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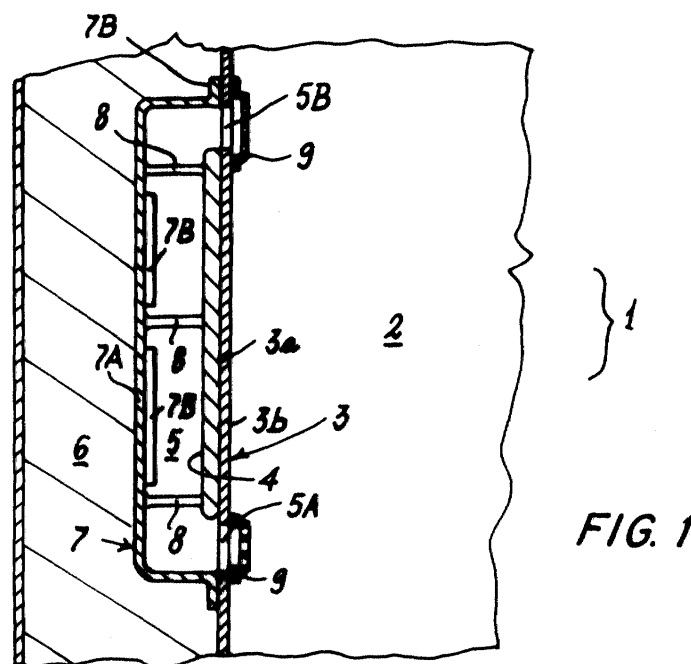
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(54) **Static refrigerator with evaporator in air channel**

(57) A static refrigerator comprising a plate evaporator (4, 4') located within the insulation (6, 6') and applied to the outer face (3a, 3a') of the cell (3, 3') bounding the refrigeration compartment (2, 2') of said refrigerator,

in which the evaporator (4, 4') is disposed in an air channel (5, 5') present between the wall (3b, 3b') and the insulation (6, 6'), said air channel (5, 5') communicating with the refrigeration compartment (2, 2') via apertures (5A, 5B; 5A', 5B') present in said wall (3b, 3b') (Figure 1).



Description

[0001] The present invention relates to a refrigerator, of the so-called static refrigerator type, provided with a plate evaporator.

[0002] Conventional static refrigerators (which can be of single or double door, combination or cabinet type or the like) are provided with a plate evaporator located either inside the refrigeration compartment or embedded in the insulation but in contact with the outside of the rear wall of the cell which bounds said compartment.

[0003] The first of these known solutions has the drawback of reducing the useful space of the refrigeration compartment and requiring additional operations for connecting the evaporator to the wall after the insulation has been formed. The second of these solutions has the drawback of not enabling the available cold of the evaporator to be properly utilized as only one of its sides or faces is usable for heat transfer purposes.

[0004] The main object of the present invention is therefore to provide a static refrigerator which achieves optimum utilization of the available cold of the evaporator, this latter being easily and comfortably mountable without limiting the capacity of the refrigeration compartment.

[0005] A further object is to reduce the refrigerator energy consumption, which is achieved by an increase in the useful surface of the evaporator, as shown by the results of energy consumption tests.

[0006] These and further objects which will be more apparent from the ensuing detailed description are attained by a static refrigerator in accordance with the teachings of the accompanying claims.

[0007] The invention will be better understood from the ensuing detailed description of preferred embodiments thereof, provided by way of non-limiting example and illustrated in the accompanying drawings, in which:

Figure 1 is a partial schematic vertical section through a first embodiment of a static refrigerator according to the invention;

Figure 2 is a section similar to that of Figure 1 taken through another embodiment of a static refrigerator of the invention;

Figure 3 is a schematic view in the direction of the arrow A of Figure 2.

[0008] With initial reference to Figure 1, the reference numeral 1 indicates a static refrigerator overall (with only that part concerning the invention being shown).

[0009] The reference numeral 2 indicates the refrigeration compartment of the refrigerator, this compartment consisting of a cell 3 of plastic material, for example obtained by vacuum forming.

[0010] In contact with the inner face 3a of the rear wall 3b of the cell 3 there is applied, for example by double-sided adhesive tape, a conventional plate evaporator 4 (which for example can be of iron, aluminium or metal-filled plastic).

[0011] According to the invention, the evaporator 4 is positioned within an air channel 5, provided between the cell 3 and the insulation 6 and defined by a moulded plastic conveying member embedded in the insulation 6.

[0012] To retain the evaporator 4 securely against the wall 3b, the conveying member 7 is provided with feet or projecting parts 8 pressing against the evaporator and able to transmit to it the thrust which is exerted on the rear wall 7A of the conveying member 7 during formation of the insulation.

[0013] The conveying member can also comprise air flow distribution ribs or fins 7B on its wall 7A.

[0014] The air channel 5 communicates at different heights with the preservation compartment 2 via apertures 5A and 5B present in the wall 3b of the cell 3, to enable air to circulate through the channel 5.

[0015] These communication apertures can be made visually attractive by means of added elements 9 (for example snap-mounted) which produce such a result without appreciably reducing the air flow.

[0016] These elements if suitably designed, for example provided with fins, can usefully aid uniform air distribution.

[0017] With the foregoing arrangement, which is that shown in Figure 1, the air moves through the channel 5 by convection.

[0018] It should be noted that during assembly, i.e. prior to forming the insulation, the conveying member 7 is secured to the inner face 3a of the cell, for example by double-sided adhesive tape applied to the surrounding flange 7B with which it is provided, or by ultrasonic bonding, to ensure the necessary seal.

[0019] The embodiment of Figure 1 can be defined as static in the sense that air circulation through the channel 5 takes place by natural convection.

[0020] In contrast, the embodiment of the other two figures (in which the same reference numerals indicate equal or corresponding parts) can be defined as dynamic in that a low power electric fan indicated by 10 is provided, positioned to correspond with the upper aperture 5B'. The fan feeds a forced air stream into the channel 5'. The fan can be advantageously of variable speed type, and the intake end of the channel 5', represented by the lower aperture 5A', be provided with manually or electronically adjustable valve means for controlling the flow. In the example illustrated in Figure 2 the inserted lower element 9' is provided with fixed directional fins. The upper element 9'' is shaped to facilitate air flow to the fan, hence acting as a volute.

[0021] The advantages provided by the invention are the following:

- a) compared with the known embedded evaporator solution, the usable heat transfer surface of the evaporator is doubled (in this respect two surfaces operate in place of one);
- b) modifications to the cell (3, 3') in relation to the possible use of grids, glass shelves, brackets etc. are not required;
- c) the usable volume of the refrigeration compartment is not penalized in practice;
- d) the appearance of the appliance is also not penalized; and
- e) from the operational viewpoint, the invention achieves a definite reduction in energy consumption and in cooling time, this latter resulting in improved food preservation.

EXAMPLE

[0022] Energy consumption tests were carried out on a static combination refrigerator prototype of the Applicant, having two compressors, a gamma of 60, a height of 1850 mm, and modified in accordance with the invention:

Refrigerant: R600a	(as current production)
Refrigerator compressor: EMT26CLP	(as current production)
Refrigerator evaporator: brazed iron, dimensions 470 mm x 450 mm	(as current production)

[0023] The plate of the indicated static evaporator is positioned in a channel provided in the rear wall of the refrigerator and having a depth of 20 mm as shown in the drawings.

[0024] Two rectangular cuts of dimensions 20 x 30 mm were made in the cell for air passage above and below the evaporator plate.

[0025] The air circulation through the channel can be natural, or can be forced by means of the electric fan.

[0026] The solution of the invention operates effectively in both configurations; the ensuing energy consumption data were obtained without using the fan.

[0027] On the basis of the foregoing the results of the energy consumption tests are summarized in the following table.

		PRODUCTION	INVENTION
AMBIENT TEMP.	(°C)	25	25
REFRIGERATION CELL TEMP.	(°C)	5	5
% COMPRESSOR OPERATION	(-)	38.6	28.3
ENERGY CONSUMPTION	(Wh/24h)	509	432

[0028] When applied to the indicated product the modification of the invention resulted in a reduction in energy consumption of 15%.

[0029] It should be noted that as the air passage is provided behind the cell, the aforescribed modification does not result in a reduction in the internal volume of the refrigeration compartment.

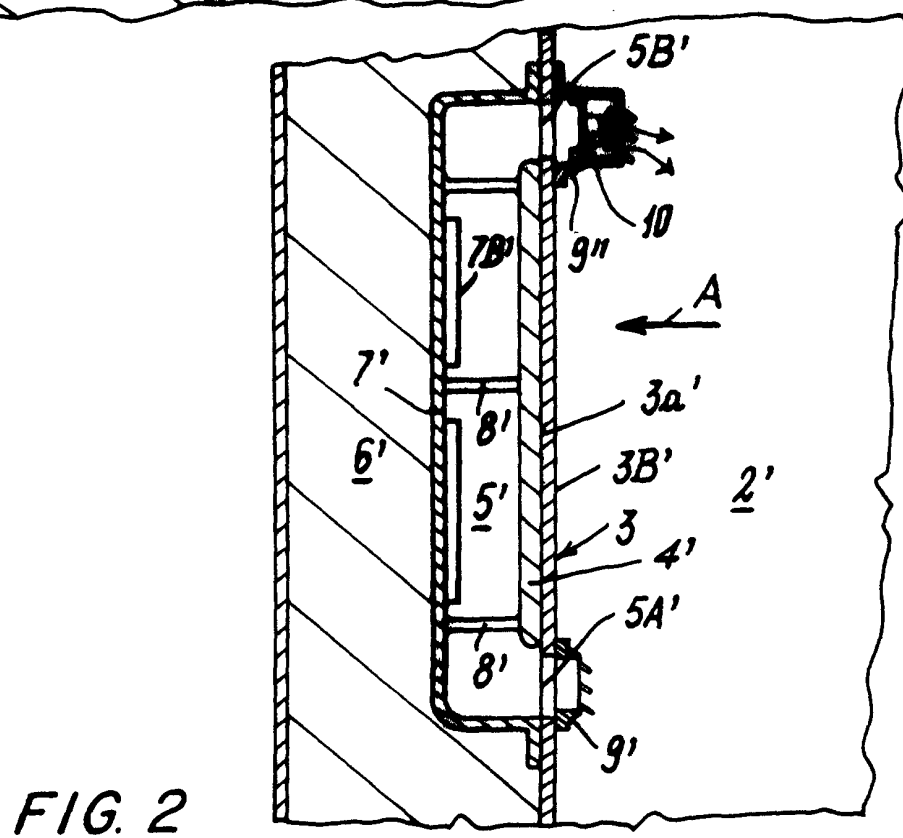
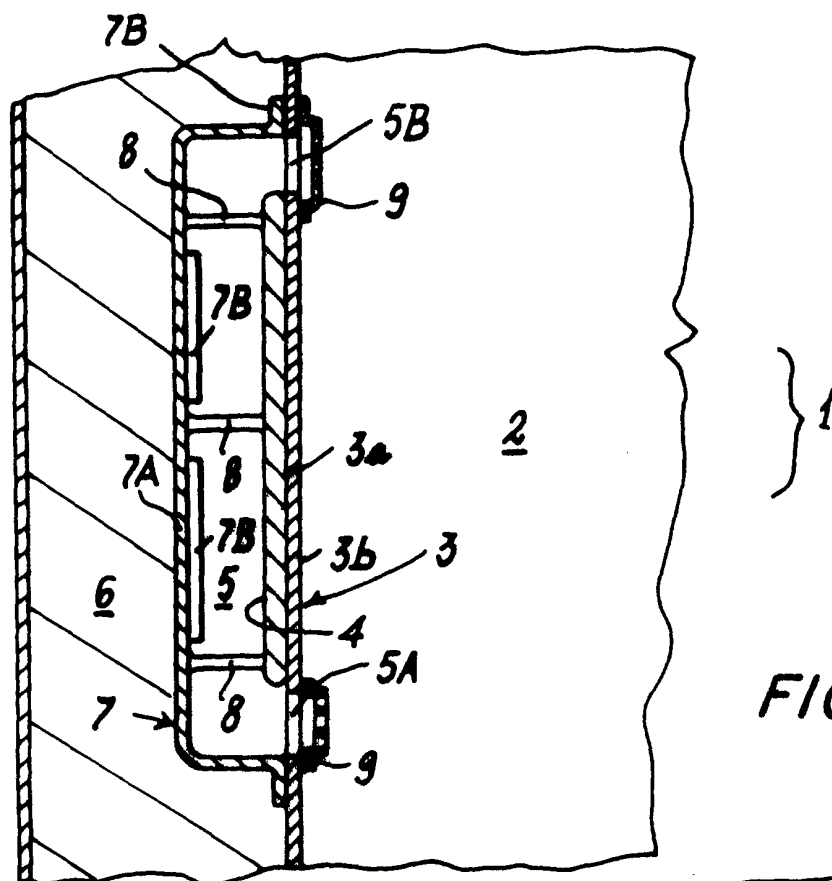
[0030] The impact on costs is very small as the evaporator is the same as that used in the production model. Consequently the additional costs are due essentially to the covering of the air channel and the possible adhesive which fixes the evaporator to the cell.

Claims

1. A static refrigerator comprising a plate evaporator (4, 4') located within the insulation (6, 6') and applied to the outer face (3a, 3a') of the cell (3, 3') bounding the refrigeration compartment (2, 2') of said refrigerator, **characterised in that** the evaporator (4, 4') is disposed in an air channel (5, 5') present between the wall (3b, 3b') and the insulation (6, 6'), said air channel (5, 5') communicating with the refrigeration compartment (2, 2') via apertures (5A, 5B; 5A', 5B') present in said wall (3b, 3b').
2. A refrigerator as claimed in claim 1, wherein the air channel (5, 5') is defined by a conveying member (7, 7') embedded within the insulation (6, 6') and applied peripherally to said wall (3b, 3b').

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3. A refrigerator as claimed in claim 2, wherein the conveying member (7, 7') is of moulded plastic material.
4. A refrigerator as claimed in claim 2 or in claims 1 and 2, wherein the conveying member (7, 7') presses against the evaporator (4, 4') to maintain it in its correct position.
5. A refrigerator as claimed in claim 2, wherein the conveying member (7, 7') presents fins (7B, 7B') for the distribution of the air stream.
6. A refrigerator as claimed in claim 1 and in one or more of the preceding claims, wherein at one of said apertures (5A, 5B) there is disposed a fan (10) for feeding a stream of forced air into the air channel (5, 5').
7. A refrigerator as claimed in claim 6, wherein the fan (10) is of the variable speed type.
8. A refrigerator as claimed in claim 1 and in one or more of the preceding claims, wherein valve means are provided for regulating the air flow.
9. A refrigerator as claimed in claim 1 and in one or more of the preceding claims, wherein at at least one of said apertures (5A, 5B; 5A', 5B') there are provided added elements (9, 9') the main purpose of which is to conceal said apertures from view without preventing air movement.



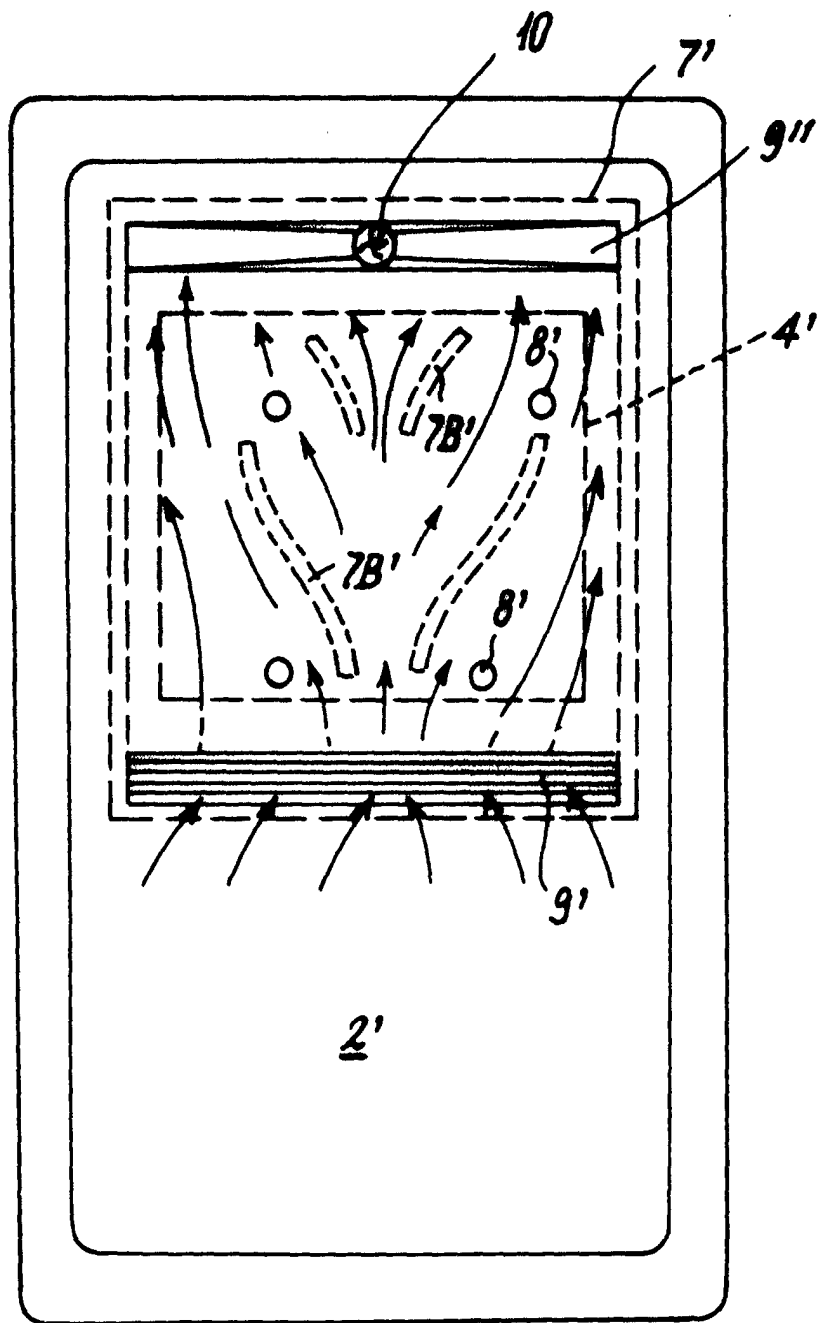


FIG. 3



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 01 10 9502

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	GB 815 460 A (GEN MOTORS CORP) 24 June 1959 (1959-06-24) * figures 1,2 * * page 1, line 39 - line 58 * ----	1,6,9	F25D23/00 F25D17/06
X	GB 789 957 A (GEN MOTORS CORP) 29 January 1958 (1958-01-29) * figure 2 * * page 1, line 38 - line 63 * * page 2, line 3 - line 18 * -----	1,6	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			F25D
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 31 July 2001	Examiner Yousufi, S
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 01 10 9502

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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31-07-2001

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82