

Description

[0001] The present invention relates to a refrigerator comprising a refrigerating compartment, a vegetable storage drawer slidably mounted on a bottom wall of the refrigerating compartment and an absorbing member disposed in said compartment.

[0002] A refrigerator of this kind is disclosed by US5253488 where the absorbing member is a gas absorbing member mounted above the vegetable storage drawer and used for absorbing a noxious gas, particularly ethylene, generated from the vegetables.

[0003] Usually in the vegetable storage drawer, known also as "crisper drawer", there is quite a huge amount of humidity that is generated by food and it can lead to an increase of microbial growth and in some case to a presence of molds on food surface or rotten food items. These phenomena cause the food waste at consumer level.

[0004] Usually, in order to reduce the amount of humidity in the crisper drawer, a fan is used to increase the air circulation but this solution implies a high energy consumption.

[0005] The problem of condensation of humidity in the area of the crisper drawer is even exacerbated in built-in "bottom mount" products where a freezer compartment is placed below a refrigeration compartment. The applicant has discovered evidences of internal condensation issue under the shelf, above the crisper drawer and below the drawer, in a portion of the refrigerator cavity inner liner which is designed in such a way to increase its overall capacity but that actually reduces the insulation properties of the insulated wall (mullion) between the freezer cavity and the refrigeration cavity.

[0006] In figures 1 and 2 it is shown a built-in refrigerator according to prior art, where RC indicates the refrigerator cavity (with temperatures usually ranging from 1°C to 5°C) and FC indicates the freezer cavity (with temperatures ranging from -20°C to -18°C). In figure 2 it is shown the zones where applicant has discovered major condensation issues.

[0007] The above issues have been discovered by using an internal test procedure carried out on bottom mount built-in commercial refrigerator Whirlpool CB310 Revo, where the objective was to assess the presence of internal condensation under crisper shelf in the refrigerating cavity RC. According to the applicant's internal procedure, the test is considered successful if there are no drops of condensation under the crisper shelf during a five days period with a wet leafy vegetables load placed inside the drawer.

[0008] After the tests, water drops formation was observed on the bottom part of the liner as well as fog and condensation dripping under the crisper glass, especially on the rear surface.

[0009] Condensation issue is much more evident in built-in products rather than free standing products because of the configuration of the mullion and the reduced foam wall thicknesses. Moreover, because of the tem-

perature difference between the top surface of freezer cavity FC and bottom of the refrigerating cavity RC, condensation issue occurs mainly on the bottom side of refrigerating cavity RC due to water drops falling / accumulation, or to a temperature distribution between the surface of the mullion close to the air temperature dew point.

[0010] An object of the present invention is to provide a refrigerator of the type mentioned at the beginning of the description in which the above water condensation issues are solved in an effective and economical way.

[0011] The above object is reached thanks to the features listed in the attached claims.

[0012] According to the invention, the applicant has discovered a simple way to absorb the water drops on the bottom surface of the refrigerating compartment RC by using a tray in which it is placed and absorbing material, preferably a zeolite powder.

[0013] Zeolite powder is able to absorb water drops as well as fog and humidity so that condensation tests can be passed without changing the liner shape (which could lead to a decrease of overall capacity of the storage cavity) or the crisper shelf position and configuration.

[0014] In order to avoid a decrease of the refrigeration capacity, to keep the same liner shape and to avoid a change of the crisper shelf position, according to a first embodiment of the invention the humidity is absorbed by using a zeolite tray, positioned under the crisper drawer, which is designed with a grid on the bottom surface, so that water drops can be collected by the lower tray. Being placed below the crisper drawer and not above it, the zeolite powder is able to collect the humidity of the whole refrigerating compartment RC, acting like a sponge.

[0015] Therefore, according to the invention, the tray below the crisper has actually two main functions, i.e. to collect the water drops coming from the crisper and to collect the humidity that occurs because of the low foam wall thickness between the refrigerating compartment RC and the freezer compartment FC (mullion).

[0016] The water drops that usually occur into the crisper and under the shelf above it are expected to fall down and drip through to the grid into the zeolite powder.

[0017] The zeolite powder is preferably not directly accessible: it is preferably positioned in a small tray placed under the crisper, onto the bottom surface of the RC liner.

The zeolite tray is made by two components: the slab made of molded zeolite powder and a cover with grid, through which the water drops coming from the above crisper and fog are expected to pass through.

[0018] Further advantages and features of a refrigerator according to the present invention will be clear from the following detailed description, provided as non limiting examples, with reference to the attached drawings in which:

- Figures 1 and 2 are section views of a built-in refrigerator according to prior art;
- Figure 3 is a section view of a refrigerator according to the invention;

- Figure 4 is a perspective sectioned view of the refrigerator of figure 3;
- Figure 5 is an enlarged view of a detail of figure 3; and
- Figures 6-7 are perspective views of a component used in the refrigerator of figures 3-5, in an exploded and mounted configurations respectively.

[0019] With reference to the drawings, a built-in refrigerator 10 comprises a top fresh food compartment RC and a bottom freezer compartment FC which are separated one from the other by a mullion 12. On a bottom surface 12a of the compartment RC, a crisper drawer 14 is slidably mounted. Such drawer is sliding on guide rails 15 provided on the side walls of the liner, so that an inner space S is defined between the drawer outer walls and the liner in order to increase the air flow around the crisper drawer 14.

[0020] In such space S and on the bottom wall 12a of the compartment, a tray 16 is placed which is formed by a plate or slab 16a of molded zeolite powder, sandwiched between a bottom plastic support 16b and a top plastic grid 16c which covers the plate 16a of zeolite.

[0021] The crisper drawer 14 is provided, on its bottom wall 14a, with a plurality of apertures 18 defining a further grid which faces the grid 16c of the tray 16. In this way the plate 16a of the tray 16 is not only able to absorb humidity and/or other noxious gases, but it allows the condensed water in the crisp drawer 14 to drip in the tray 16 and to be absorbed by the zeolite material. In order to allow absorption of any water resting on the bottom surface 12a of the compartment RC, the bottom plastic support 16b of the tray 16 is provided with apertures 20.

[0022] In another embodiment of the invention, the tray 16 may be placed directly inside the drawer 14, for instance as an auxiliary small drawer sliding inside the crisper drawer 14.

[0023] Independently on the actual position of the tray 16 within the refrigerating compartment RC, the zeolite material contained therein can be easily regenerated by placing the entire tray 16 in an oven at a temperature around 100°C for few minutes. The same regeneration process may happen by simply taking out the tray 16 from the refrigerator and leave it in a room whose air has a usual humidity content (up to 50% relative humidity).

[0024] The technical solution hereby disclosed allows applying a sort of calcareous stone self-regenerating as filters to absorb relative humidity inside the crisper drawer for fruits and vegetables. The proposed solution is made by a removable tray in which there is the zeolite molded powder presenting as a stone. The tray is placed in the bottom part of RC compartment and presents a grid facing a corresponding grid provided on the bottom wall of the drawer to hold and support all the vegetables inside the drawer, keeping them separated by the zeolite. The humidity level is reduced by zeolite that absorbs the water drop/condensation and moisture through both grids. It is not necessary to remove the water from the tray 16 because the stone absorb it and it self-regenerates. Zeolites

are widely used as ion-exchange beds in domestic and commercial water purification while in chemistry they are widely used to separate molecules; they are also widely used as catalysts and sorbents. Their well-defined pore structure and adjustable acidity make them highly active in a large variety of reactions. Zeolites have the potential of providing separation of gases including the removal of H₂O, CO₂ and SO₂ from low-grade natural gas streams. The solution according to the invention provides several benefits to user: no bacterial contamination coming from high humidity environmental on fruits and vegetables surface and so reduce food waste; no formation of drops of water inside crisper bin during vegetables storage; no needed use of fans or similar devices to reduce the condense and therefore reduced energy consumption; zeolites do not need to be replaced due to natural capability to regenerate; zeolites permit to reduce the cleaning activities at consumer level; zeolites are not in direct contact with food; zeolites have a wide range to work both in terms of temperature and relative humidity; zeolites can be also used as effective odor absorber.

Claims

1. Refrigerator (10) comprising a refrigerating compartment (RC), a vegetable storage drawer (14) slidably mounted on a bottom wall (12a) of the refrigerating compartment (RC) and an absorbing member disposed in said compartment, **characterized in that** such absorbing member (16) is placed below said drawer (14) so that it can absorb water dripping from such drawer (14) and/or condensing on said bottom wall (12a).
2. Refrigerator according to claim 1, wherein the vegetable storage drawer (14) is provided with a plurality of apertures (18) on its bottom wall (14a).
3. Refrigerator according to claim 1 or 2, wherein the absorbing member (16) is a plate (16a) molded from a zeolite powder placed on the bottom wall (12a) of the refrigerating compartment (RC).
4. Refrigerator according to claim 3, wherein the plate (16a) of the absorbing member (16a) is contained in a tray (16) removably disposed on the bottom wall (12a) of the refrigerating compartment (RC).
5. Refrigerator according to claim 1, wherein the absorbing member is a plate molded from a zeolite powder placed on a bottom wall (14a) of the drawer (14) and on which a grid or the like is present.
6. Refrigerator according to any of the preceding claims, wherein the refrigerating compartment (RC) is placed above a freezing compartment (FC) and separated therefrom by an insulated mullion (12).

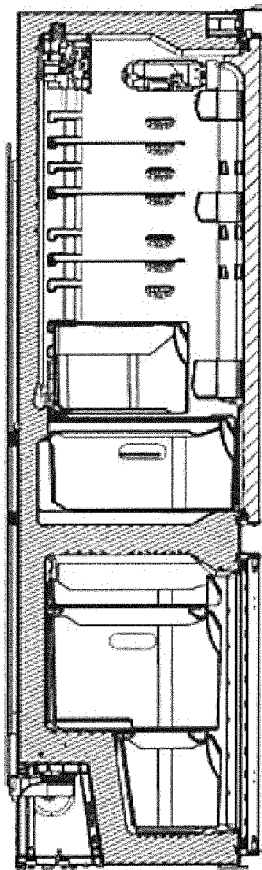


Fig. 1
(PRIOR ART)

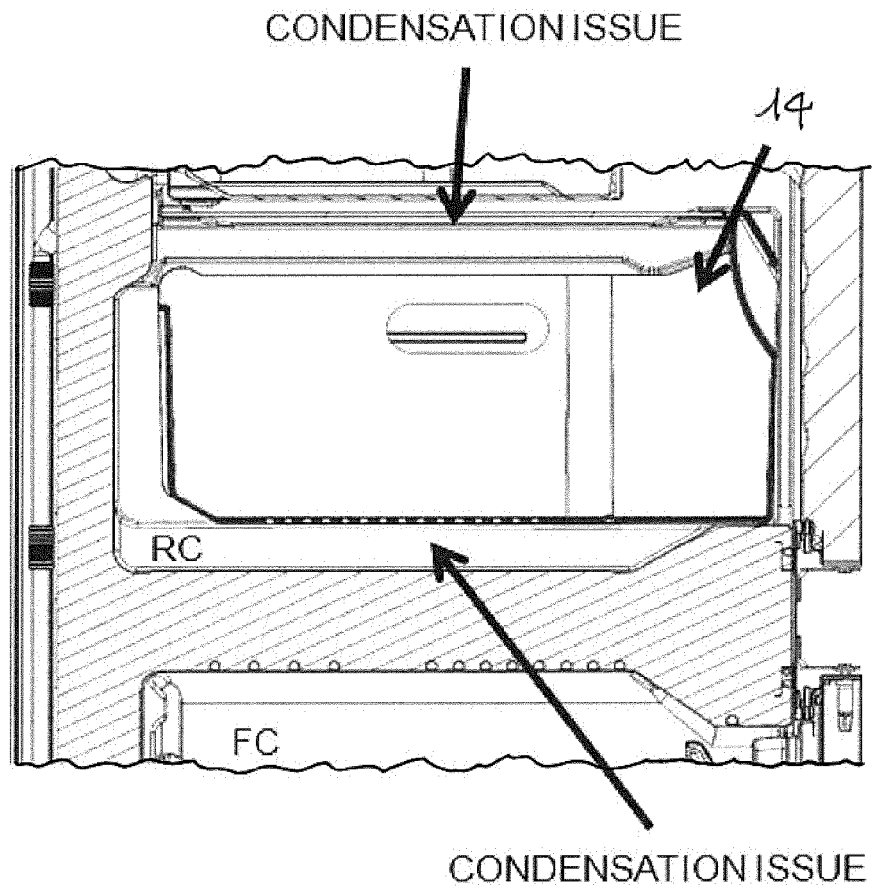


Fig. 2
(PRIOR ART)

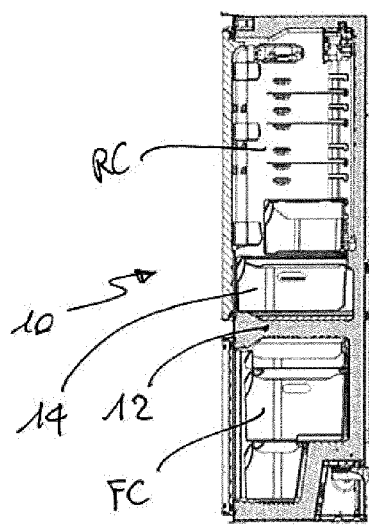


Fig. 3

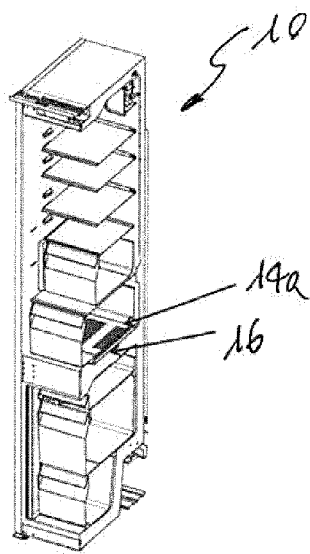


Fig. 4

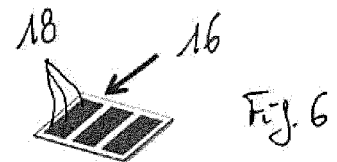


Fig. 6

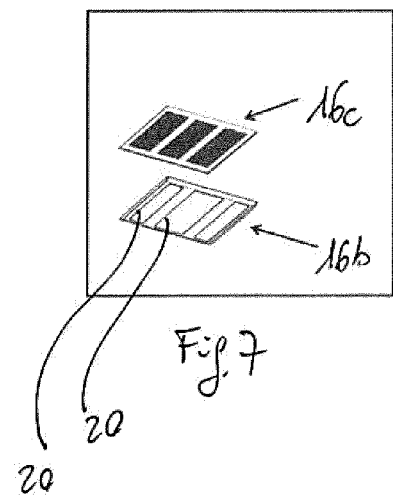
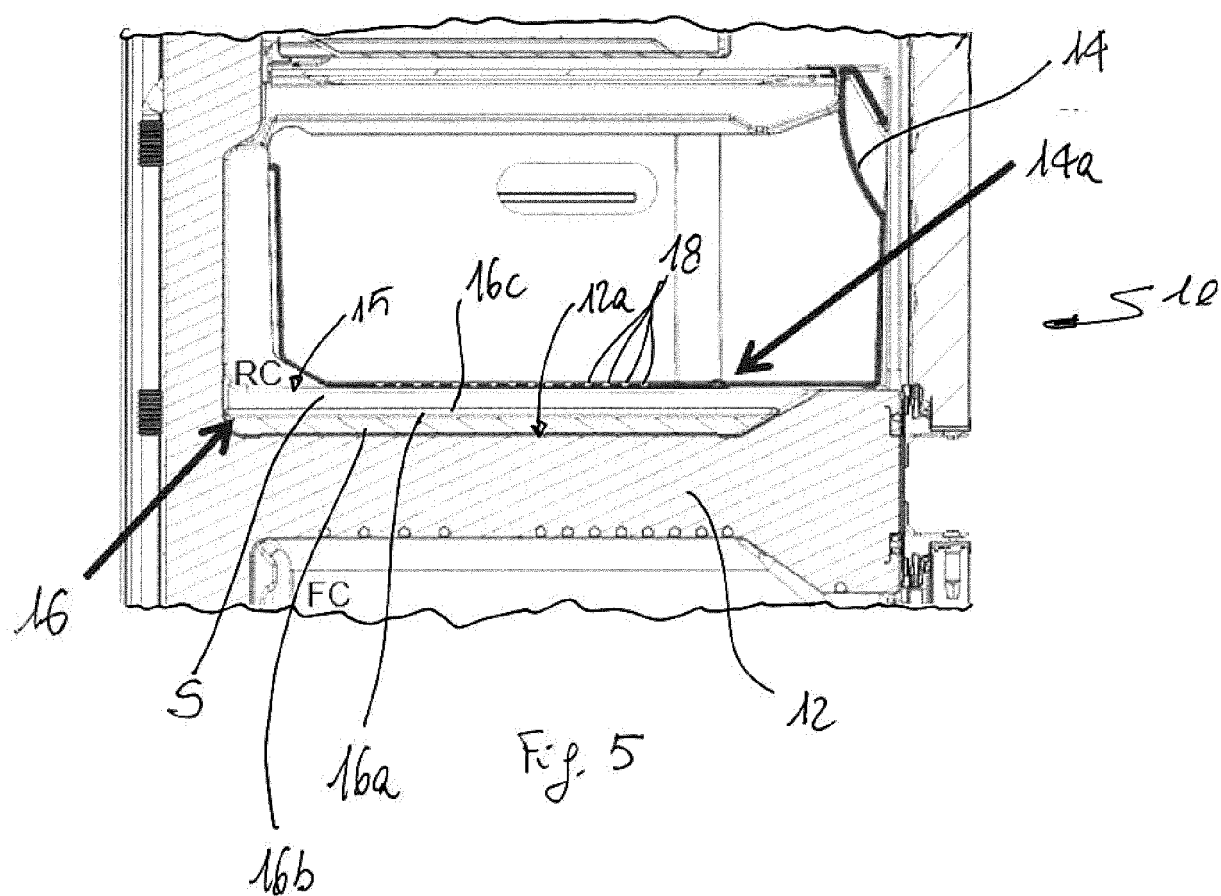


Fig. 7





EUROPEAN SEARCH REPORT

Application Number
EP 16 15 8148

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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	JP H04 353379 A (SHARP KK) 8 December 1992 (1992-12-08)	1,2,4,5	INV. F25D21/04 F25D21/14 F25D25/02
Y	* paragraphs [0001] - [0068]; figures 1-7 *	3,6	
Y	----- JP 2007 278569 A (MATSUSHITA ELECTRIC IND CO LTD) 25 October 2007 (2007-10-25) * paragraphs [0001] - [0135]; figures 1-16 *	3,6	
A	----- JP H02 93279 A (TOSHIBA CORP) 4 April 1990 (1990-04-04) * the whole document * -----	1	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			F25D
Place of search		Date of completion of the search	Examiner
The Hague		11 July 2016	Kolev, Ivelin
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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

EP 16 15 8148

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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