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(54) Cooling appliance

(57) Cooling appliance comprising at least one cooling enclosure (2) having an internal cavity (3) that is cooled by a flow of cold air (5) while the cooling appliance (1) is operating, which passes through a cooling channel (4) of the cooling enclosure (2), and at least one section of wall (6) arranged in the cooling enclosure (2), which prevents the flow of cold air (5) from exiting to the internal cavity (3), causing a transmission of thermal energy (7) from the internal cavity (3) to the flow of cold air (5) through the section of wall (6), wherein the cooling appliance (1) comprises at least one fan (8) housed in the internal cavity (3), causing the transmission of thermal energy (7) to take place by means of a circulation of a flow of forced air (9).

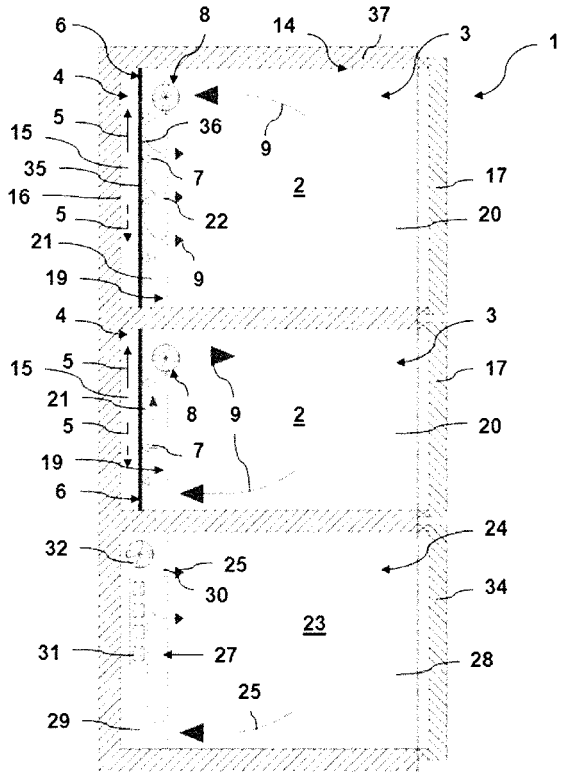

Fig. 1

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Description

TECHNICAL FIELD

[0001] The present invention relates to cooling appliances, in particular to household cooling appliances with enclosures with different temperatures.

PRIOR ART

[0002] Cooling appliances with a freezer enclosure and at least one cooling enclosure with different temperatures, with at least one evaporator-fan unit and pipes that allow flows of cool air to be directed to the different enclosures and to then return to said unit, where they come together, are known in the art. The humidity of the air collected in the cooling enclosure produces ice deposits, and frequent defrosting cycles need to be performed. As a result of this process food quickly dries out.

[0003] Patent application WO2010139535 describes a cooling appliance that comprises a cooling enclosure, the internal cavity of which is cooled with cold air, while the cooling appliance is operating, which passes through a cooling channel in the cooling enclosure, which prevents cold air from exiting to said cooling enclosure, it being arranged with at least one section of wall that forms a boundary with the internal cavity of the cooling enclosure, through which the thermal energy is transmitted from the internal cavity of the cooling enclosure to the cooling channel.

[0004] As a result, cold air is prevented from entering the cooling enclosure, the humidity is greater than the flow of cold air, and the food barely dries out. As the evaporator of the cooling appliance is located in a separate channel in the cooling enclosure, it is exposed to low humidity and thus has fewer defrosting cycles.

BRIEF DISCLOSURE OF THE INVENTION

[0005] It is the object of this invention to provide a cooling appliance, as defined in the claims.

[0006] The cooling appliance of the invention comprises at least one cooling enclosure having an internal cavity that is cooled by a flow of cold air while said cooling appliance is operating, said flow of cold air passing through a cooling channel of the cooling enclosure. It comprises at least one section of wall arranged in the cooling enclosure, which prevents the flow of cold air from exiting to the internal cavity, causing a transmission of thermal energy from the internal cavity to the flow of cold air through the section of wall. The cooling appliance also comprises a fan, housed in the internal cavity, causing the transmission of thermal energy to take place by means of a circulation of a flow of forced air.

[0007] With the cooling appliance of the invention, as well as reducing the number of defrosting cycles of the cooling appliance and preventing the food from drying out again in the cooling enclosure, a more uniform distribution of the temperature and humidity in the cooling enclosure is achieved due to the circulation of forced air along the section of wall. In addition, the efficiency of the cooling appliance is improved, as greater energy transmission is achieved with the forced air, more calories are extracted from the cooling enclosure and the same effect is achieved as with a larger exchanger operating by natural convection.

[0008] These and other advantages and characteristics of the invention will be made evident in the light of the drawings and the detailed description thereof.

DESCRIPTION OF THE DRAWINGS

[0009]

Figure 1 shows a cross-sectional side view of an embodiment of a cooling appliance of the invention with two cooling enclosures and a freezer enclosure.

Figure 2 shows a cross-sectional side view of another embodiment of a cooling appliance of the invention with a cooling enclosure and a freezer enclosure.

Figure 3 shows a perspective view of the inner front part of the cooling appliance of Figure 1, with the flow of cold air in the cooling enclosures and in the freezer enclosure.

Figure 4 shows a perspective view of the inner rear part of the cooling appliance of Figure 1, with the flow of cold air in the cooling enclosures and in the freezer enclosure.

DETAILED DISCLOSURE OF THE INVENTION

[0010] Figure 1 shows a cross-sectional side view of an embodiment of a cooling appliance 1 of the invention. In said embodiment the cooling appliance 1 comprises two cooling enclosures 2, each one of them closed with a door 17, and a freezer enclosure 23 closed with a door 34, said enclosures with different temperatures, in which each cooling enclosure 2 has an internal cavity 3, and the freezer enclosure 23 has an internal cavity 24. The internal cavity 3 of the cooling enclosure 2 is cooled by a flow of cold air 5 while the cooling appliance 1 is operating, which passes through a cooling channel 4 comprised in the cooling enclosure 2.

[0011] Figure 2 shows a cross-sectional side view of another embodiment of a cooling appliance 1 of the invention with a cooling enclosure 2 closed with a door 17, and a freezer enclosure 23 closed with a door 34. As in the embodiment shown in Figure 1, the enclosures have different temperatures, the cooling enclosure 2 being arranged with an internal cavity 3, and the freezer enclosure 23 with an internal cavity 24. The internal cavity 3 of the cooling enclosure 2 is cooled by a flow of cold air 5 while the cooling appliance 1 is operating, which passes

through a cooling channel 4 of the cooling enclosure 2.

[0012] The cooling appliance 1 also comprises at least one section of wall 6 that is arranged in the cooling enclosure 2, which prevents the flow of cold air 5 from exiting to the internal cavity 3, causing a transmission of thermal energy 7 from the internal cavity 3, which is warmer, to the flow of cold air 5 through the section of wall 6. The cooling appliance 1 also comprises a fan 8, housed in the internal cavity 3, which moves the air of said cavity, causing the transmission of thermal energy 7 to take place by means of a circulation of a flow of forced air 9 and not by natural convection.

[0013] As a result, the intake of cold air in the cooling enclosure 2 is prevented as is, therefore, the drying-out of the food in said enclosure. If the cold air comes into contact with the food, it absorbs humidity from it, heats up, and takes said humidity with it to the evaporator of the cooling appliance, where the exchange of thermal energy takes place and causes the phenomenon known as frost. In the cooling appliance 1 of the invention, the internal cavity 3 of the cooling enclosure 2 is separated from the flow of cold air 5 and, therefore, the air in said internal cavity retains a high level of humidity, and the food kept in it therefore has a higher level of humidity, and retains its characteristics better and for a longer period of time.

[0014] In any of the embodiments of the invention shown in Figures 1 and 2, the cooling enclosure 2 also comprises a sheet 19 arranged in the internal cavity 3 opposite the section of wall 6, the internal cavity 3 thus being divided into an inner storage area 20 where the food is stored for its refrigeration, and a chamber 21 where the flow of forced air 9 circulates. This sheet 19 is made of plastic in this embodiment and comprises a plurality of holes 22 that allow the circulation of the flow of forced air 9 between the chamber 21 and the inner storage area 20, a uniformly distributed flow of air thereby being obtained in the storage area 20 where the food is located, and, similarly, a uniform distribution of the temperature and, consequently, the humidity being obtained.

[0015] The relationship that exists between the relative humidity of a mass of air and the temperature to which said mass of air is subjected, which is substantially proportional, is known. This relative humidity, which is the humidity that a mass of air contains in relation to the maximum absolute humidity it is able to absorb without producing condensation, retaining the same temperature and pressure conditions, adequately reflects the capacity of the air to absorb more or less water vapour. As a result, in knowing that the maximum amount of humidity in the air in an enclosure depends on its temperature, by controlling the temperature of said enclosure the humidity in it is also controlled.

[0016] In the cooling appliance 1 of the invention, the section of wall 6 is arranged with a side 35 in contact with the flow of cold air 5 that passes through the cooling channel 4, and another side 36 in contact with the internal cavity 3 of the cooling enclosure 2. The side 35 cools in its contact with the flow of cold air 5, and the entire section of wall 6 gradually cools, the cold being stored in it, with the side 36 gradually cooling. There is, therefore, a temperature gradient between the two sides of the section of wall 6, the temperature being lower on the side of the cooling channel 4 and greater on the side of the internal cavity 3, an exchange of thermal energy 7 taking place between the side 36 of the section of wall 6 and said cavity 3, said section of wall 6 behaving as a secondary exchanger. As a result, by controlling the temperatures on each side of the section of wall 6 the temperature in the cooling enclosure 2 is controlled, and with it the humidity in it, and therefore the humidity of the food kept in it.

[0017] One way of controlling the temperature of the air circulating in the cooling enclosure 2 or secondary air is arranging a variable-speed motor 10 in the fan 8, as shown in Figure 3, which allows the volume of the flow of forced air 9 to be varied. The greater the quantity of air that passes through the side 36 of the section of wall 6 originating from the cooling enclosure 2, the greater the mass of air that corresponds to the same gradient of temperature between the sides 35 and 36, and the higher the temperature of the air that passes through the side 36 of the section of wall 6 and exits towards the cooling enclosure 2 and vice versa. The temperature of the cooling enclosure 2 is therefore controlled, and therefore the humidity in it, with the variation of the volume of the flow of forced air 9.

[0018] Another way of controlling the temperature of the air circulating in the cooling enclosure 2 or secondary air, is arranging a regulating unit 11 of the flow of cold air 5, as shown in Figures 3 and 4, located in the intake of the cooling channel 4 to the cooling enclosure 2, which allows the volume of the flow of cold air 5 to be varied. Depending on the temperature of the cooling enclosure 2 and on the specified set temperature, the air-flow regulating unit 11 is in an open or closed position for the period of time necessary for it to reach the threshold temperature corresponding to the specified set temperature. The greater the quantity of air that passes through the side 35 of the section of wall 6, the lower the temperature on said side, the section of wall 6 is cooled more, and the side 36 of said section 6 will be cooler. As a result, the flow of forced air 9 that passes through the side 36 of the section of wall 6 and exits towards the cooling enclosure 2 is cooler, and vice versa. The temperature of the cooling enclosure 2 is therefore controlled and, as a result, the humidity in it, with the variation of the volume of the flow of cold air 5 that passes through the cooling channel 4.

[0019] A third way of controlling the temperature of the air circulating in the cooling enclosure 2 or secondary air is combining the two preceding alternatives, the variable-speed motor 10 of the fan 8 and the regulation unit 11 acting in a combined way in the intake of the cooling channel 4 to the cooling enclosure 2.

[0020] As a result, the humidity in the cooling enclosure 2 is controlled by controlling the temperature in said en-

closure, and with the flow of forced air 9 the cooling efficiency in said enclosure is also improved, and a uniform distribution of the temperature and humidity in it is also achieved.

[0021] Figure 1 shows the section of wall 6 that is arranged in the cooling enclosure 2 and prevents the flow of cold air 5 from exiting to the internal cavity 3, allowing a transmission of thermal energy 7 from the warmer internal cavity 3 to the flow of cold air 5. In one embodiment said section of wall 6 is at least one sheet of material with good thermal conductivity, which may be aluminium or an aluminium alloy, materials that allow the storage of the cold and the transmission of thermal energy 7. The flow of forced air 9 that circulates through the cooling enclosure 2 is warmer than the side 36 of the section of wall 6, the section of wall 6 absorbing said heat and transmitting it through it to the flow of cold air 5, thereby cooling the air in the cooling enclosure 2.

[0022] In another embodiment said section of wall 6 is at least one plate, formed as a sandwich, which is formed in its interior by a phase-change material (PCM) surrounded by external sheets of a material with good thermal conductivity, which may be aluminium or an aluminium alloy. The phase-change material (PCM) has the characteristic of having high thermal inertia, taking a long time to heat or cool, so that in order to move from a solid to a liquid state or vice versa it must acquire or release a certain amount of energy known as phase-change latent heat, which takes a certain amount of time. This is the characteristic that is made use of in this material, so that when the phase-change material (PCM) has solidified by means of the flow of cold air 5, the solid-to-liquid phase change occurs with the absorption of the necessary energy from the air of the cooling enclosure 2, allowing it to cool.

[0023] The internal cavity 3 of the cooling enclosure 2 of the cooling appliance 1 comprises a contour 14 that surrounds it, separating it from the thermal insulation 37 and the exterior. The section of wall 6 that is arranged in said internal cavity 3 limits a space 15 with the contour 14, forming the cooling channel 4, at least by sections. The internal cavity 3 is manufactured by drawing and the space 15 is formed in the same process.

[0024] Figure 3 shows a perspective view of the inner front part of the cooling appliance of Figure 1, with the flow of cold air in the cooling enclosures and in the freezer enclosure. In the embodiment of the invention shown in Figures 1 and 3, the contour 14 comprises a back wall 16 opposite the door 17 of the cooling enclosure 2. The section of wall 6 is situated opposite said back wall 16 and limits with it the space 15 in which the cooling channel 4 extends.

[0025] In the embodiment shown in Figure 2, the section of wall 6 is at least one closed hollow channel inside which the cooling channel 4 is formed, the walls of the channel being a sheet of material with good thermal conductivity, which may be aluminium or an aluminium alloy, or the walls of the channel being a plate, formed as a sandwich, which is formed in its interior by a phase-change material (PCM), surrounded by external sheets of a material with good thermal conductivity, which may be aluminium or an aluminium alloy. These materials allow the storage of the cold, and the transmission of thermal energy 7 from the flow of forced air 9 that circulates through the cooling enclosure 2, which is warmer than the side 36 of the section of wall 6, absorbing the heat of said air and cooling it, and transmitting said heat to the flow of cold air 5 through the side 35 of the section of wall 6.

[0026] The cooling channel 4 is divided, in any of the embodiments shown, at least by means of a rib 18 arranged in the direction of the flow of cold air 5, an intake refrigeration section and an outlet refrigeration section thereby being configured. In the embodiment shown in Figure 3 the cooling channel 4 is divided by means of two ribs 18, thus configuring an intake refrigeration section and two outlet refrigeration sections, a distribution of the flow of cold air 5 therefore being more balanced and with a more uniform distribution in the section of wall 6. These ribs 18 may be manufactured by drawing in the same process as the internal cavity 3 and the space 15, or they may be manufactured in plastic or metal to form a piece that is connected directly to the inner wall 14 or to the section of wall 6, also forming the cooling channel 4.

[0027] Figures 1, 2, 3 and 4 show the cooling appliance 1, which comprises a freezer enclosure 23, which is arranged with an internal cavity 24 that is cooled by a flow of cold air 25. The freezer enclosure 23 comprises a sheet 27, which closes it and is made of plastic in the embodiments shown. Said sheet 27 is arranged in the internal cavity 24 and divides it into an inner storage area 28 where food is stored for its freezing, and a chamber 29, the flow of cold air 25 circulating through said chamber 29 before moving into the internal cavity 24 of the freezer enclosure 23. The sheet 27 comprises a plurality of holes 30 that allow the circulation of the flow of cold air 25 between the chamber 29 and the inner storage area 28, a uniformly distributed flow of air thereby being obtained in the storage area 28, where the food is stored for freezing.

[0028] The cooling appliance 1 according to any of the embodiments shown comprises a circuit of cooling agent with an evaporator unit 31 and a fan 32. Figures 3 and 4 show the flows of cold air 5 and 25 and their travel through the different enclosures. The evaporator unit 31 and the fan 32 are arranged in the chamber 29, which is the place where the flows of cold air 5 arrive and come together after having passed through the cooling enclosure 2, and the flow of cold air 25 after having passed through the freezer enclosure 23. When said flows of cold air reach the chamber 29, they mix together and pass through the evaporator unit 31 driven by the fan 32, entering into a heat-exchange relationship with it, and being driven again by the fan 32 and directed towards the cooling channel 4 and the freezer enclosure 23 by a series of pipes.

[0029] The fan 8 housed in the internal cavity 3 of the cooling enclosure 2 may be arranged in the inner storage area 21 or may be arranged in one of the holes 22 of the sheet 19, and therefore connected to it, thereby creating a more efficient circulation of the flow of forced air 9. Said fan 8 may be an absorption or impulse fan, in the first case with the fan 8 absorbing the air of the inner storage area 20 and driving it towards the chamber 21, and in the second case with the fan 8 absorbing the air of the chamber 21 and driving it towards the inner storage area 20, one or another being used depending on the internal distribution of the inner storage area 20 and the temperature defined for said enclosure.

Claims

1. Cooling appliance comprising at least one cooling enclosure (2) having an internal cavity (3) that is cooled by a flow of cold air (5) while the cooling appliance (1) is operating, which passes through a cooling channel (4) of the cooling enclosure (2), and at least one section of wall (6) arranged in the cooling enclosure (2), which prevents the flow of cold air (5) from exiting to the internal cavity (3), causing a transmission of thermal energy (7) from the internal cavity (3) to the flow of cold air (5) through the section of wall (6), **characterised in that** the cooling appliance (1) comprises at least one fan (8), housed in the internal cavity (3), causing the transmission of thermal energy (7) to take place by means of a circulation of a flow of forced air (9).

2. Cooling appliance according to claim 1, wherein the cooling enclosure (2) comprises at least one sheet (19) arranged in the internal cavity (3) opposite the section of wall (6), dividing the internal cavity (3) into an inner storage area (20) where the food is stored for its refrigeration, and into a chamber (21) in which the flow of forced air (9) circulates, the sheet (19) comprising a plurality of holes (22) that allow the circulation of the flow of forced air (9) between the chamber (21) and the inner storage area (20).

3. Cooling appliance according to claims 1 or 2, wherein the fan (8) comprises a variable-speed motor (10) that allows the volume of the flow of forced air (9) to be varied so that the temperature and the humidity in the internal cavity (3) may thereby be varied.

4. Cooling appliance according to any of claims 1 to 3, wherein the cooling channel (4) in its intake to the cooling enclosure (2) comprises a regulating unit (11) of the flow of cold air (5) that allows its volume to be varied so that the temperature and the humidity in the internal cavity (3) may thereby be varied.

5. Cooling appliance according to any of the preceding claims, wherein the section of wall (6) comprises a sheet made of a material with good thermal conductivity, preferably aluminium or aluminium alloys.

6. Cooling appliance according to any of claims 1 to 4, wherein the section of wall (6) comprises a plate that is formed in its interior by a phase-change material (PCM), surrounded by external sheets made of a material with good thermal conductivity, preferably aluminium or aluminium alloys.

7. Cooling appliance according to any of the preceding claims, wherein the cooling channel (4) is delimited between the contour (14) of the internal cavity (3) and the section of wall (6).

8. Cooling appliance according to the preceding claim, wherein the contour (14) of the internal cavity (3) is manufactured by drawing.

9. Cooling appliance according to claims 7 or 8, wherein the cooling channel (4) is arranged in the back wall (16) of the contour (14) of the internal cavity (3).

10. Cooling appliance according to claims 1 to 4, wherein the section of wall (6) comprises a closed hollow channel inside which the cooling channel (4) is formed, the walls of the channel being a sheet of material with good thermal conductivity, or the walls of the channel being a plate that is formed in its interior by a phase-change material (PCM), surrounded by external sheets made of a material with good thermal conductivity, the sheets preferably being aluminium or aluminium alloys

11. Cooling appliance according to any of the preceding claims, wherein the cooling channel (4) is divided at least by a rib (18), said rib (18) being manufactured by drawing in the same process as the internal cavity (3), or said rib (18) being a plastic or metal piece connected to the contour (14) or the section of wall (6).

12. Cooling appliance according to any of the preceding claims, wherein the fan (8) is an absorption or impulse fan, and is arranged connected to the sheet (19) in one of the holes (22).

13. Cooling appliance according to any of the preceding claims, wherein the cooling appliance (1) comprises at least one freezer enclosure (23) comprising an internal cavity (24), that is cooled by a flow of cold air (25), said enclosure (23) comprising a sheet (27) arranged in the internal cavity (24), which divides it into an inner storage area (28) where the food is stored for its freezing, and into a chamber (29), said sheet (27) comprising a plurality of holes (30) that allow the circulation of the flow of cold air (25) be-

tween the chamber (29) and the inner storage area (28).

14. Cooling appliance according to the preceding claim, wherein the cooling appliance (1) comprises a circuit of cooling agent with at least one evaporator unit (31) and a fan (32) arranged in the chamber (29), the flows of cold air (5, 25) from the cooling enclosure (2) and the freezer enclosure (23) respectively returning and coming together in said chamber (29), entering into a heat-exchange relationship with the evaporator unit (31), and being driven and directed to the cooling channel (4) and the freezer enclosure (23) respectively.

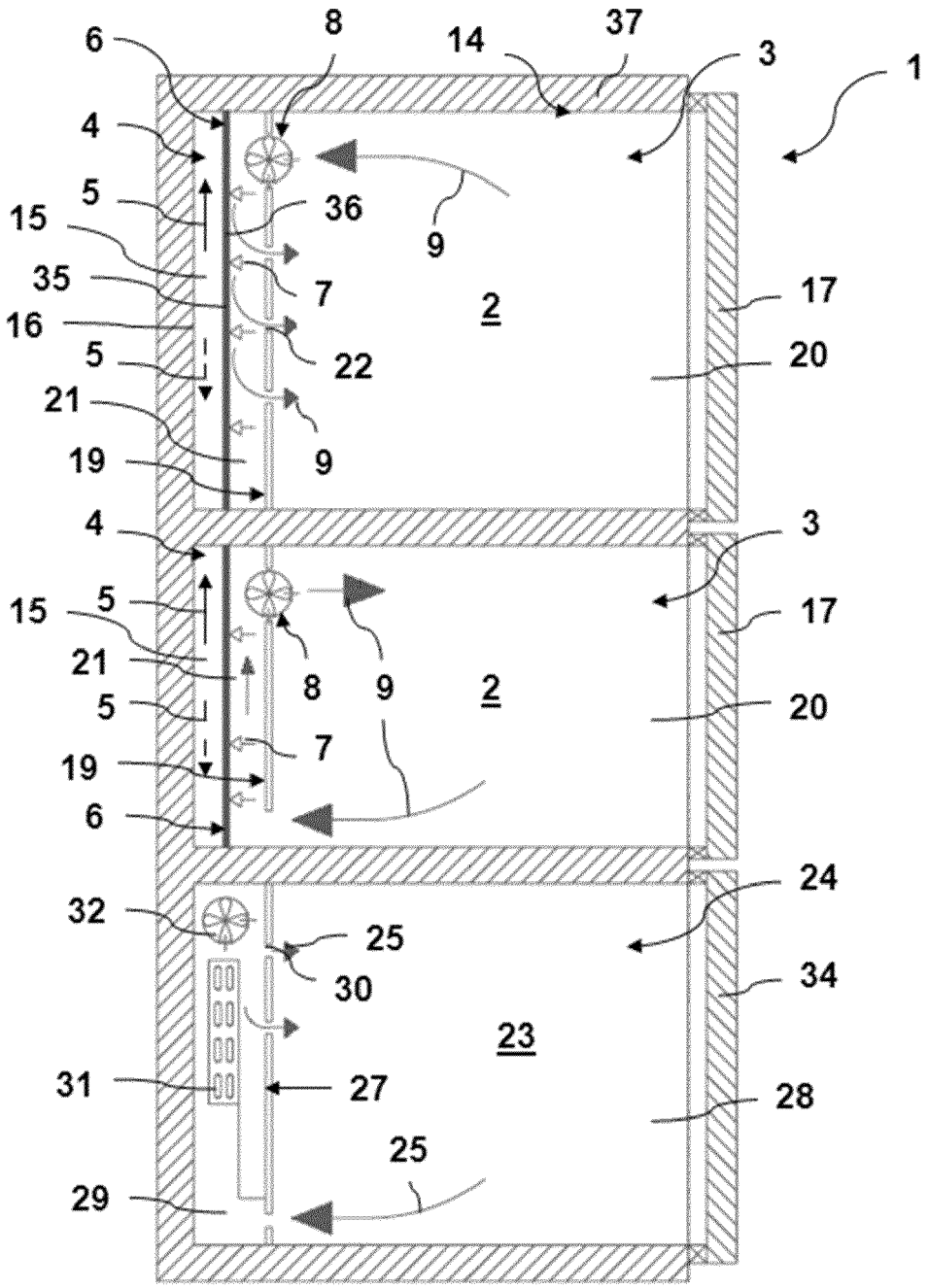
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Fig. 1

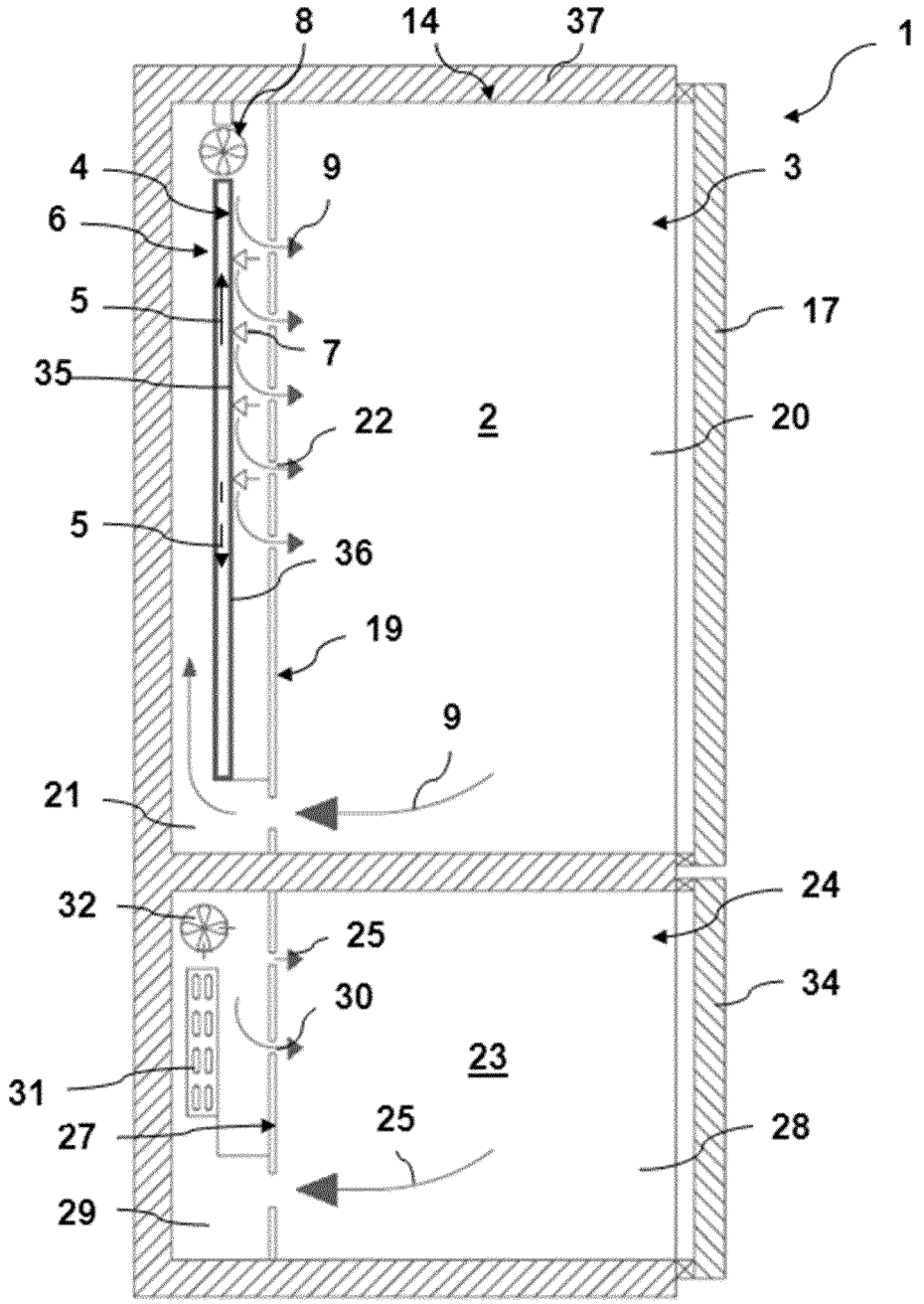
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Fig. 2

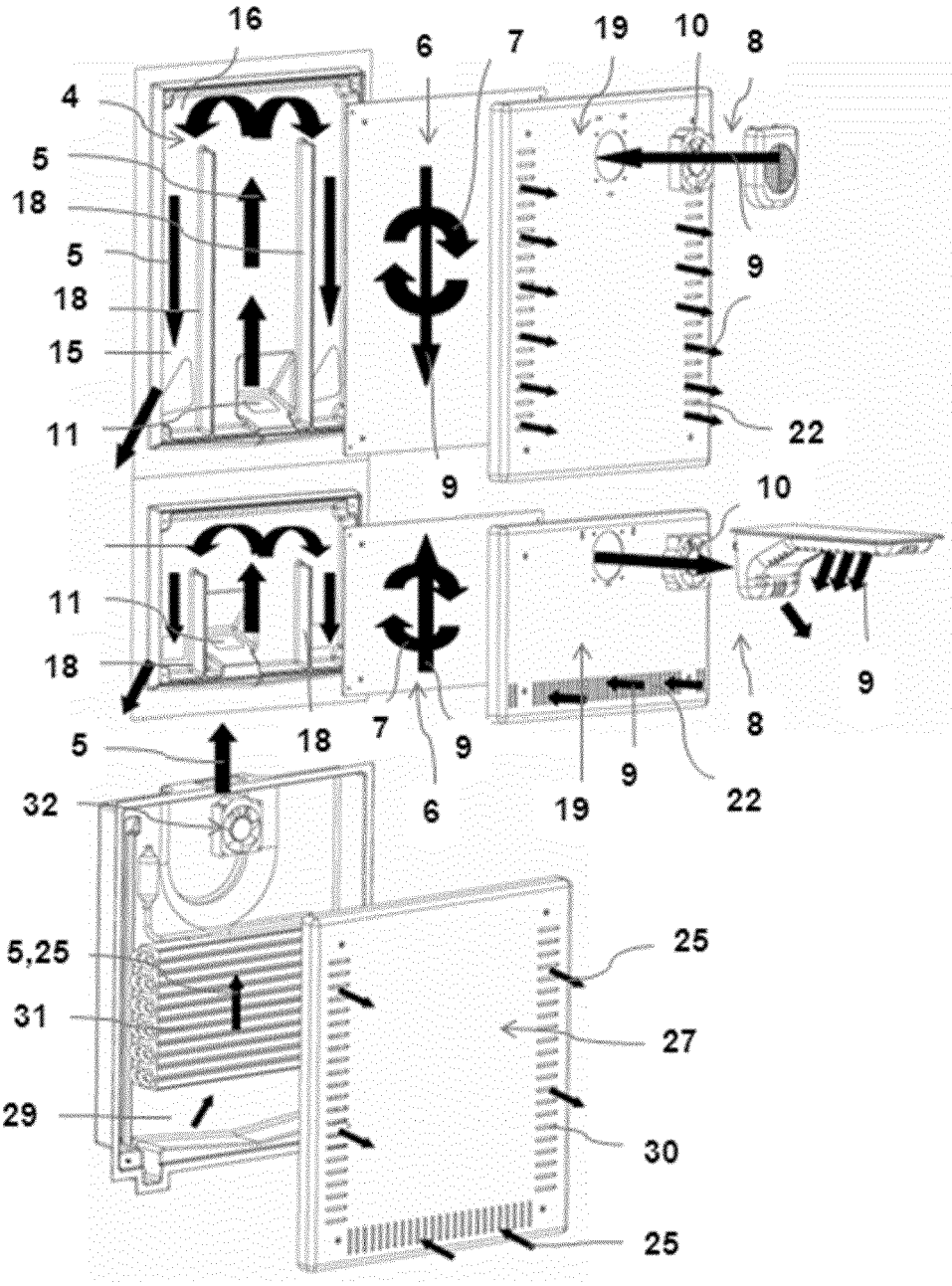
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Fig. 3

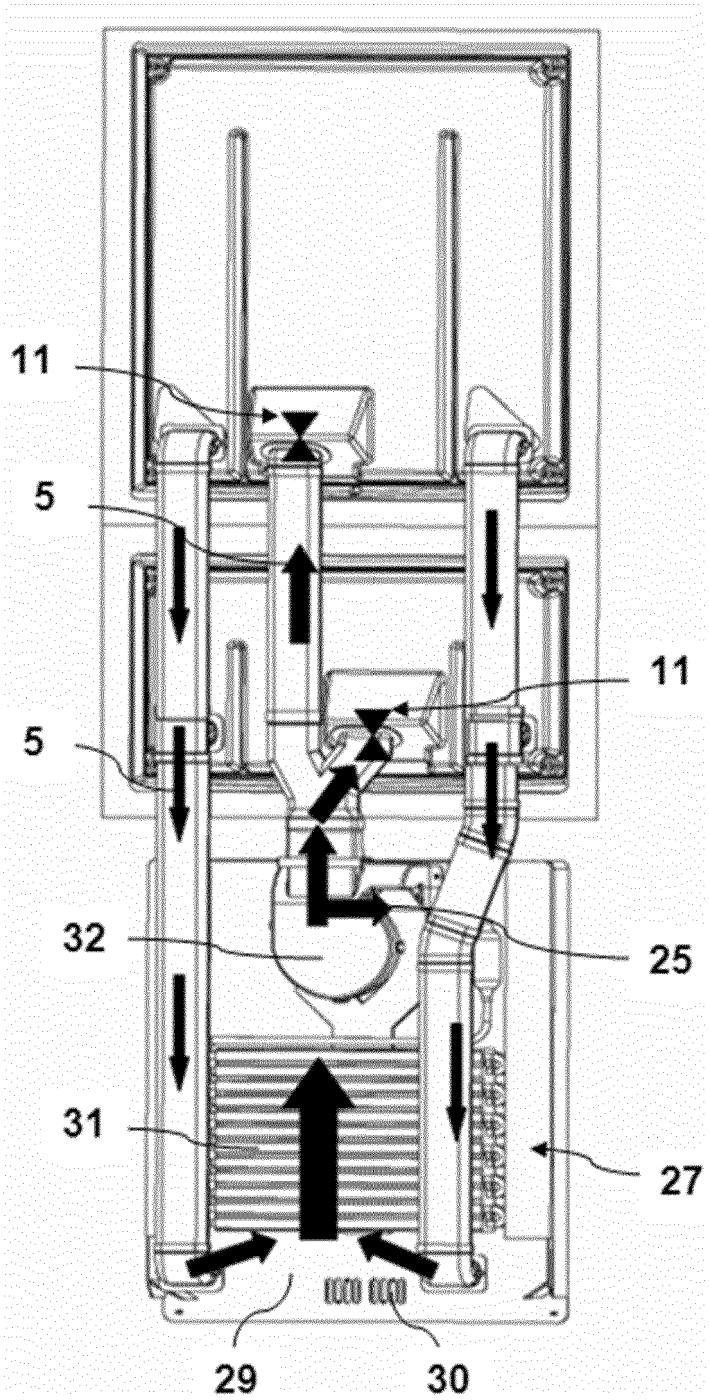

Fig. 4

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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