweiten (**A_{CH,RL}**) Luftkanal zu teilen, wobei die Trennwand (210) so geformt ist, dass sich wenigstens ein Abschnitt des ersten Luftkanals (**A_{CH,RU}**) zwischen der zweiten Kühlfachwand (120_{RL}) und dem Gehäuse (110) erstreckt und sich wenigstens ein Abschnitt des zweiten Luftkanals (**A_{CH,RL}**) zwischen der ersten Kühlfachwand (120_{RU}) und dem Gehäuse (110) erstreckt.
4. Kühlvorrichtung (**100**) nach Anspruch 3, wobei die Trennwand (210) einstückig mit der Auskleidung (120) hergestellt ist.
5. Kühlvorrichtung (**100**) nach Anspruch 3 bei Abhängigkeit von Anspruch 2, wobei die Trennwand (210) einen U-förmigen Mittelabschnitt (210_C) und an den Enden desselben einen ersten (210₁) und einen zweiten (210₂) Fortsatz umfasst, die sich zu der ersten (205₁) beziehungsweise zweiten (205₂) vorstehenden Kante erstrecken.
6. Kühlvorrichtung (**100**) nach Anspruch 5, wobei der wenigstens eine Abschnitt des ersten Luftkanals (**A_{CH,RU}**) einen von unten durch den U-förmigen Mittelabschnitt (210_C) begrenzten ersten Abschnitt umfasst und der wenigstens eine Abschnitt des zweiten Luftkanals (**A_{CH,RL}**) einen durch den U-förmigen Mittelabschnitt (210_C), den ersten Fortsatz (210₁) und die erste vorstehende Kante (205₁) begrenzten zweiten Abschnitt sowie einen durch den U-förmigen Mittelabschnitt (210_C), den zweiten Fortsatz (210₂) und die zweite vorstehende Kante (205₂) begrenzten weiteren zweiten Abschnitt umfasst.

7. Kühlvorrichtung (**100**) nach einem der Ansprüche 3 bis 6, ferner umfassend erste Auskleidungsöffnungen (220₁, 220₂) an dem wenigstens einen Abschnitt des ersten Luftkanals (**A_{CH,RU}**), um eine Flüssigkeitsverbindung des zweiten Kühlfachs (105_L) mit dem ersten Luftkanal (**A_{CH,RU}**) herzustellen, und zweite Auskleidungsöffnungen (215₁, 215₂) an dem wenigstens einen Abschnitt des zweiten Luftkanals (**A_{CH,RL}**), um eine Flüssigkeitsverbindung des ersten Kühlfachs (105_U) mit dem zweiten Luftkanal (**A_{CH,RL}**) herzustellen.
8. Kühlvorrichtung (**100**) nach Anspruch 7 bei Abhängigkeit von Anspruch 7, wobei die zweiten Auskleidungsöffnungen (215₁, 215₂) eine erste (215₁) und eine zweite (215₂) Öffnung in dem zweiten Abschnitt beziehungsweise dem weiteren zweiten Abschnitt des wenigstens einen Abschnitts des zweiten Luftkanals (**A_{CH,RL}**) umfassen.
9. Kühlvorrichtung (**100**) nach Anspruch 7 oder 8, ferner umfassend eine Trennvorrichtung (130), die sich im Wesentlichen horizontal zwischen der hinteren Wand (120_R) der Auskleidung (120) und der Vorderfront des Gehäuses (110) erstreckt, um das erste Kühlfach (105_U) von dem zweiten Kühlfach (105_L) zu trennen, wobei die Trennvorrichtung (130) wenigstens einen Luftdurchlass (135₁, 135₂) festlegt, der eine Flüssigkeitsverbindung des zweiten Kühlfachs (105_L) mit der ersten Auskleidungsöffnung (220₁, 220₂) herstellt, um einen Luftstrom von dem zweiten Kühlfach (105_L) in den ersten Luftkanal (**A_{CH,RU}**) durch den wenigstens einen Luftdurchlass (135₁, 135₂) und die erste Auskleidungsöffnung (220₁, 220₂) zu ermöglichen.
10. Kühlvorrichtung (**100**) nach Anspruch 9, wobei die Trennvorrichtung (130) eine Trennvorrichtungsoberseite (130_T), die eine Unterseite des ersten Kühlfachs (105_U) festlegt, und eine Trennvorrichtungsunterseite (130_B), die eine Oberseite des zweiten Kühlfachs (105_L) festlegt, umfasst, wobei die Trennvorrichtungsoberseite (130_T) und die Trennvorrichtungsunterseite (130_B) so geformt sind, dass sie den wenigstens einen Luftdurchlass (135₁, 135₂) zwischen sich festlegen.
11. Kühlvorrichtung (**100**) nach einem der vorhergehenden Ansprüche, wobei das erste (105_U) und das zweite (105_L) Kühlfach Kombinationen aus Kühlschränken-, Gefrier- oder Nullgradfächern umfassen.

Revendications

1. Appareil frigorifique (100) comprenant :
- une armoire (110),

à l'intérieur de ladite armoire, des premier (105_U) et second (105_L) compartiments frigorifiques séparés l'un de l'autre et accessibles pour le stockage d'aliments,

l'appareil frigorifique (100) comprenant un premier conduit d'air (A_{CH,RU}) entre l'armoire (110) et une première paroi de compartiment frigorifique (120_{RU}), et un second conduit d'air (A_{CH,RL}) entre l'armoire (100) et une seconde paroi de compartiment frigorifique (120_{RL}), lesdits premier (A_{CH,RU}) et second (A_{CH,RL}) conduits d'air étant conçus pour canaliser l'air frigorifique dans les premier (105_U) et second (105_L) compartiments frigorifiques, respectivement, et

le premier compartiment frigorifique (105_U) s'ouvrant vers le second conduit d'air (A_{CH,RL}) pour permettre à l'air frigorifique dans le premier compartiment frigorifique (105_U) de s'écouler dans le second compartiment frigorifique (105_L) à travers le second conduit d'air (A_{CH,RL}), et le second compartiment frigorifique (105_L) s'ouvrant vers le premier conduit d'air (A_{CH,RU}) pour permettre à l'air frigorifique dans le second compartiment frigorifique (105_L) de s'écouler dans le premier compartiment frigorifique (105_U) à travers le premier conduit d'air (A_{CH,RU}), l'appareil frigorifique (100) comprenant en outre :

une cuve (120) délimitant lesdits premier (105_U) et second (105_L) compartiments frigorifiques, la cuve (120) ayant une paroi arrière (120_R) comprenant lesdites première (120_{RU}) et seconde (120_{RL}) parois de compartiment frigorifique et étant espacée d'un panneau arrière (110_R) de l'armoire (110) de sorte à définir un conduit d'air arrière (A_{CH,R}) comprenant lesdits premier (A_{CH,RU}) et second (A_{CH,RL}) conduits d'air, un premier et un second évaporateur de pompe à chaleur (E_U, E_L) pour refroidir correctement l'air frigorifique jusqu'à la température frigorifique prévue, et un ventilateur (F) pour favoriser la circulation de l'air frigorifique,

le premier évaporateur (E_U) étant associé au premier compartiment frigorifique (105_U) et étant disposé le long du premier conduit d'air (A_{CH,RU}) ;

le second évaporateur (E_L) étant associé au second compartiment frigorifique (105_L) et étant disposé le long du second conduit d'air (A_{CH,RL}), et

le ventilateur (F) étant disposé le long du second conduit d'air (A_{CH,RL}),

caractérisé en ce que l'appareil frigorifique (100) comprend en outre :

une séparation entre lesdits premier (A_{CH,RU}) et second (A_{CH,RL}) conduits d'air empêchant l'air frigorifique circulant du premier compartiment frigorifique (105_U) vers le second conduit d'air (A_{CH,RL}) de se mélanger avec l'air frigorifique circulant du second compartiment frigorifique (105_L) vers le premier (A_{CH,RU}) conduit d'air.

2. Appareil frigorifique (100) selon la revendication 1, la cuve (120) comprenant, sur ses côtés opposés, des premier (205₁) et second (205₂) bords en saillie délimitant latéralement ledit conduit d'air arrière (A_{CH,R}).

3. Appareil frigorifique (100) selon la revendication 1 ou 2, comprenant en outre un déflecteur de séparation (210) entre ladite paroi arrière (120_R) et ledit panneau arrière (110_R) pour séparer le conduit d'air arrière (A_{CH,R}) en lesdits premier (A_{CH,RU}) et second (A_{CH,RL}) conduits d'air, le déflecteur de séparation (210) étant formé de sorte qu'au moins une partie du premier conduit d'air (A_{CH,RU}) s'étende entre la seconde paroi de compartiment frigorifique (120_{RL}) et l'armoire (110), et au moins une partie du second conduit d'air (A_{CH,RL}) s'étende entre la première paroi de compartiment frigorifique (120_{RU}) et l'armoire (110).

4. Appareil frigorifique (100) selon la revendication 3, le déflecteur de séparation (210) étant constitué d'une seule pièce avec la cuve (120).

5. Appareil frigorifique (100) selon la revendication 3 lorsqu'elle dépend de la revendication 2, le déflecteur de séparation (210) comprenant une partie centrale en forme de U (210c) et, à ses extrémités, des premier (210₁) et second (210₂) appendices s'étendant vers les premier (205₁) et second (205₂) bords en saillie, respectivement.

6. Appareil frigorifique (100) selon la revendication 5, ladite au moins une partie du premier conduit d'air (A_{CH,RU}) comprenant une première partie délimitée depuis le bas par la partie centrale en forme de U (210c), et ladite au moins une partie du second conduit d'air (A_{CH,RL}) comprenant une seconde partie délimitée par la partie centrale en forme de U (210c), le premier appendice (210₁) et le premier bord en saillie (205₁), et une autre seconde partie délimitée par la partie centrale en forme de U (210c), le second appendice (210₂) et le second bord en saillie (205₂).

7. Appareil frigorifique (100) selon l'une quelconque des revendications de 3 à 6, comprenant en outre, au niveau de ladite au moins une partie du premier conduit d'air (A_{CH,RU}), des premières ouvertures de cuve (220₁, 220₂) pour relier de façon fluide le second compartiment frigorifique (105_L) au premier

conduit d'air ($A_{CH,RU}$), et au niveau de ladite au moins une partie du second conduit d'air ($A_{CH,RL}$), des secondes ouvertures de cuve (215_1 , 215_2) pour relier de manière fluide le premier compartiment frigorifique (105_U) au second conduit d'air ($A_{CH,RL}$). 5

8. Appareil frigorifique (100) selon la revendication 7 lorsqu'elle dépend de la revendication 7, lesdites secondes ouvertures de cuve (215_1 , 215_2) comprenant des première (215_1) et seconde (215_2) ouvertures dans la seconde partie et dans l'autre seconde partie, respectivement, de ladite au moins une partie du second conduit d'air ($A_{CH,RL}$). 10

9. Appareil frigorifique (100) selon la revendication 7 ou 8, comprenant en outre un séparateur (130) s'étendant sensiblement horizontalement entre la paroi arrière (120_R) de la cuve (120) et l'avant de l'armoire (110) pour séparer le premier compartiment frigorifique (105_U) du second compartiment frigorifique (105_L), le séparateur (130) définissant au moins un passage d'air (135_1 , 135_2) reliant de manière fluide le second compartiment frigorifique (105_L) à la première ouverture de cuve (220_1 , 220_2) pour permettre l'écoulement d'air du second compartiment frigorifique (105_L) dans le premier conduit d'air ($A_{CH,RU}$) à travers l'au moins un passage d'air (135_1 , 135_2) et la première ouverture de cuve (220_1 , 220_2). 15 20 25 30

10. Appareil frigorifique (100) selon la revendication 9, le séparateur (130) comprenant une partie supérieure de séparateur (130_T) qui définit une partie inférieure du premier compartiment frigorifique (105_U) et une partie inférieure de séparateur (130_B) qui définit une partie supérieure du second compartiment frigorifique (105_L), la partie supérieure de séparateur (130_T) et la partie inférieure de séparateur (130_B) étant formées de sorte à définir entre elles ledit au moins un passage d'air (135_1 , 135_2). 35 40

11. Appareil frigorifique (100) selon l'une quelconque des revendications précédentes, les premier (105_U) et second (105_L) compartiments frigorifiques comprenant des combinaisons de compartiments frigorifique, congélateur ou à zéro degré. 45 50 55

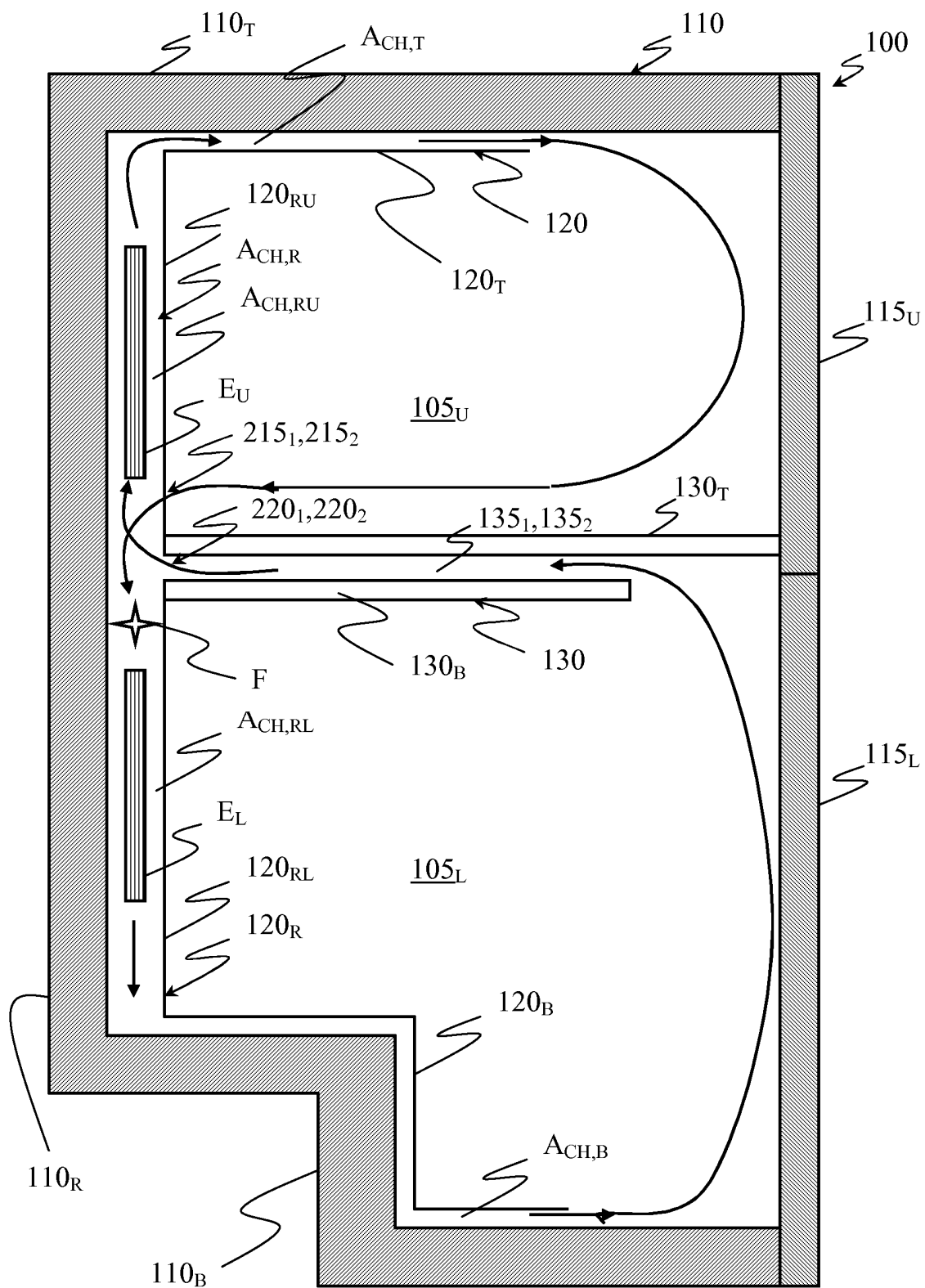


Figure 1

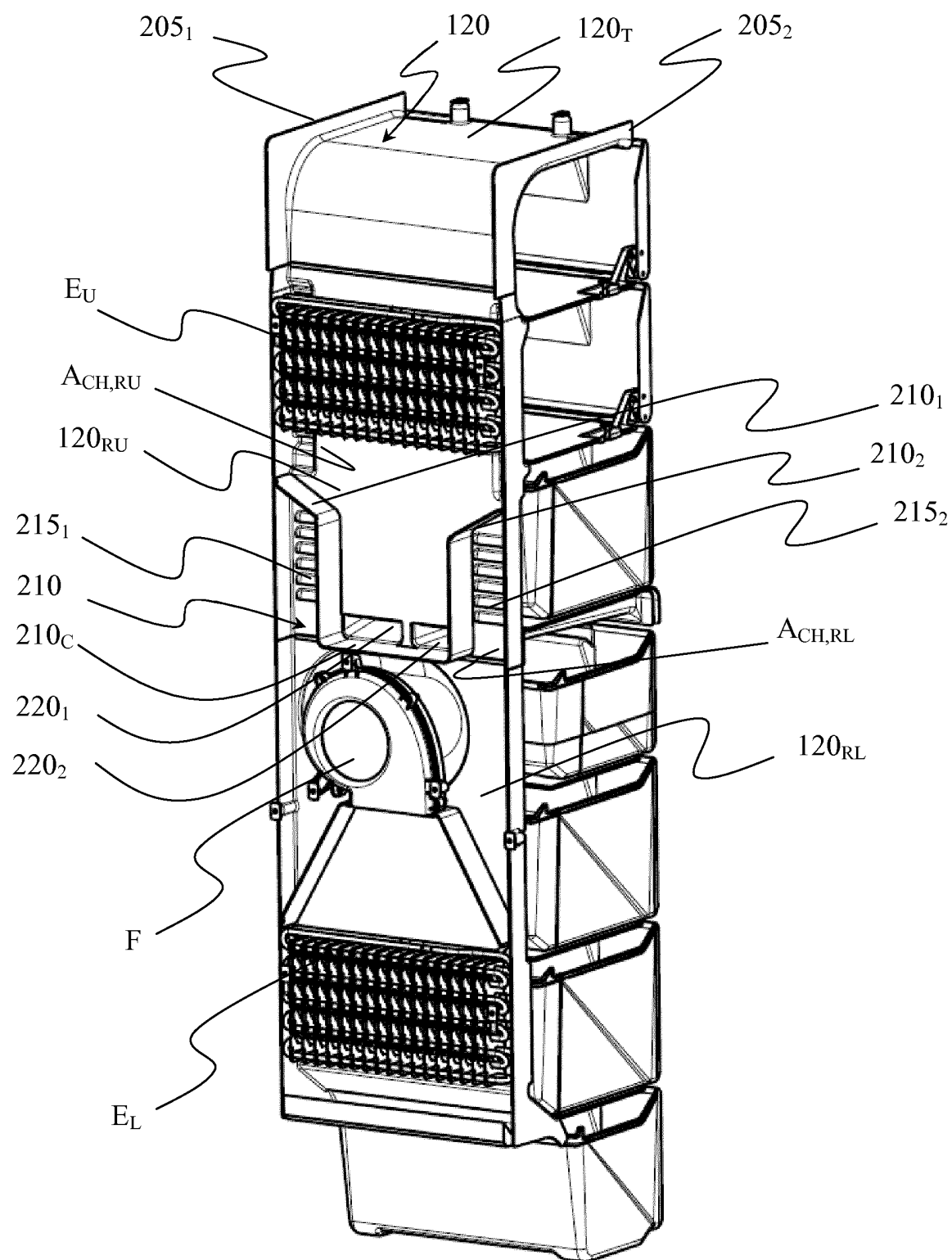


Figure 2

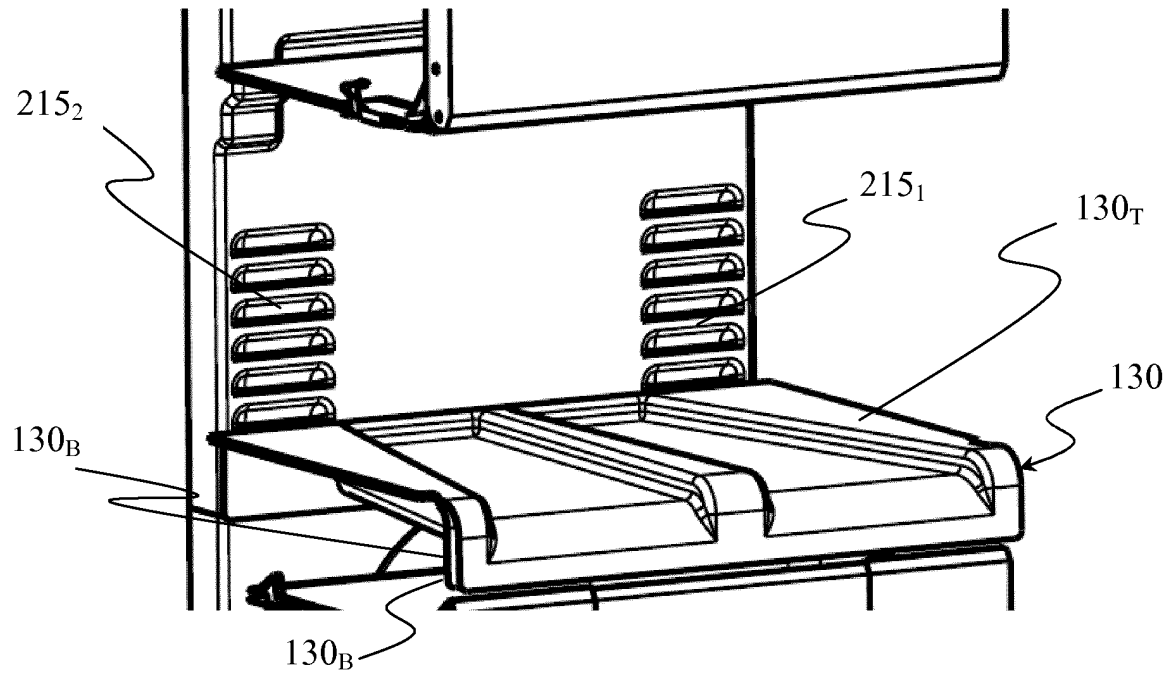


Figure 3A

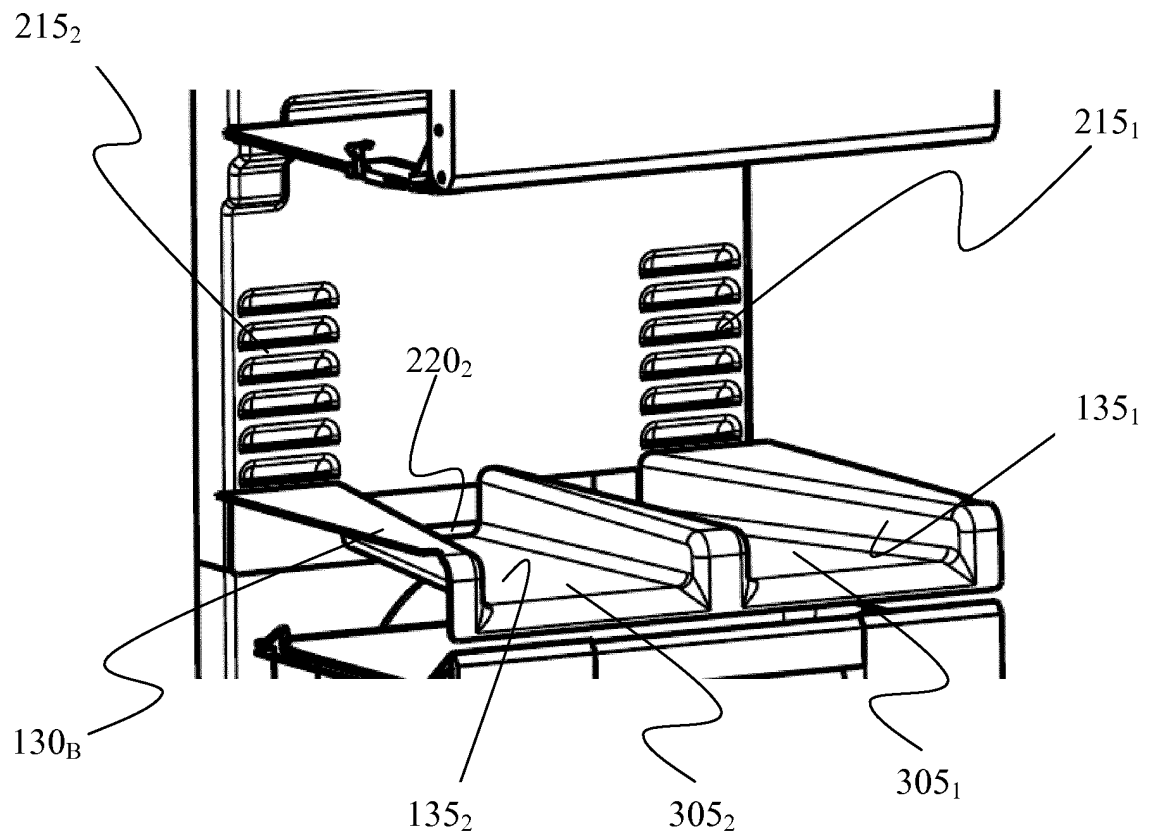


Figure 3B

REFERENCES CITED IN THE DESCRIPTION

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