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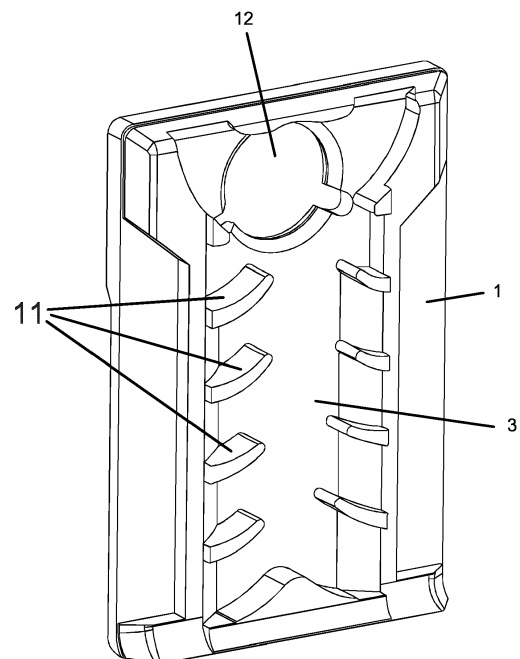
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(54) **REFRIGERATOR PROVIDED WITH AIR DISTRIBUTION SYSTEM**

(57) The present invention pertains to technological field of refrigerators.

The present invention refers to a refrigerator provided with air distribution system comprising at least one refrigerated chamber constituted by at least one structural wall (1) and at least one air diffuser (2) secured to said structural wall (1); at least one intermediate chamber (3) defined between said structural wall (1) and said air diffuser (2); said structural wall (1) comprising a plurality of air deflectors (11) and at least one hole (12) for forced reception of refrigerated air; said air diffuser (2) comprising a plurality of side openings (21) aligned in at least two vertical sequences (22); part of the refrigerated air (AR) coming from said hole (12) being firstly directed to said air deflectors (11) of the structural wall (1) so as to be spread in the interior of the intermediate chamber (3); and part of the refrigerated air (AR) spread in the interior of the intermediate chamber (3) being sequentially directed to the interior of the refrigerated chamber through said side openings (21) of said air diffuser (2).



**FIG.1**

## Description

### Field of the Invention

**[0001]** The present invention refers to a refrigerator provided with air distribution system and, more specifically, an air distribution system capable of evenly distributing refrigerated air throughout the interior of a refrigerated chamber.

### Background of the Invention

**[0002]** A number of refrigerator models, each provided with their own refrigerated air system, are already known from the state of the art. Generally speaking, such systems usually comprise ducts funneling and sending the refrigerated air coming from the refrigeration unit to the interior of a climatized chamber through communication openings.

**[0003]** Conventionally, most of the state-of-the-art refrigerators comprise refrigerated air distribution openings disposed along the vertical extension of the rear wall of the refrigerated chamber. Thus, the refrigerated air is distributed from the said rear wall of the refrigerated chamber in horizontal direction, travelling in a practically rectilinear pathway.

**[0004]** Such solutions are particularly useful when the refrigerated chamber of a refrigerator has small dimensions, or also, when same is not completely filled because after all a small number of items to be refrigerated can be disposed near the rear wall so as to be directly exposed to a refrigerated air stream coming from the air distribution system.

**[0005]** Nevertheless, when referring to a refrigerator with a refrigerated chamber is of large proportions, or also when same is totally filled, those items to be refrigerated are exposed to an heterogeneous refrigeration since all items disposed near the rear wall will end up blocking the efficient passage of refrigerated air to more distant areas and consequently those items placed closer to the front are not appropriately refrigerated.

**[0006]** In theory and aiming at solving this problem, it would be possible to increase the refrigeration capacity of the refrigerator. However, it is known that such operation may cause excessive refrigeration of those items placed near the rear wall, thereby causing some damage such as freezing of liquid substances.

**[0007]** Hence, seeking for an alternative solution for distributing refrigerated air in the interior of a refrigerated chamber of a refrigerator, document CN201992937 discloses a multidirectional air-distributing system disposed in an intermediate layer of the rear wall of a refrigerator, comprising side and top openings for supplying refrigerated air to the interior of a refrigerating chamber. Such an embodiment aims at obtaining a homogenous refrigeration wherein the items disposed at the bottom of the refrigerated chamber does not block the passages of the refrigerated air stream coming from the air-distribution

system.

**[0008]** Nevertheless, the air distribution system of said document CN201992937 does not provide any solution to allow for a proportional refrigerated air distribution between said side openings once same are disposed along the vertical extension of the rear wall of the refrigerated chamber. By this way, considering that the refrigerated air flow is supplied by an air injection system, such as a fan (usually disposed at the top portion of the rear wall of the climatized chamber), the side openings disposed above will receive much more refrigerated air than the openings disposed below so that a more effective homogenous distribution of the refrigerated air is not achieved.

**[0009]** On the other hand, document WO02011110648 refers to a refrigerator provided with an air distribution system, comprising multiple air distribution structures having deflectors for directing air towards distribution openings conventionally disposed along the vertical extension of the rear wall of the refrigerating chamber.

**[0010]** This means that the present state of the art comprises air distribution systems capable of laterally and not equally distributing refrigerated air as exemplified in CN201992937, and air-distribution systems capable of vertically/rectilinearly and equally distributing refrigerated air, as exemplified in WO2011110648.

**[0011]** Nevertheless, the present state of the art does not teach any solution that synergistically encompasses these two solutions. Based on this scenario, the present invention is developed.

### Objects of the Invention

**[0012]** Hence, one of the objects of the present invention is to provide a refrigerator comprising an air distribution system specially containing means to allow for a homogenous refrigerated air distribution throughout the interior of a climatized chamber, irrespectively of its size and irrespectively of the amount of items stored therein.

**[0013]** Further an object of the present invention is to provide a refrigerator that prevents liquid products from being frozen, particularly those disposed at the bottom of the interior of the refrigerated chamber.

**[0014]** Yet another object of the present invention is to provide a refrigerator that rapidly cools the items disposed at the front of the interior of the refrigerated chamber.

### Summary of the Invention

**[0015]** These and other objects of the present invention are entirely achieved by means of the refrigerator provided with air distribution system, which comprises at least one refrigerated chamber composed of at least one structural wall and at least one air diffuser secured to said structural wall, wherein a intermediate chamber defined between said structural wall and said air diffuser is further included therein.

**[0016]** According to the present invention, said structural wall comprises a plurality of air deflectors and at least one hole for forced reception of refrigerated air. Said air diffuser comprises in turn a plurality of side openings aligned in at least two vertical sequences.

**[0017]** In this sense, it is observed that part of the refrigerated air coming from the hole is firstly directed to the air deflectors of the structural wall in order to be spread in the interior of the intermediate chamber and sequentially directed to the interior of the refrigerated chamber through said side openings of the air diffuser.

**[0018]** In a preferred embodiment, said air diffuser further comprises at least one upper opening which also receives a refrigerated air flow. More preferably, said air diffuser can further comprise at least one inner opening which also receives refrigerated air flow.

**[0019]** Most preferably said air deflectors are of an essentially curved configuration.

#### Brief Description of Drawings

##### **[0020]**

Fig. 1 illustrates an embodiment of the refrigerated air deflector in accordance with the present invention;

Fig. 2 illustrates a refrigerated air deflector in accordance with the present invention;

Fig. 3 illustrates an exploded perspective view of the deflector and diffuser which are part of the air distribution system in accordance with the present invention; and

Figs. 4A and 4B illustrate the refrigerated air distribution in the interior of the refrigerator in accordance with the present invention.

#### Brief Description of the Invention

**[0021]** According to some concepts and objects of the present invention, a refrigerator provided with an air-distribution system specifically designed to allow for homogeneous refrigeration throughout the interior of the refrigerated chamber of the refrigerator and consequently of all items stored therein is disclosed.

**[0022]** Particularly, said refrigerator comprises at least one structural wall 1 and at least one air diffuser 2 secured to said structural wall 1 so as to define at least one intermediate chamber 3.

**[0023]** Said structural wall 1 further comprises a plurality of air deflectors 11 and at least one hole 12 for forced reception of refrigerated air. An air diffuser 2 in turn comprises a plurality of side openings 21 aligned in at least two vertical sequences 22.

**[0024]** In this sense, part of the refrigerated air AR coming from said hole 12 is firstly directed to air deflectors 11 of the structural wall 1 such that it can be spread in the interior of the intermediate chamber 3. Part of this refrigerated air AR that is spread in the interior of the

intermediate chamber 3 is then sent to the interior of the refrigerated chamber through side openings 21 of the air diffuser 2.

**[0025]** More specifically, the air flow supplied by said hole 2 may by fan action be vertically displaced downwardly to contact the first deflectors 11. Such contact creates an intermediate reflux retaining part of the refrigerated air flow before same is directed to a side opening 21 to allow the remnant to go on downwardly vertically in the direction of the other air deflectors 11, as illustrated in Fig. 3.

**[0026]** Preferably, and as shown in Fig. 4, each air deflector 11 is aligned and cooperates with a side opening 21 such that all side openings 21 receive a proportional amount of refrigerated air. More preferably, said air deflectors 11 have a specific configuration, which is preferably curved, to divert the air flow directly to the side openings.

**[0027]** The process proceeds until the air flow reaches the last air deflectors 11 disposed at the lower end of the structural 1. Thus, the construction shown in Fig. 2 allows for the refrigerated air flow supplied by said hole 12 to be proportionally distributed by said several side openings 21 instead of favoring the opening disposed at the upper end of said structural wall 1 as known from the state of the art.

**[0028]** In a preferred embodiment, in order to obtain a better distribution of the refrigerated air, said air diffuser 2 further comprises at least one upper portion 23 that also receives a refrigerated air flow. Further, more preferably, said air flow 2 may also comprise at least one inner opening 24 which also receives the refrigerated air.

**[0029]** As formerly said, the use of a refrigerated air distribution system in a refrigerator in accordance with the present invention makes it possible to uniformly refrigerate those items placed in the interior of the refrigerator even when it is near its maximum storage capacity.

**[0030]** This is because in this specific case, blocking of the refrigerated air flow by the products arranged at the bottom of the inner housing will be avoided and as such the products positioned closer to the front are appropriately refrigerated. Furthermore, since said products at the bottom do not receive a disproportional amount of refrigerated air they will not be excessively refrigerated and then will not freeze in the case of liquid products.

**[0031]** The present invention is thus extremely useful when applied to refrigerators specifically intended to cool beverages, including those commonly found in stores. As mentioned above, beverages positioned in the front portion of the interior of a refrigerator are well refrigerated when placed at the bottom, thereby avoiding the inconveniences of maldistribution of refrigerated air.

**[0032]** Therefore, when using the air distribution system in a refrigerator in accordance with the present invention, a very effective construction is achieved since all products placed anywhere in the interior of the refrigerator are equally refrigerated.

**[0033]** Having described an example of preferred embodiment of the present invention, it is to be understood that the scope thereof contemplates other variations which should be limited only by the contents of the claims, including all possible equivalents.

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## Claims

1. Refrigerator provided with air distribution system, **characterized in that** it comprises:

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at least one refrigerated chamber constituted by at least one structural wall (1) and at least one air diffuser (2) secured to said structural wall (1);  
 at least one intermediate chamber (3) defined between said structural wall (1) and said air diffuser (2);  
 said structural wall (1) comprising a plurality of air deflectors (11) and at least one hole (12) for forced reception of refrigerated air;  
 said air diffuser (2) comprising a plurality of side openings (21) aligned in at least two vertical sequences (22);  
 part of the refrigerated air (AR) coming from said hole (12) being firstly directed to air deflectors (11) of the structural wall (1) so as to be spread in the interior of the intermediate chamber;  
 part of the refrigerated air (AR) spread in the interior of the refrigerated chamber (3) being sequentially directed to the interior of the refrigerated chamber through side openings (21) of said air diffuser (2).

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2. Refrigerator, in accordance with claim 1, **characterized in that** said air diffuser (2) further comprises at least one upper opening (23).
3. Refrigerator, in accordance with claim 1, **characterized in that** said air diffuser (2) further comprises at least one lower opening (24).
4. Refrigerator, in accordance with claim 1, **characterized in that** at least one air deflector (11) of said structural wall (1) cooperates with at least one side opening (21) of said air diffuser (2).
5. Refrigerator, in accordance with claim 1, **characterized in that** said air deflectors (11) of the structural wall (1) comprise an essentially curved configuration.

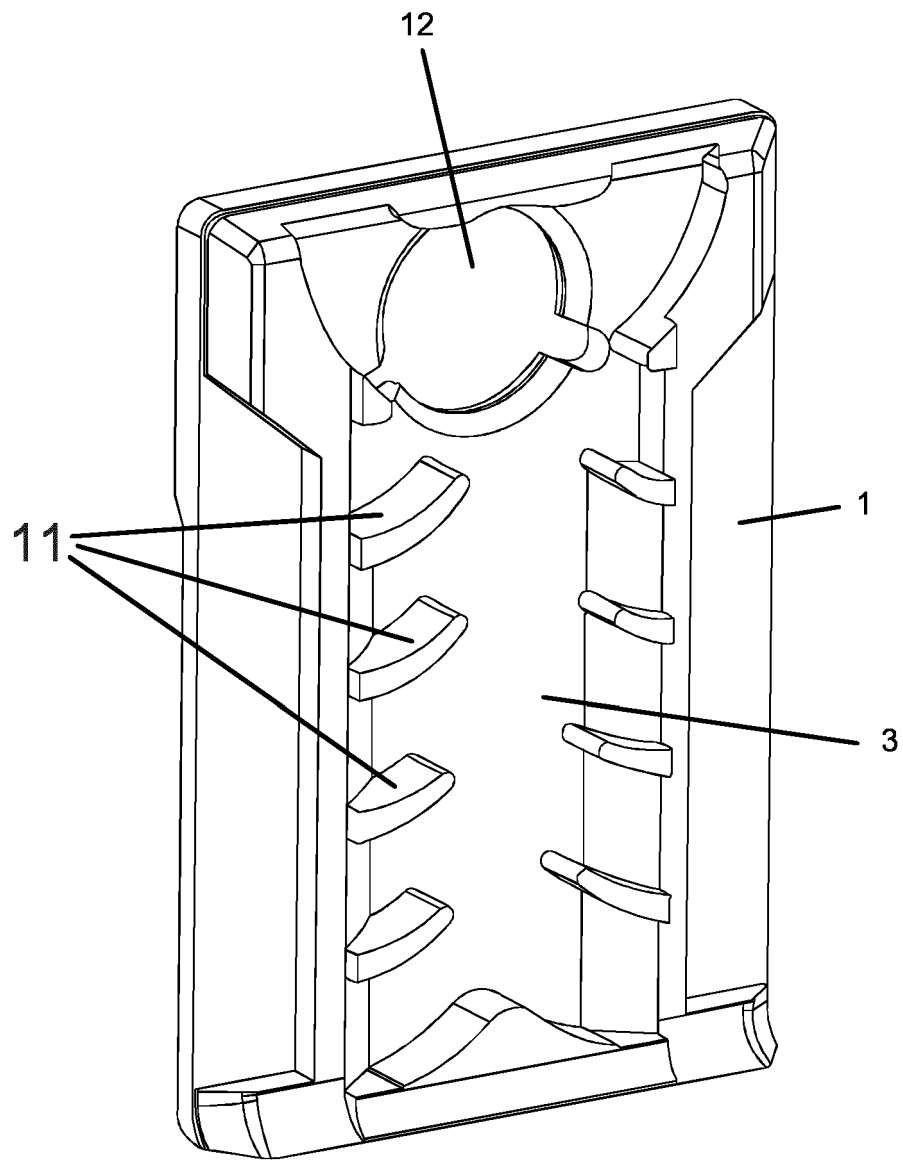
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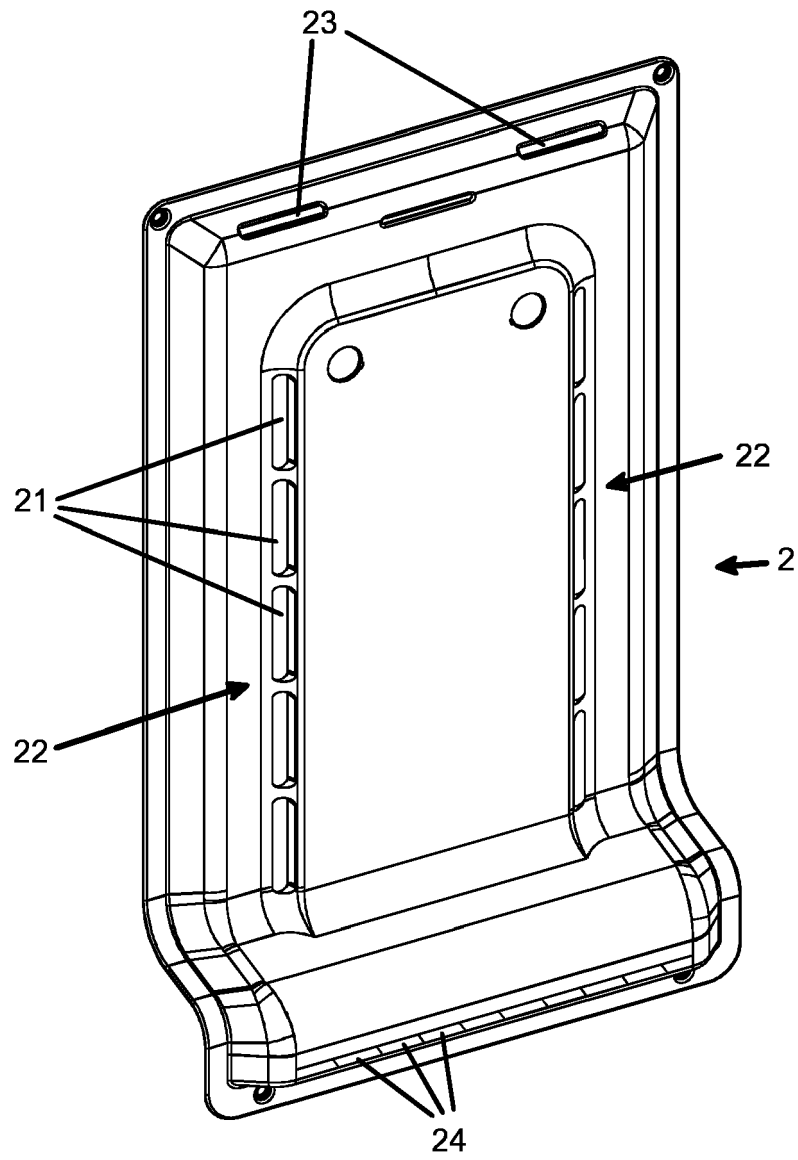
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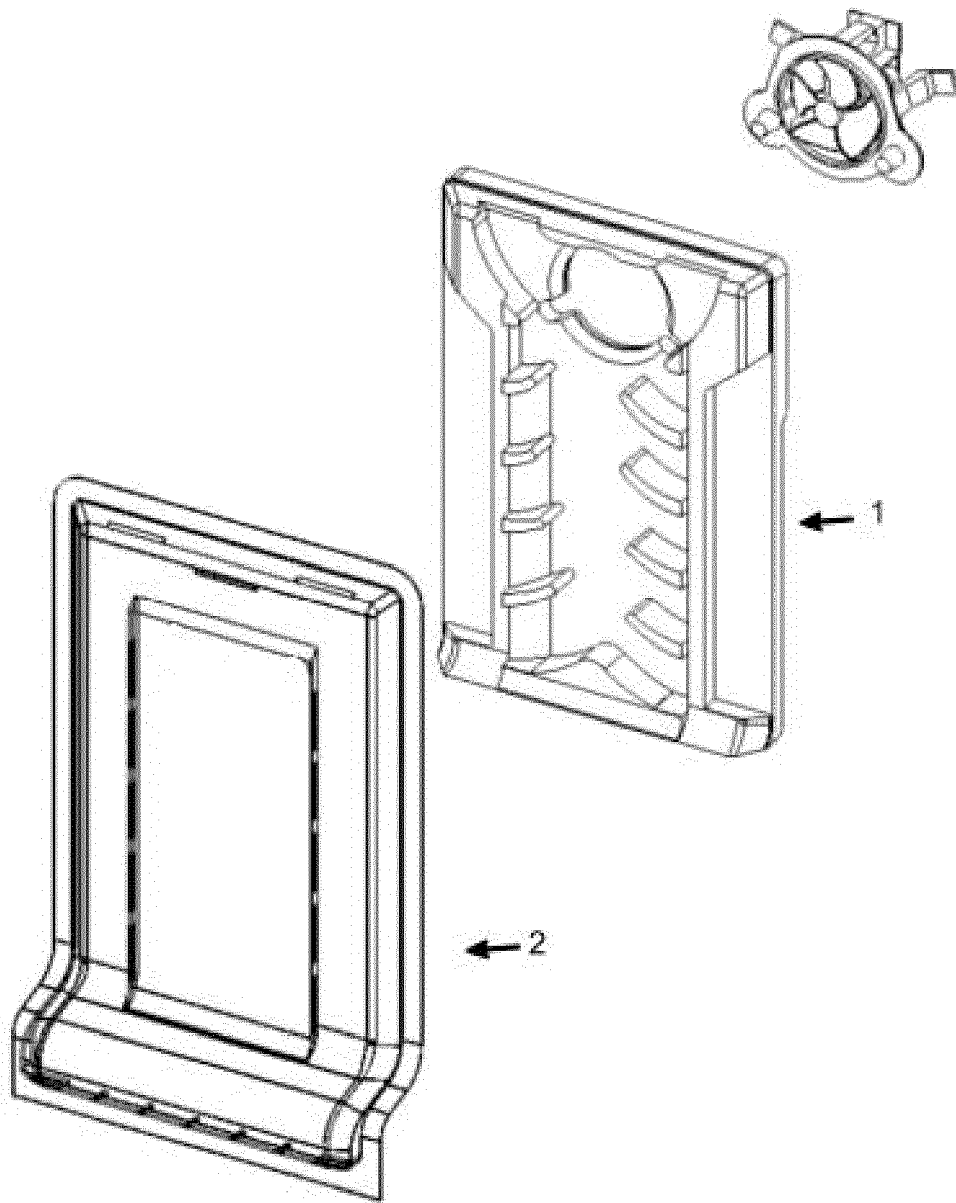
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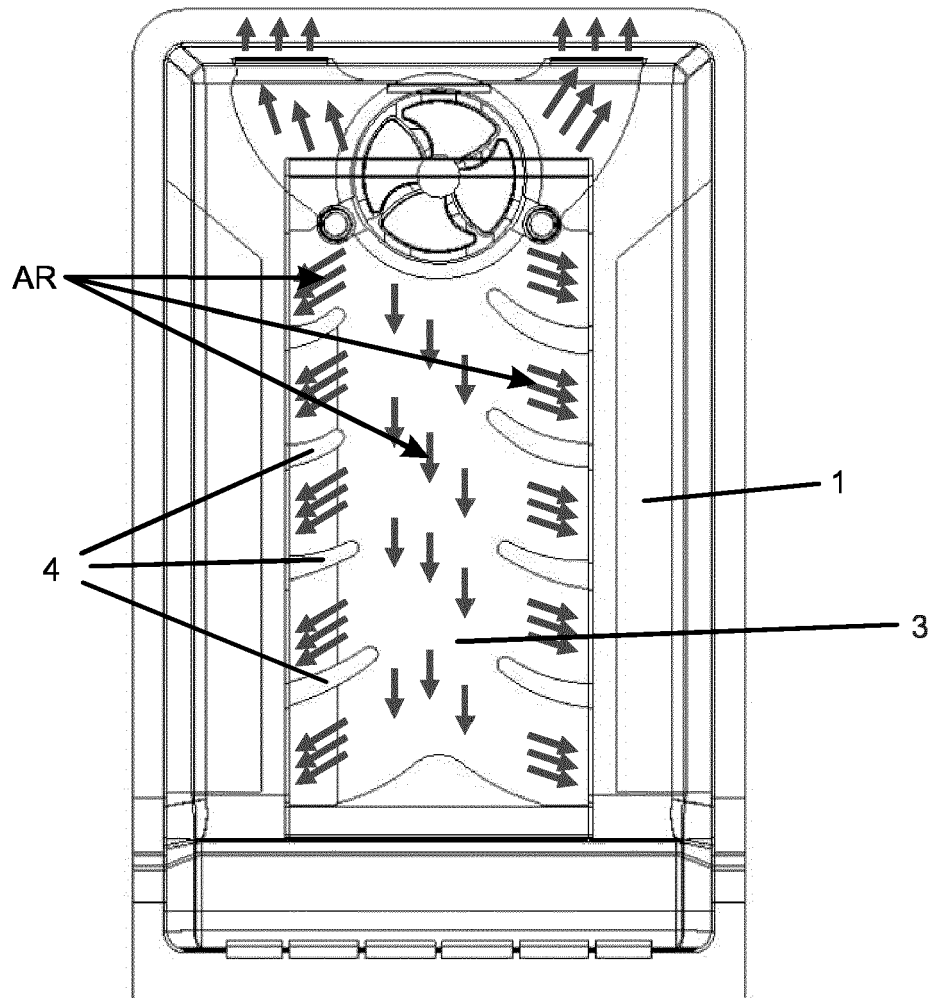
**FIG.1**



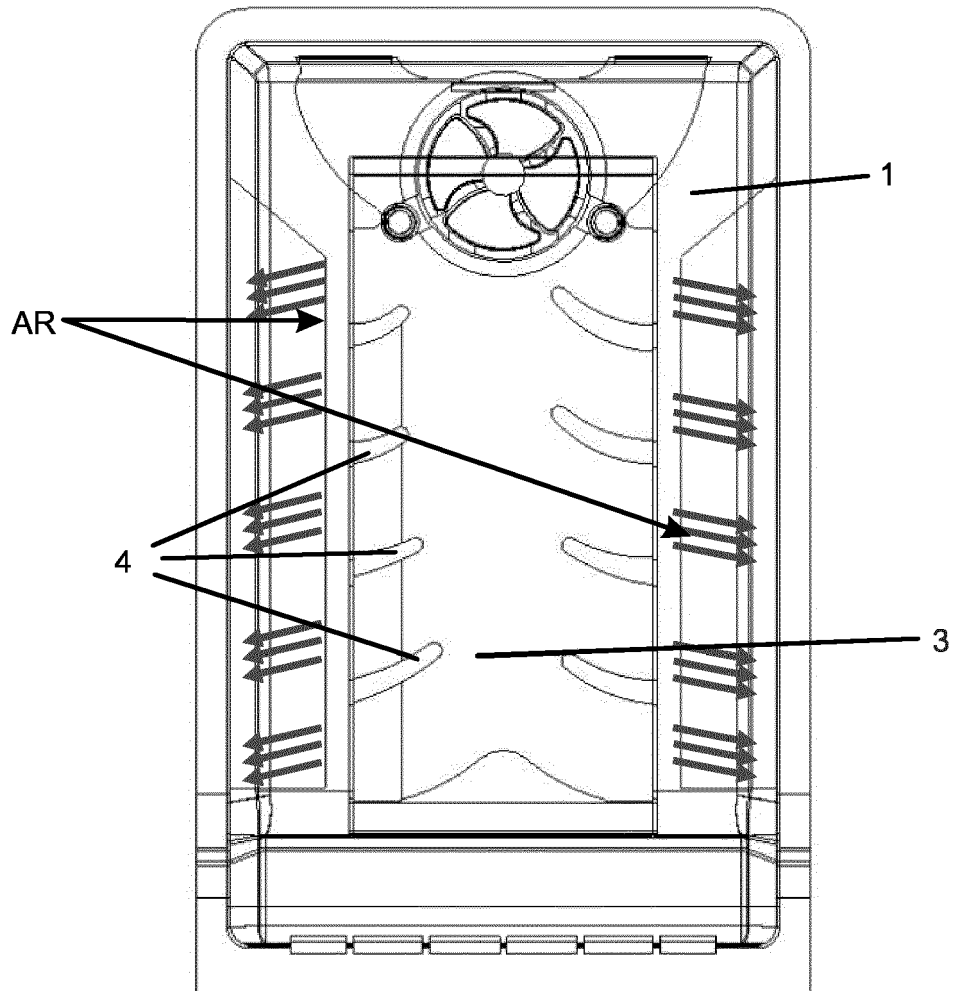
**FIG.2**



**FIG.3**



**FIG.4A**



**FIG.4 B**



## EUROPEAN SEARCH REPORT

Application Number  
EP 15 16 9122

| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                                          |                                                                                                    |                                  |                                         |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|----------------------------------|-----------------------------------------|
| Category                                                                                                                                                                                                                                                                     | Citation of document with indication, where appropriate, of relevant passages                      | Relevant to claim                | CLASSIFICATION OF THE APPLICATION (IPC) |
| X                                                                                                                                                                                                                                                                            | US 3 366 432 A (CARMER LOUIS E)<br>30 January 1968 (1968-01-30)<br>* the whole document *          | 1-5                              | INV.<br>F25D17/06                       |
| X                                                                                                                                                                                                                                                                            | JP 2001 116425 A (SHARP KK)<br>27 April 2001 (2001-04-27)<br>* the whole document *                | 1-5                              |                                         |
| X                                                                                                                                                                                                                                                                            | JP H08 5225 A (MATSUSHITA REFRIGERATION)<br>12 January 1996 (1996-01-12)<br>* the whole document * | 1-5                              |                                         |
| X                                                                                                                                                                                                                                                                            | JP H07 4821 A (HITACHI LTD)<br>10 January 1995 (1995-01-10)<br>* the whole document *              | 1-4                              |                                         |
|                                                                                                                                                                                                                                                                              |                                                                                                    |                                  | TECHNICAL FIELDS SEARCHED (IPC)         |
|                                                                                                                                                                                                                                                                              |                                                                                                    |                                  | F25D                                    |
| The present search report has been drawn up for all claims                                                                                                                                                                                                                   |                                                                                                    |                                  |                                         |
| Place of search                                                                                                                                                                                                                                                              |                                                                                                    | Date of completion of the search | Examiner                                |
| The Hague                                                                                                                                                                                                                                                                    |                                                                                                    | 16 September 2015                | de Graaf, Jan Douwe                     |
| CATEGORY OF CITED DOCUMENTS                                                                                                                                                                                                                                                  |                                                                                                    |                                  |                                         |
| X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document                                                      |                                                                                                    |                                  |                                         |
| T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>& : member of the same patent family, corresponding document |                                                                                                    |                                  |                                         |

EPO FORM 1503 03/82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

EP 15 16 9122

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
The members are as contained in the European Patent Office EDP file on  
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16-09-2015

| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member(s)       | Publication<br>date      |
|-------------------------------------------|---------------------|----------------------------------|--------------------------|
| US 3366432 A                              | 30-01-1968          | NONE                             |                          |
| JP 2001116425 A                           | 27-04-2001          | JP 3603942 B2<br>JP 2001116425 A | 22-12-2004<br>27-04-2001 |
| JP H085225 A                              | 12-01-1996          | NONE                             |                          |
| JP H074821 A                              | 10-01-1995          | NONE                             |                          |

**REFERENCES CITED IN THE DESCRIPTION**

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**Patent documents cited in the description**

- CN 201992937 [0007] [0008] [0010]
- WO 02011110648 A [0009]
- WO 2011110648 A [0010]