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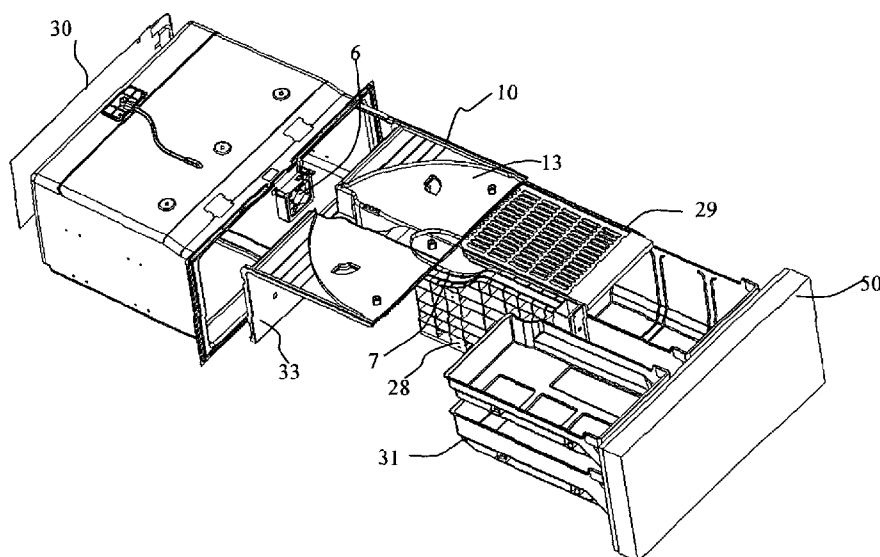


Figure 3

(57) Abstract: The invention relates to a refrigerator. The refrigerator (1) comprises a storage compartment (24) and a moisture retaining unit (29). According to the disclosure, the refrigerator further comprises a separation wall (4) provided within the storage compartment (24), the storage compartment (24) being divided by the separation wall (4) into a first storage chamber (2) and a second storage chamber (3), wherein the moisture retaining unit (29) is disposed in the second storage chamber (3).



REFRIGERATOR

Technical Field

The invention relates to a refrigerator and, in particular, to a refrigerator having a moisture retaining unit.

Background Art

It is known in the prior art that a moisture retaining unit can be provided in a refrigerator for retaining the moisture of stored foods (such as vegetables and fruits) inside corresponding storage chambers, so that the foods can be kept fresh. In China market, Siemens three-door refrigerators are generally provided with such moisture retaining units. Specifically, the refrigerator is provided with two drawers one above the other in a zero-degree compartment of it, wherein an upper opening of one of the drawers is covered by a moisture retaining unit for preventing moisture from leaving the drawer. As a result, a relatively high humidity can be maintained in the drawer, and thus fruits, vegetables and other foods can be stored in a fresh state for long. Refrigerators having such moisture retaining drawers are now very popular on market.

Summary of the Invention

An object of the invention is to contribute further improvement to the above prior art by providing a refrigerator which comprises a dry storage area and a wet storage area, which are separated from each other more distinctively.

For this end, the invention in one aspect relates to a refrigerator. The refrigerator comprises a storage compartment and a moisture retaining unit, characterized in that the refrigerator further comprises a separation wall provided within the storage compartment, the storage compartment being divided by the separation wall into a first storage chamber and a second storage chamber, wherein the moisture retaining unit is

disposed in the second storage chamber.

By dividing the storage compartment into two storage chambers having different humidities by means of the separation wall rather than by the moisture retaining unit itself, the storage compartment may have a dry area and a wet area which are separated from each other more distinctively.

Other features of the invention, which are disclosed here individually or in combination with other correlated features, will be described in the following technical solutions.

According to a preferred embodiment of the invention, the first storage chamber and the second storage chamber are located side by side.

According to a preferred embodiment of the invention, the moisture retaining unit is located at a top portion of the second storage chamber or near the top portion.

According to a preferred embodiment of the invention, each of the first storage chamber and the second storage chamber is provided with at least one container inside, a front end of the separation wall extending beyond a front end of each of the containers.

According to a preferred embodiment of the invention, the separation wall extends to a front end opening of the storage compartment, and the first storage chamber and the second storage chamber are each closed by a corresponding door, a back side of the door being configured to be engaged with a front end surface of the separation wall.

According to a preferred embodiment of the invention, the first storage chamber and the second storage chamber are closed by a pair of French type doors.

According to a preferred embodiment of the invention, the first storage chamber and the second storage chamber each comprise corresponding cooling air outlet openings.

According to a preferred embodiment of the invention, the refrigerator further comprises an air passage within the storage compartment, the air passage comprising a first branch and a second branch for transferring cooling air to the first storage chamber and the second storage chamber respectively.

According to a preferred embodiment of the invention, the first branch and the second branch are bifurcated at the separation wall and then extend to top portions of the first storage chamber and the second storage chamber respectively.

According to a preferred embodiment of the invention, the first branch and the second branch share a common fan for blowing the cooling air into the first storage chamber and the second storage chamber respectively.

According to a preferred embodiment of the invention, the separation wall is provided with a plurality of through holes, the first storage chamber and the second storage chamber being in fluid communication with each other by means of the through holes.

According to a preferred embodiment of the invention, the through holes are disposed in a grid-like pattern in the separation wall.

According to a preferred embodiment of the invention, the first storage chamber and the second storage chamber have the same temperature therein.

According to a preferred embodiment of the invention, the storage compartment is a zero-degree compartment or a refrigerating compartment.

According to a preferred embodiment of the invention, the separation wall is parallel to opposite side walls of the storage compartment.

The structural details and other objects and advantages of the invention will be more comprehensively understood by reading the description to preferred embodiments below with reference to the drawings.

Brief Description of the Drawings

The drawings, which form a portion of the specification and provide further understanding to the invention, show some preferred embodiments of the invention and disclose the principle of the invention together with the detailed description, wherein:

Figure 1 is a schematic partial perspective view of a refrigerator according to a preferred embodiment of the invention, wherein a door of the second storage compartment is

removed;

Figure 2 is a partial assembled view of a zero-degree compartment according to a preferred embodiment of the invention, wherein an outer shell and an insulation material of the refrigerator are not shown;

Figure 3 is an exploded view of Figure 2;

Figure 4 is a perspective view of a moisture retaining unit according to a preferred embodiment of the invention;

Figure 5 is a partial perspective view of an air guiding plate according to a preferred embodiment of the invention;

Figure 6 is a schematic sectional view taken along a line A-A in Figure 2;

Figure 7 is a schematic sectional view taken along a line B-B in Figure 2; and

Figure 8 is a schematic sectional view taken along a line C-C in Figure 2.

Detailed Description of Preferred Embodiments

With reference to the drawings, especially with reference to Figure 1 first, a refrigerator 1 comprises a heat insulation cabinet 20 which comprises an inner shell 21, an outer shell 22, and a thermal insulation material (not shown) between the inner shell 21 and the outer shell 22. The thermal insulation material can be formed in a foaming process in which a foamable material is injected into the space between the inner shell 21 and the outer shell 22. When the foaming process is finished, the inner shell 21 and the outer shell 22 are fixed together by the hardened thermal insulation foam material.

In the present embodiment, the cabinet 20 defines a thermally insulated refrigerating compartment 23 in its upper section, a zero-degree compartment 24 directly under the refrigerating compartment 23, and a freezing compartment 25 in a lower section of the cabinet 20. These storage compartments 23, 24 and 25 are thermally separated from each other by corresponding separation walls (not shown).

The refrigerator 1 comprises a plurality of doors for closing these storage compartments. In an embodiment, the refrigerating compartment 23 is closed by a pair of French doors 26 which are hinged to opposites of the cabinet 20 and are able to rotate around corresponding vertical axes, and the zero-degree compartment 24 and the freezing compartment 25 can be closed by corresponding drawer type doors respectively.

As shown in Figure 1, Figure 2 and Figure 3, the interior of the zero-degree compartment 24 is divided by a separation wall 4 extending in a longitudinal direction into a first storage chamber 2 and a second storage chamber 3 which are arranged side by side. In the present embodiment, the separation wall 4 is vertically located in a middle location of the zero-degree compartment 24 so that the first storage chamber 2 and the second storage chamber 3 have the same width. However, in other embodiments, the first storage chamber 2 and the second storage chamber 3 may have different widths which are determined by the location of the separation wall 4.

The first storage chamber 2 and the second storage chamber 3 are each provided with at least one container 31 for storing items. Each container 31 comprises a drawer having an open upper end.

A front end of the separation wall 4 extends forwards beyond the front end of each container 31. Thus, the separation wall 4 is easily to be seen by a user, which gives the user an impression that the first storage chamber 2 and the second storage chamber 3 are two individual storage compartments. In the present embodiment, the separation wall 4 extends to the front end opening of the zero-degree compartment 24. When the door of the zero-degree compartment 24 is in a closed state, the back side of the door contacts the front end surface of the separation wall 4.

The first storage chamber 2 and the second storage chamber 3 can be closed by a common door 50. In an alternative preferred embodiment, the first storage chamber 2 and the second storage chamber 3 are closed by respective doors. For example, the first storage chamber 2 and the second storage chamber 3 may be closed by a pair of French

doors. For example, the French type doors 26 extends to a level below the bottom wall of the zero-degree compartment 24, so that each of the first storage chamber 2 and the second storage chamber 3 may also be closed by a corresponding one of the French type doors 26. As another possible solution, each of the first and second storage chambers may be closed by a corresponding one of another pair of French type doors, which are separately provided with respect to the French type doors 26. Of course, it is also possible that the first storage chamber 2 and the second storage chamber 3 are closed by respective drawer type doors. A sealing gasket provided on the back side of the door is preferably able to come into tight engagement with the front end of the separation wall 4.

In the present embodiment, the separation wall 4 is provided with many through holes 28 for establishing fluid communication between the first and second storage chambers 2 and 3, so that the first storage chamber 2 and the second storage chamber 3 may have substantially the same storing temperature. The through holes 28 are disposed in a grid-like pattern, which facilitates sufficient heat exchange between the two storage chambers 2 and 3.

A moisture retaining unit 29 may be provided in the second storage chamber 3 for increasing or maintaining the humidity in the second storage chamber 3, so that the second storage chamber 3 is particularly suitable for storing vegetables, fruits, or similar foods.

The moisture retaining unit 29 is located at the top portion of the second storage chamber 3 or near the top portion of the second storage chamber 3. By decreasing or preventing moisture carried away from the container 31 by air, the container 31 may have a humidity higher than that in the first storage chamber 2, so that items stored in the container 31 of the second storage chamber 3 may be stored in the container 31 in a longer timer and a fresher state.

With reference to Figure 2 to Figure 4 in combination, the moisture retaining unit 29 is in the form of a cover plate assembly which covers the top of the container 31, the cover

plate assembly comprising a shelf plate 80, a filtering mesh fixing member 82, and a filtering mesh 81 disposed between the shelf plate 80 and the filtering mesh fixing member 82. The material of the filtering mesh may be a cloth material, such as nylon fibers.

In a mounted state, the shelf plate 80 is further away from the top portion of the second storage chamber 3 compared with the filtering mesh fixing member 82. The filtering mesh fixing member 82 is provided with a first array composed of a plurality of through holes 83, and the shelf plate 80 is provided with a second array composed of a plurality of through holes 84. The projections of first array of through holes 83 on the shelf plate 80 are at least partly overlapped with the corresponding second array of through holes 84. Air is allowed to pass through the first array of through holes 83 and the second array of through holes 84 to enter into the container 31 or leave the container 31. When leaving the container 31, the air must pass through the filtering mesh 81, so that the moisture in the air can be captured by the filtering mesh and thus is retained in the container 31. In this way, a relatively high humidity can be maintained in the container 31, or in other words, the humidity in the container 31 is increased.

In this way, the zero-degree compartment 24 is divided in a lateral direction into a “dry area” (the first storage chamber) and a “wet area” (the second storage chamber) which are arranged side by side.

In an alternative embodiment, the second storage chamber 3 may also be configured in a form of a moisturizing unit, which can generate moisture, such as water vapor, for increasing or maintaining the humidity in the second storage chamber 3. In this case, a corresponding humidity controlling device may be used for controlling the operation of such a moisturizing device.

As shown in Figure 3, Figure 6 and Figure 7, the refrigerator 1 comprises an evaporator 30 which can perform heat exchange with the zero-degree compartment 24 (including both the first storage chamber 2 and the second storage chamber 3). The evaporator 30 comprises a refrigerant pipe and a heat conductive element arranged in close contact

with the refrigerant pipe. In the present embodiment, the heat conductive element is in the form of a plate which covers nearly the whole back wall 32 of the zero-degree compartment 24. The evaporator 30 may be arranged on a side of the back wall 32 of the zero-degree compartment 24 which faces towards the thermal insulation layer, and the evaporator abuts closely against the back wall 32 to cool the back wall 32, so that the back wall 32 forms a cooling surface. In another embodiment, the evaporator 30 may be provided on the inner side of the back wall 32 within the zero-degree compartment 24, so that the evaporator 30 itself forms a cooling surface.

In order to lower down the temperature gradients in the first storage chamber 2 and the second storage chamber 3, the refrigerator 1 comprises an air circulation device for drawing out air from the first and second storage chambers 2 and 3, cooling the air directly or indirectly by means of the evaporator, and then supplying the cooled air into the first and second storage chambers 2 and 3 again. The air circulation device comprises an air guiding plate 10 for forming an air passage 5 and a fan 6 disposed in the air passage 5.

With reference to Figure 3 and Figure 5 to Figure 8, in this embodiment, the air guiding plate 10 comprises a top plate 13 which is located near a common top wall 12 of the first storage chamber 2 and the second storage chamber 3 of the zero-degree compartment 24 and is separated from the top wall 12 by a distance. The air guiding plate 10 further comprises a back plate 33 bending from the back end of the top plate 13 and extending downwards. The back plate 33 is proximal to the back wall 32 and is separated from the back wall 32 by a distance. In this way, the air passage 5 extends from a gap between the back plate 33 and the back wall 32 to a gap between the top plate 13 and the top wall 12. Lateral edges of the top plate 13 and the back plate 33 may comprise spacing walls 34 extending towards the top wall 12 and the back wall 32 respectively, so that the above described gaps are formed between the air guiding plate 10 and the inner shell 21.

The top plate 13 and the back plate 33 may be substantially perpendicular to each other,

so that the air guiding plate 10 forms a substantially “L” shape in cross section. In the present embodiment, the back plate 33 covers a majority of the back wall 32. It is understood that, in other embodiments, the back plate 33 may cover only a portion of the back wall 32. For example, it is possible that the back plate 33 covers a small portion near an upper end of the back wall 32 or covers an upper half portion of the back plate 33. A gap existed between a lower end of the back plate 33 and the bottom walls of the first storage compartment 2 and the second storage compartment 3 forms a back flow port 41.

The top plate 13 and the back plate 33 are each provided with a plurality of fixing holes 45, and fixing members (not shown), such as screws, may be inserted through these fixing holes 45 to fix the air guiding plate 10 to the inner shell 21. Sealing slots 49 may be formed along the spacing walls 34 on opposite lateral edges of the back plate 33 and the spacing walls 34 on the back side of the top plate 13, and sealing strips (not shown) may be inserted into the sealing slots, so that lateral edges of the back plate 33 and the back side of the top plate 13 may abut against the back wall 32 and the top wall 12 respectively in a sealing manner.

The top plate 13 comprises a pair of substantially plate-like main bodies 35 exposed above the first storage chamber 2 and the second storage chamber 3 respectively, and a middle portion 36 between the pair of main bodies 35.

The main bodies 35 are substantially parallel to the top wall 12 and extend in horizontal directions. The air passage 5 comprises a first branch 8 and a second branch 9, which are formed between the top wall 12 of the first storage chamber 2 and the second storage chamber 3 and corresponding main bodies 35, for transferring cooling air into the storage chambers 2 and 3 respectively. In the present embodiment, the first branch 8 and the second branch 9 are symmetrical with respect to a longitudinal central normal plane of the top plate 13.

The first branch 8 and the second branch 9 each have a substantially circular sector shape. Each of the main bodies 35 may comprise arc-shaped first baffle plate 44 and

second baffle plate 27, for defining the boundaries of the first branch 8 and the second branch 9. The first baffle plate 44 extends between the front outer corner and the back inner corner of a corresponding one of the main bodies 35 to prevent the cooling air from being detained at back outer corners of the first storage chamber 2 and the second storage chamber 3 where it is likely to result in turbulence flows by detained air.

According to a preferred embodiment of the invention, the middle portion 36 comprises a protrusion part 11 protruded downwards. The protrusion part 11 is formed in a back portion of the middle portion 36, and a back end of the protrusion part 11 is emerged in the back plate 33.

The protrusion part 11 is hollow and comprises a space 38. An upper end of the space 38 is open and is in fluid communication with the first branch 8 and the second branch 9. A back end of the space 38 is open into the back plate 33. Thus, the space 38 is in fluid communication with a portion of the air passage 5 between the back plate 33 and the back wall 12. After having been cooled by the cooling surface, air can enter into the space 38 via the opening of the space 38 in the back plate 33.

The space 38 comprises a fan accommodating socket 38a for accommodating the fan 6, and an air duct 38b in front of the fan accommodating socket 38a. In this embodiment, the fan accommodating socket 38a is formed in the back portion of the space 38 with respect to the air duct 38b.

The fan accommodating socket 38a may be wider than the air duct 38b, for accommodating the fan 6. Of course, whether the fan accommodating socket 38 is wider or narrower than the air duct 38b should be determined on the basis of the size of the fan 6.

The bottom wall of the fan accommodating socket 38a is preferably flat, while the bottom wall of the air duct 38b is preferably in the form of smooth curved surface which facilitates the flow of air. In the present embodiment, the air duct 38b of the protrusion part 11 has a vertical height which is decreased gradually from back to front,

or in other words, the bottom wall of the air duct 38b of the protrusion part 11 is raised from back to front.

The separation wall 4 is substantially plate like, with the upper end of the separation wall 4 connected to the under side of the middle portion 36. When assembling, the separation wall 4 may be inserted into the zero-degree compartment 24 from front to back along the middle portion 36.

The separation wall 4 which is under the middle portion 36 is provided with a recessed space 7 for accommodating the protrusion part 11. The recessed space 7 is recessed downwards from the back portion of the upper end of the separation wall 4. In the present embodiment, the separation wall 4 has a reduced height in its back portion for forming the notch-like recessed space 7. The separation wall 4 has a lateral width which is substantially constant from front to back.

The upper end of the front portion of the separation wall 4 is substantially flat, and the separation wall has a height there which is approximately equal to that of the first storage chamber 2 and the second storage chamber 3. Thus, when the separation wall 4 is viewed from its front surface, the recessed space 7 is invisible.

The recessed space 7 has a vertical depth which is decreased gradually from back to front. Thus, the upper end surface of the separation wall 4 in the recessed space 7 is raised up gradually from back to front for following the shape of the protrusion part 11.

The length of the protrusion part 11 and the recessed space 7 in the front-to-back direction may be at least larger than one third of the length of the separation wall 4, for example, approximately equal to one half of the length of the separation wall 4. Correspondingly, the upper end surface of the separation wall 4 in the recessed space 7 comprises a curved surface similar to the bottom wall of the air duct 38b.

The fan 6 is accommodated in the fan accommodating socket 38a of the protrusion part 11. Since the protrusion part 11 is protruded into the recessed space 7, the fan 6 is at least partly accommodated in the recessed space 7. In an embodiment, the air guiding

plate 10 comprises a mounting plate 40 extending over the fan accommodating socket 38a, and the fan 6 is attached to the under side of the mounting plate 40.

In the present embodiment, the fan 6 blows air in a front direction. When the fan 6 is operated, cooling air, which has been cooled by the evaporator 30, is drawn by the fan 6 into the space 38 and is forced to flow forwards into the air duct 38b. Then, the cooling air enters into the first branch 8 and the second branch 9 from opposite sides of the air duct 38b respectively, and then enters into corresponding one of the storage chambers 2 and 3 via the outlet openings 14 in the front end of each of the main bodies 35.

By means of the air passage 5, a negative pressure is established near the cooling surface, and thus the air in the first storage chamber 2 and the second storage chamber 3 leaves the first storage chamber 2 and the second storage chamber 3 from the back flow port 41 at the lower end of the back plate 33 and enters into the portion of the air passage 5 which is behind the back plate 33, so that the air is cooled by means of heat exchange with the evaporator 30. Then, the cooled air is drawn by the fan 6 into the space 38 again, is then divided from the space 38 and flows into the first branch 8 and the second branch 9, and is finally supplied into the first storage chamber 2 and the second storage chamber 3 respectively. In this way, compulsory air circulation is established.

The side of the back plate 33 which faces towards the back wall 32 may be provided with several curved baffle ribs 48 for distributing the returning air flow to the whole cooling surface evenly, so that the air can sufficiently undergo heat exchange.

In addition to the main outlet openings 14 in the front end of the air guiding plate 10, the air circulation system may further comprise at least one group of secondary outlet openings 15a and 15b between the fan and the main outlet openings 14 at locations corresponding to the first and second storage chambers 2 and 3. By means of the secondary outlet openings, more uniform temperature distribution in the first and second storage chambers 2 and 3 can be obtained.

In the above embodiments, the zero-degree compartment 24 is divided into a low humidity area and a high humidity area, which are arranged side by side, by the separation wall 4 which is parallel to opposite side walls of the zero-degree compartment 24. However, the invention is not limited thereto. In an alternative embodiment, the zero-degree compartment 24 is divided into a low humidity area and a high humidity area, which are arranged one on top of the other, by a horizontal wall.

It should be understood that the invention is also applicable in other compartments of the refrigerator, such as the refrigerating compartment 23, in addition to the zero-degree compartment.

Claims:

1. A refrigerator (1) comprising:

a storage compartment (24), and

a moisture retaining unit (29),

characterized in that the refrigerator further comprises a separation wall (4) provided within the storage compartment (24), the storage compartment (24) being divided by the separation wall (4) into a first storage chamber (2) and a second storage chamber (3), wherein the moisture retaining unit (29) is disposed in the second storage chamber (3).

2. The refrigerator (1) of claim 1, characterized in that the first storage chamber (2) and the second storage chamber (3) are disposed side by side.

3. The refrigerator (1) of claim 1 or 2, characterized in that the moisture retaining unit (29) is located at a top portion of the second storage chamber (3) or near the top portion.

4. The refrigerator (1) of any one of claims 1 to 3, characterized in that each of the first storage chamber (2) and the second storage chamber (3) is provided with at least one container (31) inside, a front end of the separation wall (4) extending beyond a front end of each of the containers (31).

5. The refrigerator (1) of any one of claims 1 to 4, characterized in that the separation wall (4) extends to a front end opening of the storage compartment (24), and the first storage chamber (2) and the second storage chamber (3) are each closed by a corresponding door (26), a back side of the door (26) being configured to be engaged with a front end surface of the separation wall (4).

6. The refrigerator (1) of claim 5, characterized in that the first storage chamber (2) and the second storage chamber (3) are closed by a pair of French type doors (26).

7. The refrigerator (1) of any one of claims 1 to 6, characterized in that the first storage

chamber (2) and the second storage chamber (3) each comprise corresponding cooling air outlet openings (14, 15a, 15b).

8. The refrigerator (1) of claim 7, characterized in that it further comprises an air passage (5) within the storage compartment (24), the air passage (5) comprising a first branch (8) and a second branch (9) for transferring cooling air to the first storage chamber (2) and the second storage chamber (3) respectively.

9. The refrigerator (1) of claim 8, characterized in that the first branch (8) and the second branch (9) are bifurcated at the separation wall (4) and then extend to top portions of the first storage chamber (2) and the second storage chamber (3) respectively.

10. The refrigerator (1) of claim 8 or 9, characterized in that the first branch (8) and the second branch (9) share a common fan (6) for blowing the cooling air into the first storage chamber (2) and the second storage chamber (3) respectively.

11. The refrigerator (1) of any one of claims 1 to 10, characterized in that the separation wall is provided with a plurality of through holes (28), the first storage chamber (2) and the second storage chamber (3) being in fluid communication with each other by means of the through holes (28).

12. The refrigerator (1) of claim 11, characterized in that the through holes (28) are disposed in a grid-like pattern in the separation wall (4).

13. The refrigerator (1) of any one of claims 1 to 12, characterized in that the first storage chamber (2) and the second storage chamber (3) have the same temperature therein.

14. The refrigerator (1) of any one of claims 1 to 12, characterized in that the storage compartment (24) is a zero-degree compartment or a refrigerating compartment.

15. The refrigerator (1) of any one of claims 1 to 14, characterized in that the separation wall (4) is parallel to opposite side walls of the storage compartment (24).

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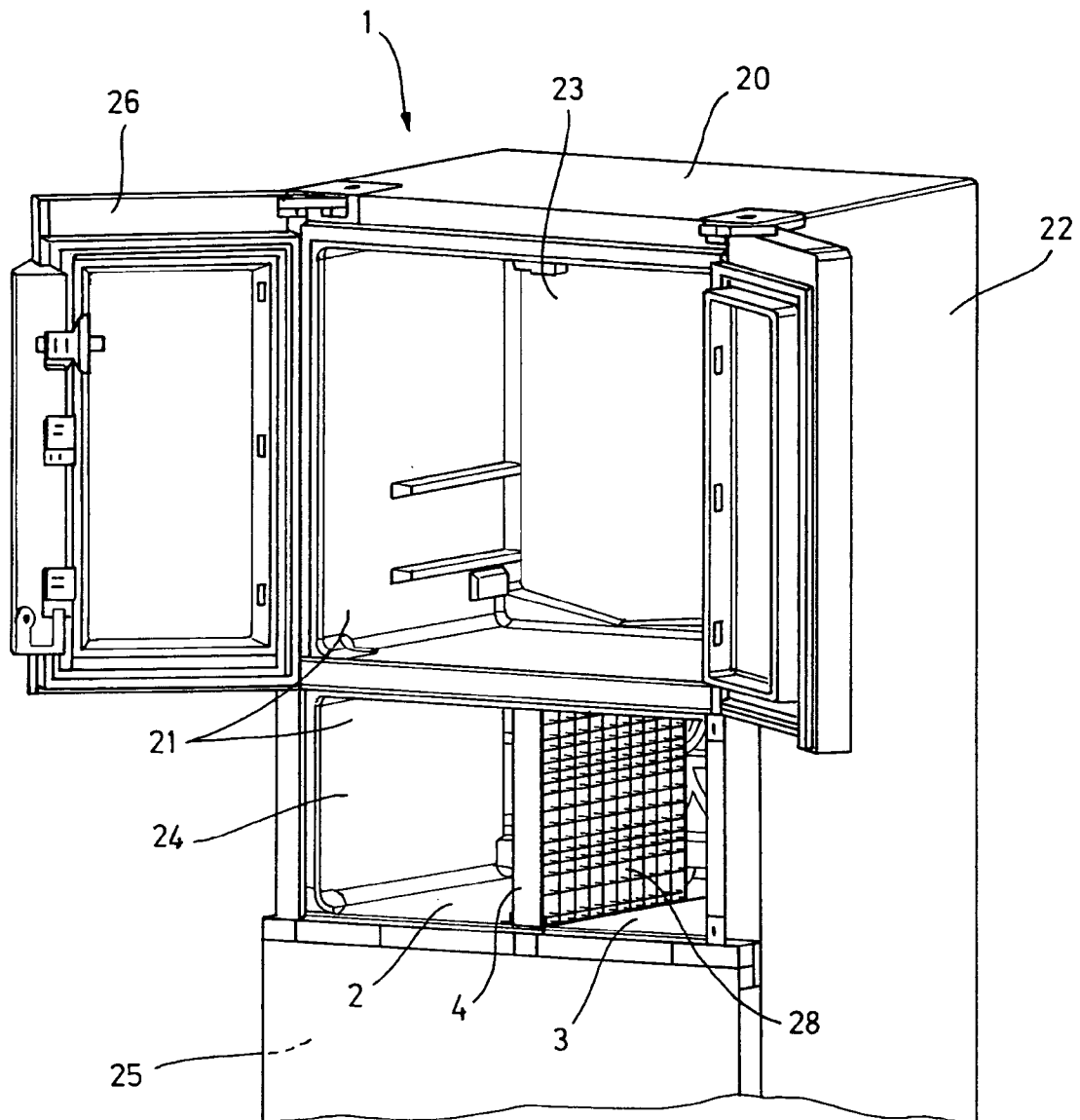


Figure 1

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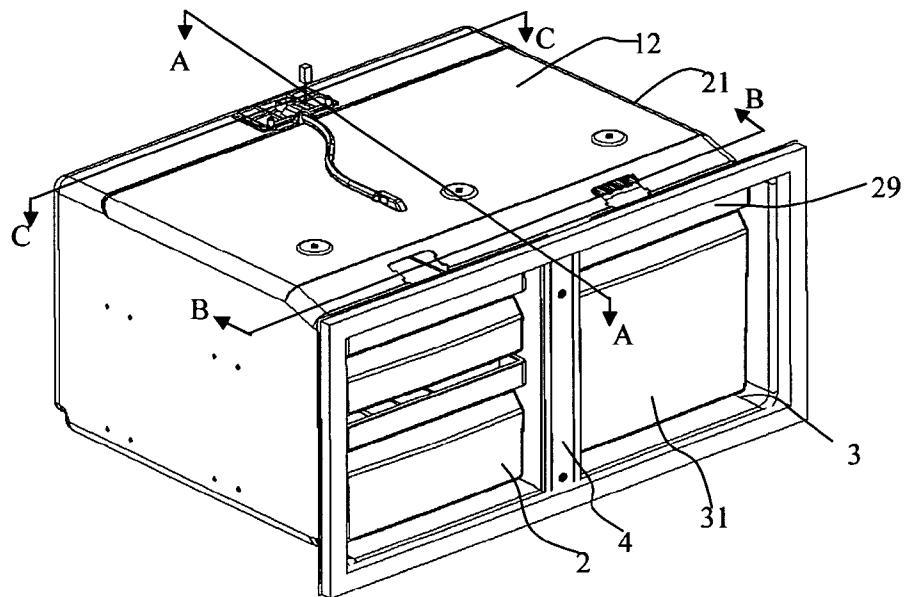


Figure 2

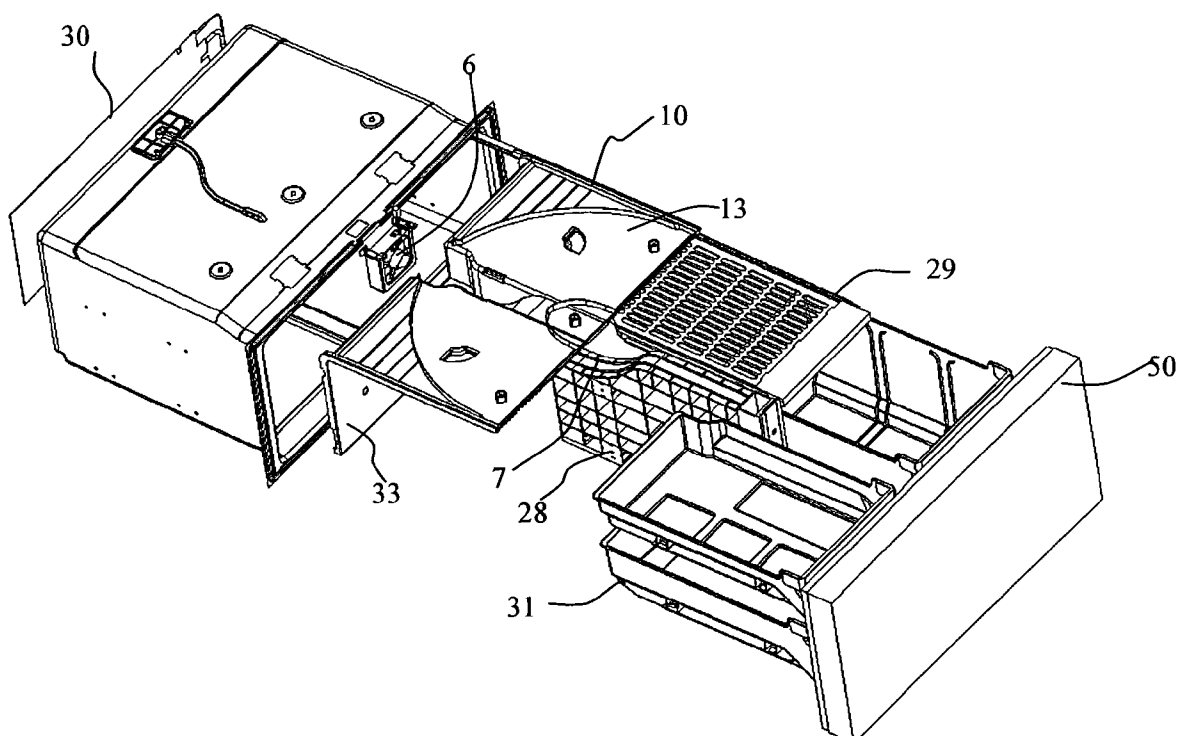


Figure 3

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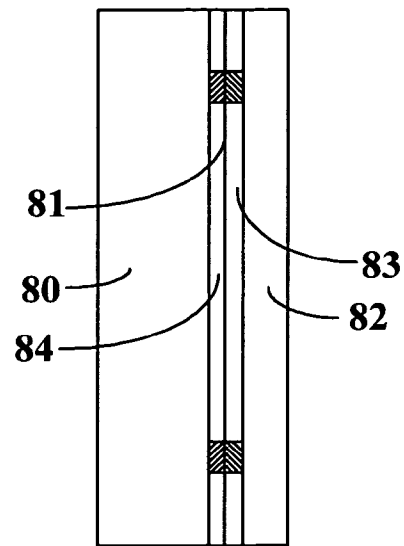


Figure 4

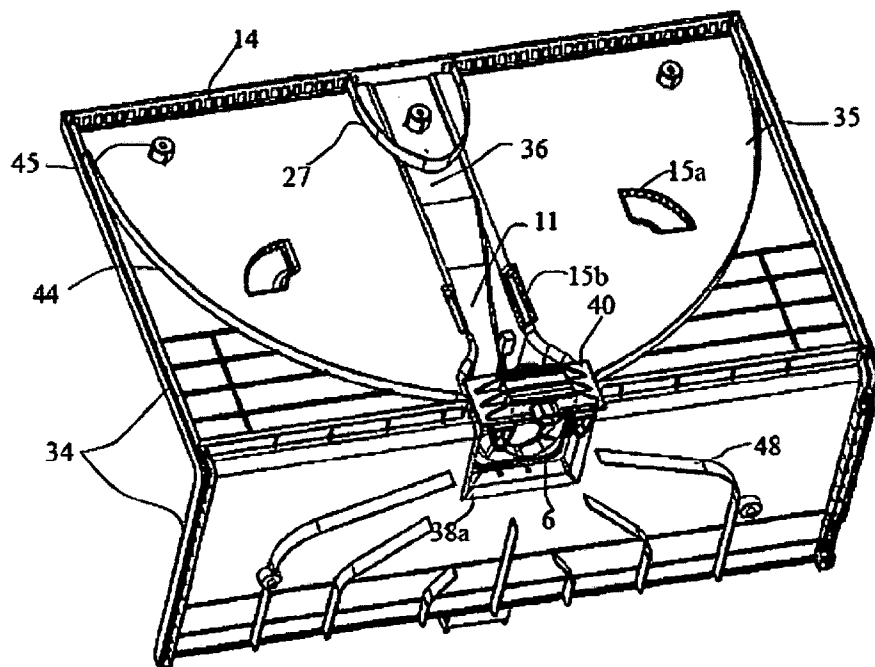


Figure 5

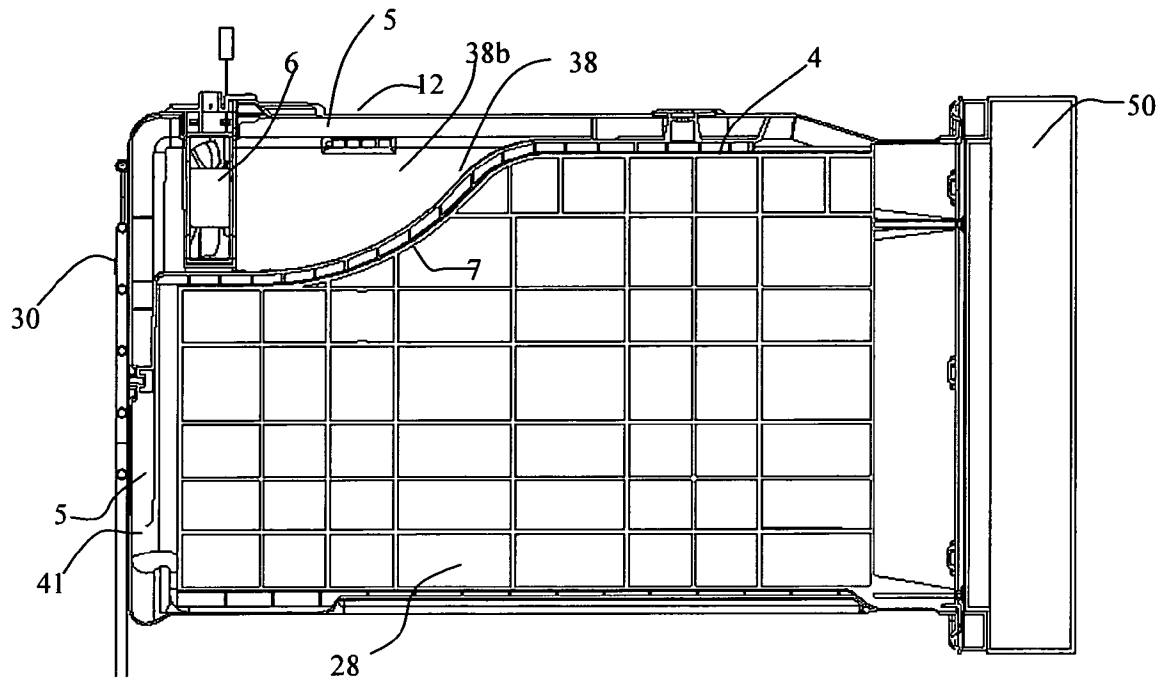


Figure 6

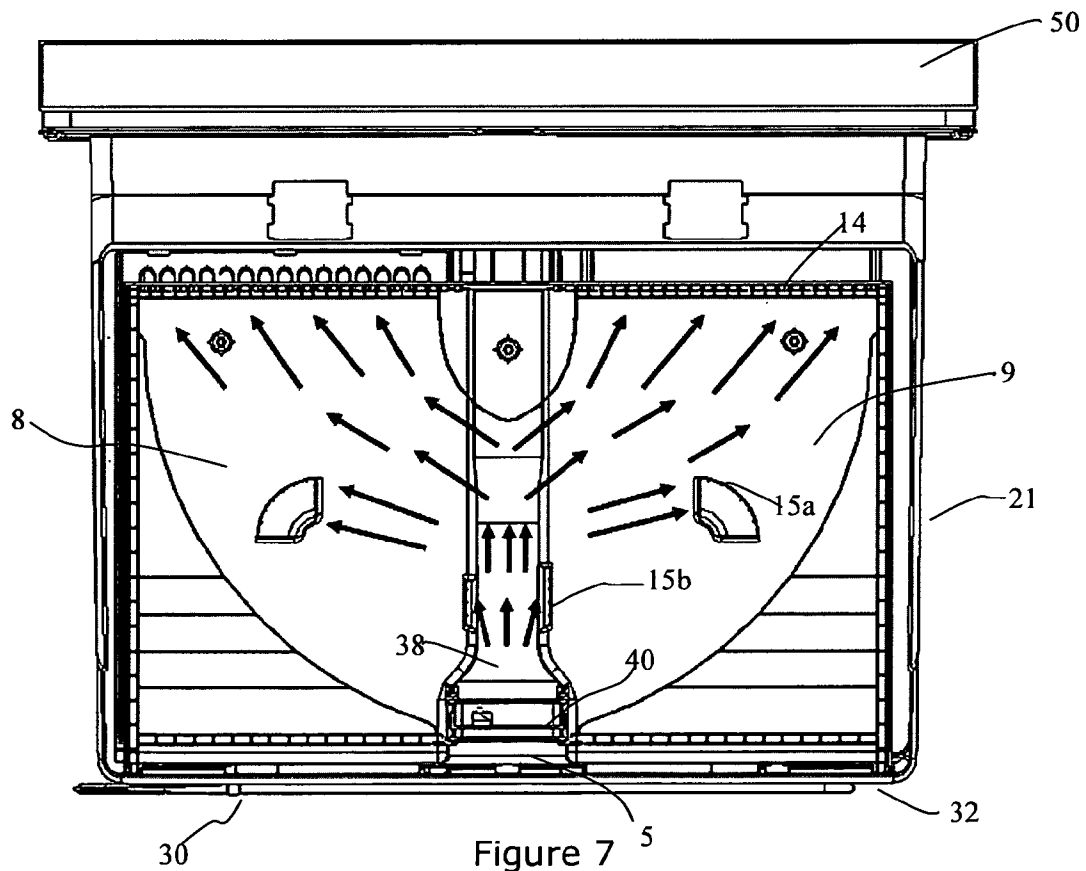


Figure 7

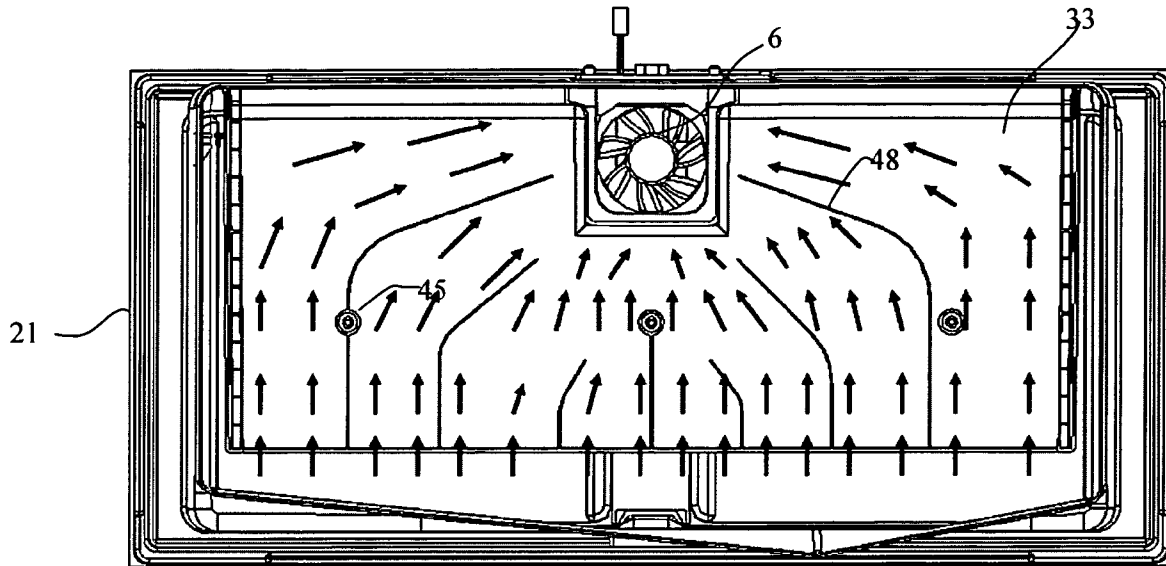


Figure 8