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(54) **Appliance for the preservation of food and related manufacturing process**

(57) An appliance for the preservation of food, particularly a freezer, comprising a metallic evaporator (4) and plastic inner structural elements (5, 6, 7) defining,

together with the evaporator, a compartment for accommodating food, wherein the evaporator and the structural elements are made as a single body by means of a molding process

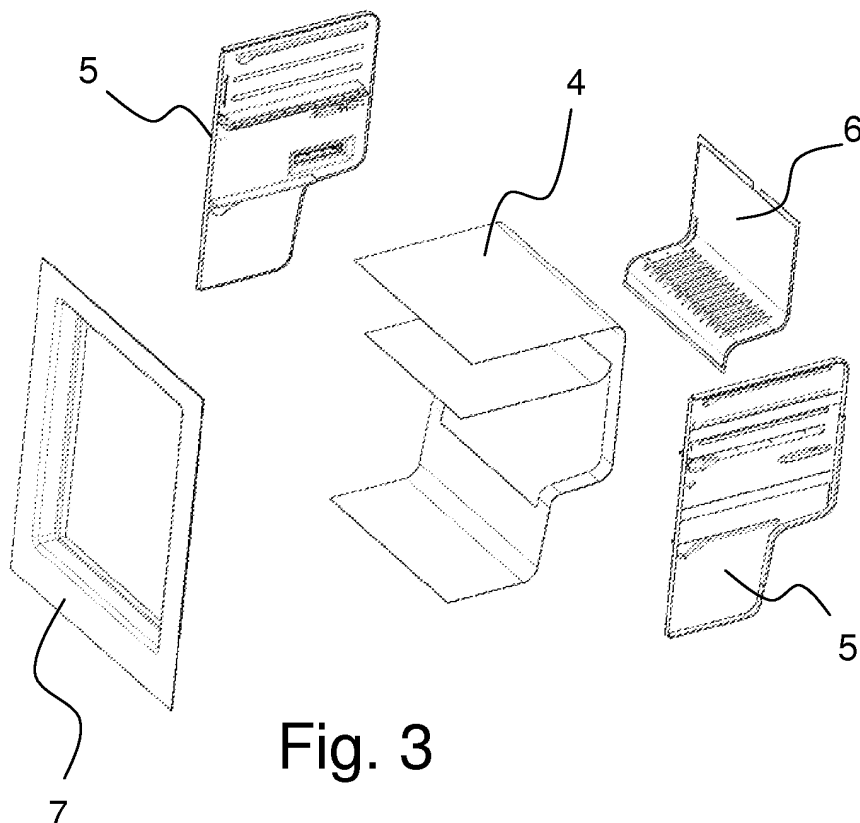


Fig. 3

Description

[0001] The present invention relates to an appliance for the preservation of food, particularly for domestic use.

[0002] A typical household freezer includes a cabinet, a series of internal structural elements defining a food storage compartment, and a cooling system comprising in turn a compressor, a condenser and an evaporator.

[0003] The evaporator, usually of static kind, can be of three types:

- "tube on plate": such an evaporator comprises a shell of aluminum sheet (e.g. having a tubular shape with rectangular cross section) on which an aluminum tube for the flow of the coolant is stretched and taped;
- "wire on tube": such an evaporator includes an iron tube within which the cooling liquid passes and on which iron wires (or strips) are welded;
- "roll bond": such an evaporator comprises a panel obtained by rolling two sheets of aluminum, on which there are obtained, by means of a subsequent blowing operation, the channels for the coolant.

[0004] Each of these types of evaporator has advantages and disadvantages.

[0005] The "tube on plate" evaporator can be used in freezers of the "Combi-top" type (i.e. combined to a refrigerator arranged thereupon), "Upright Freezer" type (i.e. of vertical type and having the typical size of a refrigerator) and "Combi Bottom" type (i.e., combined with a refrigerator arranged below). The "tube on plate" evaporator is relatively cheap but, due to its characteristics, it offers good performance only in freezers of the Combi Top type.

[0006] The "wire on tube" evaporator is usually employed in freezers of the types Upright Freezers and Combi Bottom. Despite its good performance, it has the disadvantage of having to declare a significantly lower net volume (compared to the actual volume of the cell), due to encumbrance of the evaporator, to the lost space (volume that cannot be declared) between the upper evaporating shelf and the compartment top, the need for using a lower drawer to allow passage of air between the test packages (which are used for testing the consumption and preservation according to the European standards) and the bottom of the compartment.

[0007] The "roll bond" evaporator type is currently perhaps the least used. Even though it offers high performance and optimal exploitation of the internal volume, and although it does not need a lower drawer to achieve the desired net volume, it has the disadvantage of being relatively expensive and of requiring an assembly operation with the various plastic components that delimit the inner space of food preservation.

[0008] The object of the present invention is therefore to make a freezer in which the above mentioned problems

related to the evaporator are at least partially solved, and particularly in which the process for making it is particularly simple, inexpensive and fast.

[0009] The Applicant has found that by making, through a molding process, a single body comprising both the metallic evaporator and the other structural parts of plastic material, the manufacturing process of the freezer can be made particularly simple, inexpensive and fast.

[0010] According to the present invention, the evaporator is preferably of the roll bond type and is already shaped in its final shape before being inserted into the mold. The molding process is then performed by means of a co-injection operation, i.e. a simultaneous injection into the mold of different polymers.

[0011] The resulting single body defines therein the food storage compartment. In particular, thanks to the molding, the inner side walls and/or the front frame and/or rear closing portions, as well as other plastic parts like the supports for the door hinges, the outer freezer (lower, upper and/or side) walls, possible reinforcements and the support for the compressor can be realized integral with the evaporator.

[0012] Such a single body can be assembled with traditional techniques with the other components of the freezer, so as to obtain the final product.

[0013] In a first aspect, the present invention is therefore related to an appliance for the preservation of food, preferably a freezer, including therein a metal evaporator, for example of the roll bond type, and structural elements in plastic material defining together with the evaporator a compartment for accommodating and preserving food, wherein the evaporator and such structural elements form a single body.

[0014] For the purposes of the present invention, with "single body" or "single piece" it is meant a body whose parts are integral to each other and therefore do not need to be assembled. The single body of the present invention is advantageously formed by a molding process, preferably the co-injection type.

[0015] The above structural elements may include two side walls inside the appliance, delimiting the compartment. In addition, the structural elements may include a rear body that defines, along with the evaporator, a back wall delimiting said compartment. The structural elements may also include a front frame, delimiting an area of access to said compartment. The structural elements may also include outer walls of the appliance, such as the back wall or the side walls or the upper wall.

[0016] In addition, the structural elements may include strengthening internal side walls associated with the back wall. The structural elements may also include a support element of a compressor, this support element may possibly be defined by said back wall. The structural elements may also include supports for the freezer door hinge.

[0017] The evaporator may have a higher portion defining an upper wall of said compartment. Furthermore,

the evaporator may have a lower portion defining a bottom wall of said compartment. The evaporator can also have a cantilevered horizontal intermediate portion, defining a shelf inside said compartment. Furthermore, the evaporator may have a window, which is closed by said rear body.

[0018] In a second aspect, the present invention relates to a process of manufacturing of an appliance for the preservation of food, particularly a freezer, including the step of shaping a metal evaporator, preferably of the roll-bond type, inserting the evaporator into a mold, and performing a molding process in said mold to obtain a single body comprising the metal evaporator and plastic parts adapted to define structural elements of the appliance.

[0019] Such single body advantageously defines a food storage compartment.

[0020] The molding process can advantageously be performed by co-injection molding of plastic material, particularly suitable polymers.

[0021] The process may include the step of forming two side walls made of plastic material joined to said evaporator. The molding process may also include the step of forming an element in plastic material that closes a window obtained in the rear portion of the evaporator. Furthermore, the molding process may include the step of forming a frame of plastic material joined with at least one edge of the evaporator, and adapted to define a front frame for the access to an inner compartment of the appliance.

[0022] The molding process may also include the steps of forming a back wall of the appliance and possibly reinforcement side walls associated with the back wall. Such back wall may in itself define a support element for a compressor. Alternatively, the molding process may include the step of forming the support elements for the compressor.

[0023] The molding process may also include the step of forming hinge supports for door of the appliance.

[0024] For a better understanding of the present invention some preferred embodiments are now described, purely by way of non-limitative example, with reference to the attached drawings, wherein:

- Figure 1 is a perspective view of an appliance for the preservation of food in accordance with the present invention, including a freezer and a refrigerator;
- Figure 2 shows in perspective view the single body made according to the process of the present invention, defining the inner compartment for the preservation of food in the freezer of the appliance of Figure 1;
- Figure 3 is an exploded view of the various parts of the single body of Figure 2;
- Figure 4 shows in perspective view, a roll bond type

evaporator used in the freezer of Figure 1;

- Figure 5 is a magnified view of part of the single body, and
- Figures 6 and 7 are two perspective views, respectively front and rear, of a different embodiment of the single body formed in accordance with the present invention.

[0025] In Figure 1 there is denoted with 1 in its entirety an appliance for refrigeration / freezing of a Combi Bottom type, including a freezer 2 at the bottom and a refrigerator 3 at the top.

[0026] The freezer 2 and the refrigerator 3 have respective compartments 2a and 3a for accommodating and preserving food second and third, and include respective closure doors 2b and 3b.

[0027] In the case of the freezer 2, the food preservation compartment 2a is defined by a hollow body 8 made, in accordance with the present invention, in a single piece. The body 8, shown isolated in Figures 2 and 3, is obtained by means of a co-injection molding process, as described below.

[0028] Referring to Figure 3, the body 8 includes an evaporator 4, preferably of the roll bond type 4 and made of metal, especially aluminum, and a plurality of parts, including internal structural elements, made of plastic, comprising two side walls 5, a portion of rear wall 6 and a front frame 7.

[0029] The evaporator 4, shown in more detail in Figure 4, is made from a single sheet of aluminum, by cutting and bending.

[0030] In particular, the evaporator 4 has a vertical rear portion 4a, an upper horizontal portion 4b extending at 90° from the rear portion 4a, a substantially horizontal connecting portion 4c, extending approximately at 90° from the rear portion, a substantially vertical connecting portion 4d, extending approximately at 90° from the horizontal connecting portion 4c, and a lower horizontal portion 4e, extending about at 90° from vertical connecting portion 4d. The different portions 4a-4e are obtained by bending at 90° a sheet of aluminum originally flat and rectangular.

[0031] The upper horizontal portion 4b and the lower horizontal portion 4e respectively define an upper wall and lower wall of the compartment for accommodating the food.

[0032] From the rear portion 4a also extends, in the same direction as the upper 4b and lower 4e portions and parallel thereto, a cantilevered portion 4f, obtained by cutting centrally the sheet along three sides of a rectangle, and folding that part at 90° with respect to the fourth side (the upper one) in order to leave a centrally uncovered window 4g of similar size. The cantilevered portion 4f defines a shelf for the food inside the compartment 2a.

[0033] The window 4g extends for part of the rear por-

tion 4a, for the entire horizontal connecting portion 4c, and for part of the vertical connecting portion 4d. Throughout the part of the evaporator 4 in which the window 4g is obtained, the continuity of the piece is ensured by the two lateral edges 4h delimiting the windows itself.

[0034] The portion of rear wall 6, made of plastic, has a shape that matches that of the window 4g so that, after the molding process, the rear wall 6 completely closes the window 4g, keeping the same profile of the evaporator 4. In particular, as shown in Figure 5, the rear wall 6 has, in side view, a substantially L-shaped profile and has a vertical upper portion 6a, which closes the window 4g obtained in the real vertical portion 4a of the evaporator, a horizontal intermediate portion 6b that closes the window 4g obtained in horizontal connecting portion 4c of the evaporator and a lower vertical portion 6c, extending much less than the other two portions, which closes the part of the window 4g obtained in the vertical connecting portion 4d of the evaporator.

[0035] On the upper surface of the horizontal intermediate portion 6b there is a plurality of raised elements 6d essentially straight and parallel to one another, extending between the vertical upper portion 6a and the vertical lower portion 6c, and occupying almost the whole length of the horizontal intermediate portion 6b. Such raised elements 6d act as spacers to create air passages between the element 6 and the bodies that are positioned above the portion 6b, as provided for by the tests of consumption and preservation according to the European standards (where such bodies are test packages).

[0036] The frame 7, delimiting an area of access to the compartment 2a, has a substantially rectangular shape and, in its side facing the compartment 2a, has its upper and lower horizontal edges joined to edges of the upper and lower horizontal portions 4a and 4b of the evaporator, respectively.

[0037] The body 8, thanks to its peculiar profile, delimits in the back and lower part of the freezer 2 a seat for housing a compressor (not shown).

[0038] The freezer 2 also includes a bottom (i.e. lower) wall that can also act as a support for the compressor. In the embodiment of Figures 2-5, such bottom wall is not represented and is not part of the body 8 and can be made for example of metal.

[0039] In the embodiment of Figures 6 and 7, the bottom wall is denoted as 9, is made of plastic and is part of the body 8. Such bottom wall 9 defines a support element for the compressor. In this embodiment, the body 8 includes, in addition to the bottom wall 9, also the side reinforcement elements 10, of trapezoidal shape and also in plastic, which extend vertically from the rear part of the bottom wall 9.

[0040] The side walls 5 mirror each other and have a profile that matches the profile of the evaporator, so that the body 8 is closed on all sides except the front one in which the frame 7 is formed. More specifically, the side walls 5 have a substantially rectangular shape, with the absence of a lower edge to follow the profile of the por-

tions 4c and 4d of the evaporator 4.

[0041] The side walls 5 have, in a mirror way and towards the inside of the compartment, a series of raised elements for the support of possible shelves and for housing the side edges of the cantilevered portion 4f of the evaporator 4. Such raised elements can also be used to accommodate possible sensors or probes.

[0042] The body 8 has therefore an upper wall and a lower wall made in metal and defined by the portions 4b and 4e of the evaporator, a rear wall partly of metal and partly of plastic defined by the portions 4a, 4c, 4d of the evaporator and by the plastic portion 6, two plastic side walls defined by the walls 5, a plastic front edge defined by the frame 7, and a metal shelf defined by the portion 4f of the evaporator.

[0043] The body 8 is obtained, as already mentioned, by means of a molding process, preferably of the co-injection type.

[0044] Before performing the molding process, the evaporator 4, previously made in its final shape, is placed inside the mold. Thereafter, the plastic materials to form the plastic parts of the body 8 are injected into the mold. Plastic materials that are particularly suitable for this purpose are ABS, polystyrene and polypropylene homopolymer loaded with inorganic materials like talc or calcium carbonate.

[0045] The molding process is performed at a temperature, at a pressure and for a predetermined time.

[0046] Possible process values are:

- for ABS:
 - mold temperature between 40 °C and 80 °C;
 - temperature of the polymer between 200 °C and 280 °C;
 - cycle time between 60 sec and 80 sec;
 - injection pressure (for average flow of material for standard section) between 100 Mpa and 130 Mpa.
- For polystyrene:
 - mold temperature between 15 °C and 70 °C;
 - temperature of the polymer between 170 °C and 280 °C;
 - cycle time between 60 sec and 80 sec;
 - injection pressure (for average flow of material for standard section) between 100 MPa and 120 MPa.
- For the loaded polypropylene:
 - mold temperature between 20 °C and 60 °C;
 - temperature of the polymer between 200 °C and 300 °C;
 - cycle time between 60 sec and 80 sec;
 - injection pressure (for average flow of material for standard section) between 100 MPa and 120

Mpa.

[0047] It is also clear that the embodiment described above is purely illustrative and to the appliance of the present invention changes and variations may be made without going beyond the protection scope of the present invention.

[0048] For example, in a different embodiment the evaporator 4 may be joined by molding to only the side walls 5, while the rear portion 6 and the frame 7 could be made separately and joined to the resulting body by mechanical means of a known type. Otherwise the evaporator 4 could be joined by molding to the side walls 5 and the rear portion 6, while the frame 7 could be made separately and joined to the resulting body by mechanical means of a known type.

[0049] In addition, other parts of the appliance may be implemented in a single body with the evaporator during the molding phase, such as the support for the hinges of the door, the outer side walls of the freezer and the upper wall of the freezer.

[0050] In a possible variant of the embodiment of Figures 6 and 7, the support element of the compressor could be separated from the back wall 9, and preferably also part of the single body 8.

[0051] Furthermore, the single body 8 could include hinge supports for the freezer door.

[0052] It is also clear that although this invention has been described with reference to a roll bond type of evaporator, the same technique can be used with other types of evaporator.

[0053] In particular, the evaporator can have different shapes and sizes than those described, for example, it could include side elements totally or partly replacing the elements 5 of Figure 3, or it might be of different types from the "Roll Bond", for example, of the "Tube On Plate" type or similar.

[0054] Furthermore, the appliance of the present invention may be of a type other than Bottom Combi, for example of the Combi Top type or Upright Freezer type.

[0055] Finally, it appears that, although the invention has been described with particular reference to a freezer, the same technique can be used to make a single body that defines a food preservation compartment inside a refrigerator. In other words, the food preservation appliance of the present invention could be a stand-alone refrigerator, or a combined appliance in which the refrigerator has a single body made according to the present invention, or a combined appliance wherein both the refrigerator and the freezer are provided with a respective single body made according to the present invention.

Claims

1. Appliance for the preservation of food, comprising a metallic evaporator (4) and structural elements (5, 6, 7) in plastic material defining, together with the

evaporator, a space (2a) for accommodating the foods, **characterized in that** the evaporator and said structural elements are realized in a single body (8).

2. Appliance according to claim 1, in which said structural elements include two inner side walls (5) delimiting said space (2a).
3. Appliance according to claim 1, in which said structural elements include a rear body (6) that defines, together with said evaporator (4), a rear wall delimiting said space (2a).
4. Appliance according to claim 1, in which said structural elements include a frontal frame (7), delimiting an access area to said space (2a).
5. Appliance according to claim 1, in which the evaporator (4) has an upper portion (4b) defining an upper wall of said space (2a).
6. Appliance according to claim 1, in which the evaporator (4) has a lower portion (4e) defining a lower wall of said space (2a).
7. Appliance according to claim 1, in which the evaporator (4) has a cantilevered horizontal intermediate portion (4f), defining a shelf inside said space (2a).
8. Appliance according to claim 3, in which the evaporator (4) has a window (4g) closed by said rear body (6).
9. Appliance according to claim 1, in which said structural elements include a bottom wall (9) of said appliance.
10. Appliance according to claim 1, in which said structural elements include a compressor support element.
11. Method for the production of an appliance for the preservation of foods, comprising the steps of:
 - shaping a metallic evaporator;
 - inserting the evaporator into a die;
 - performing a moulding process in said die to obtain a single body comprising the metallic evaporator and parts in plastic material adapted to define structural parts of said appliance.
12. Method according to claim 11, in which said performing the moulding process includes co-injecting plastic material in said die.
13. Method according to claim 11, in which said performing the moulding process includes forming two side

walls in plastic material joined to said evaporator.

14. Method according to claim 11, in which said performing the moulding process includes forming an element in plastic material that closes a window formed in a rear portion of the evaporator. 5
15. Method according to claim 11, in which said performing the moulding process includes forming a frame in plastic material joined to at least one edge of the evaporator and adapted to define a frontal frame for the access to a space inside of the appliance. 10

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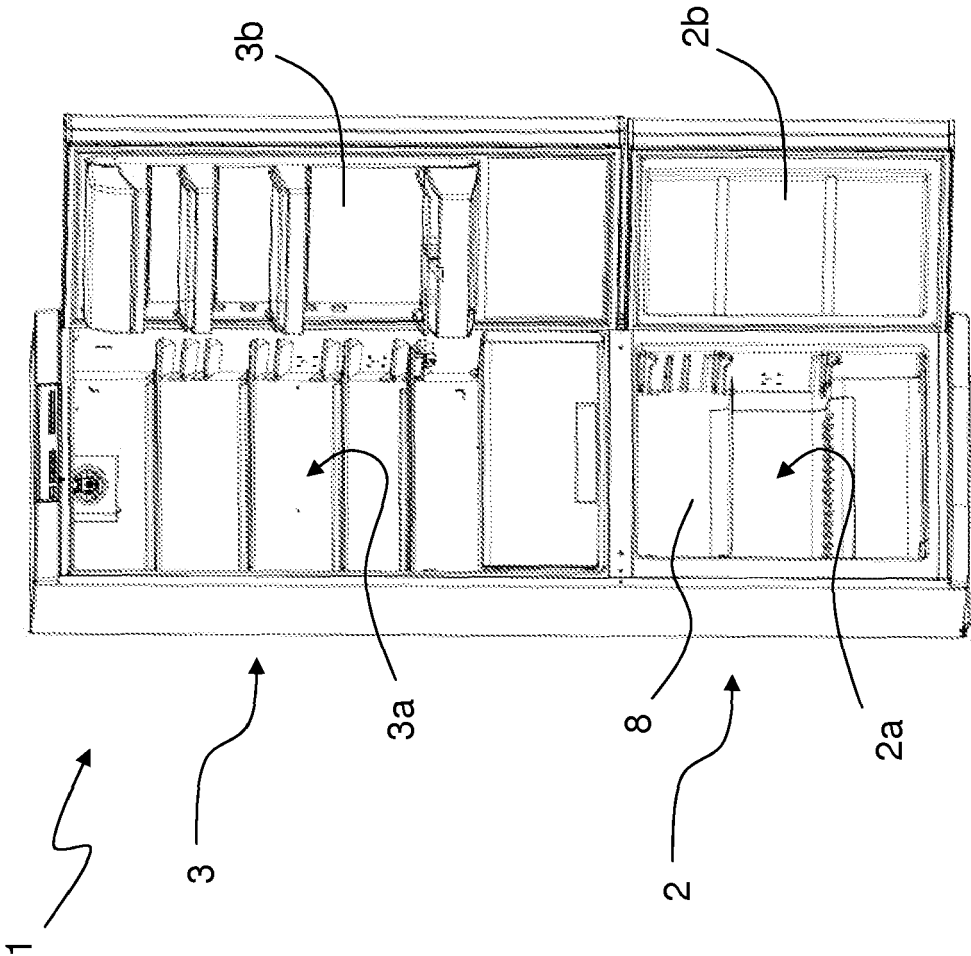


Fig. 1

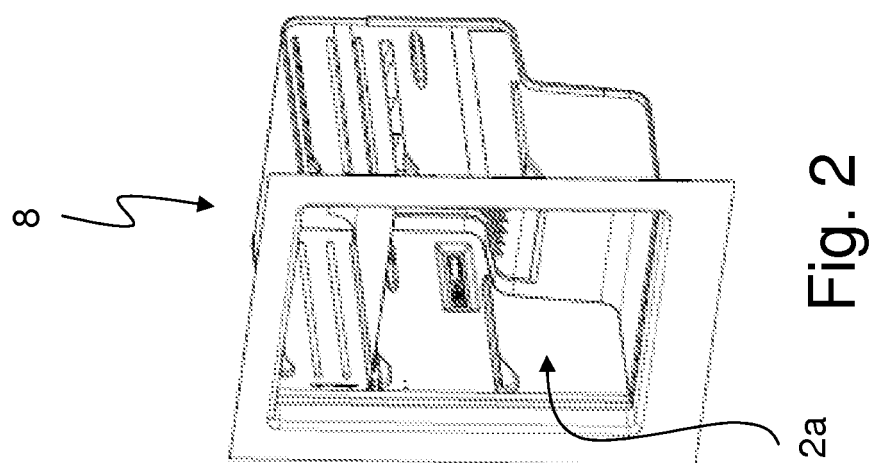


Fig. 2

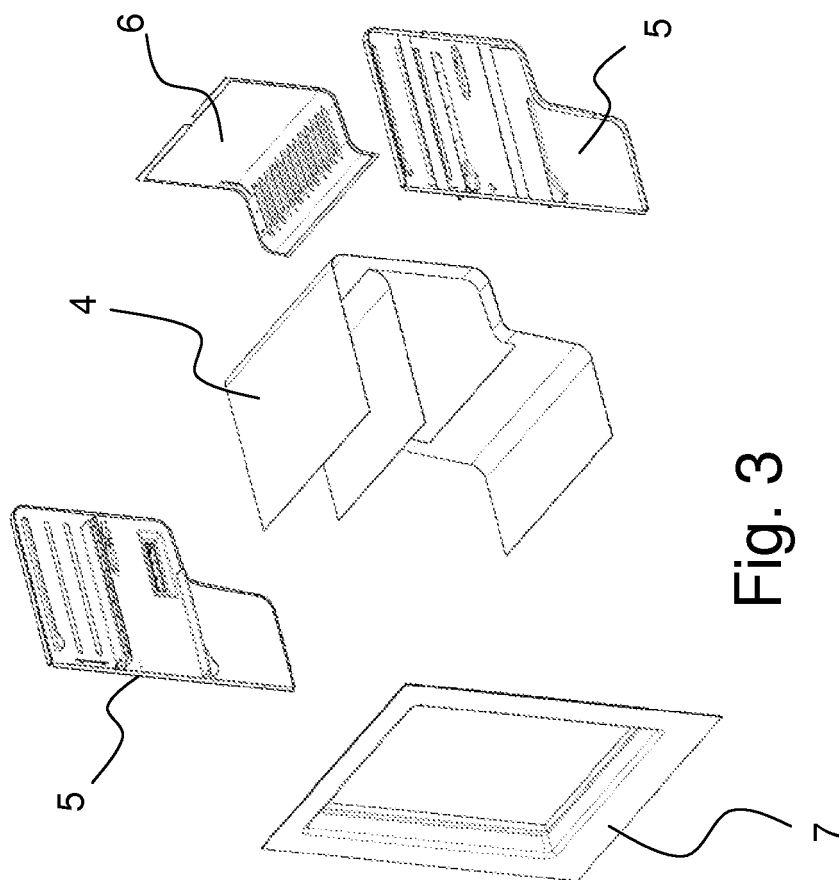


Fig. 3

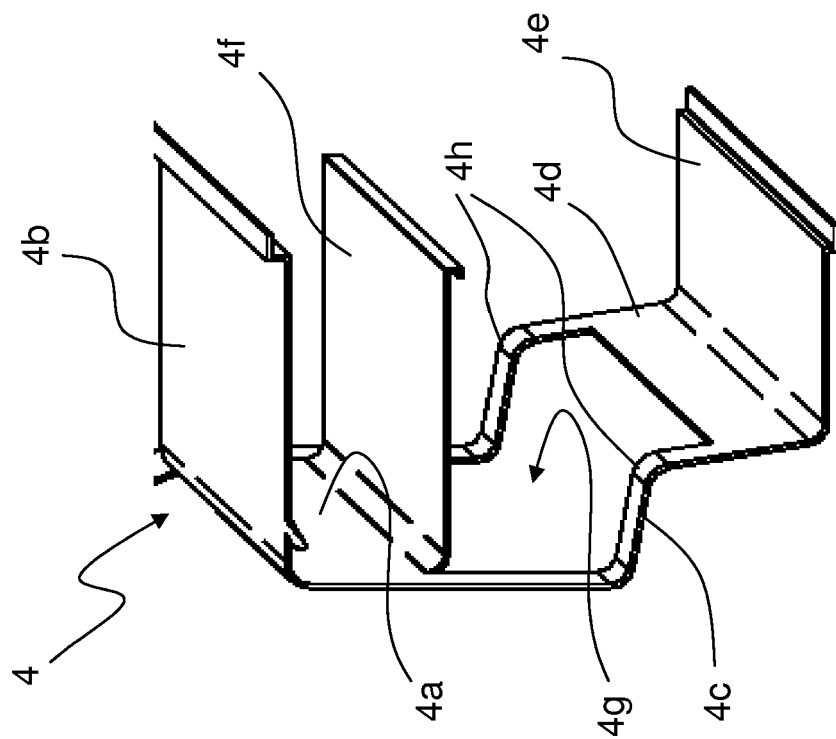


Fig. 4

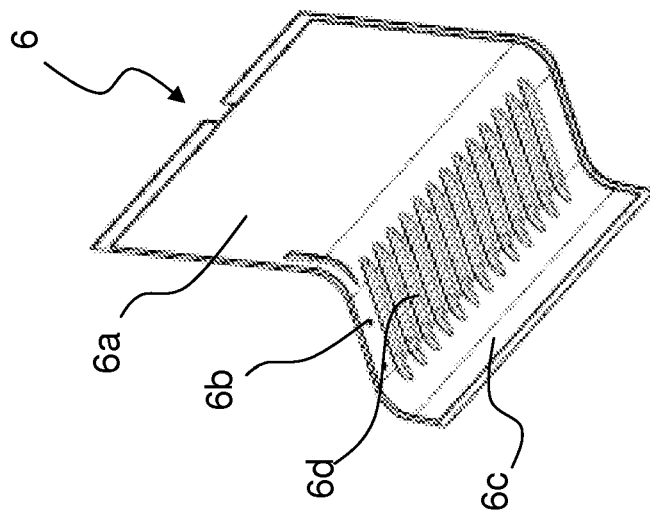


Fig. 5

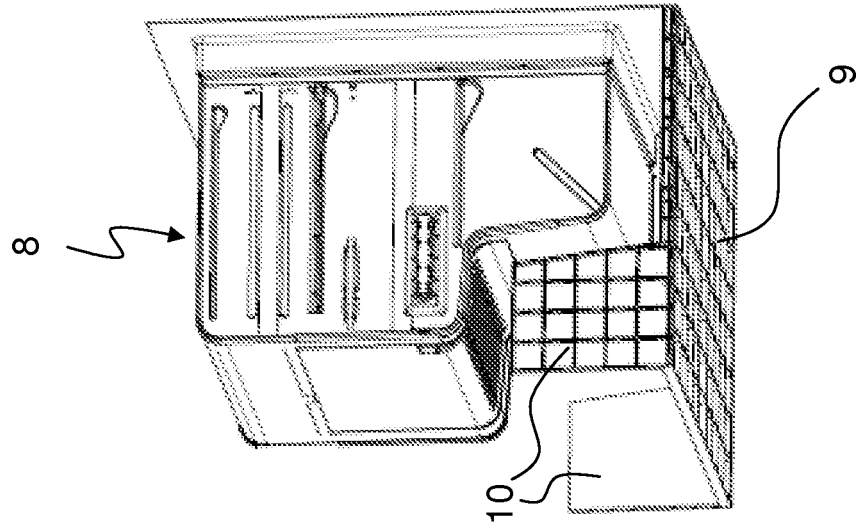


Fig. 7

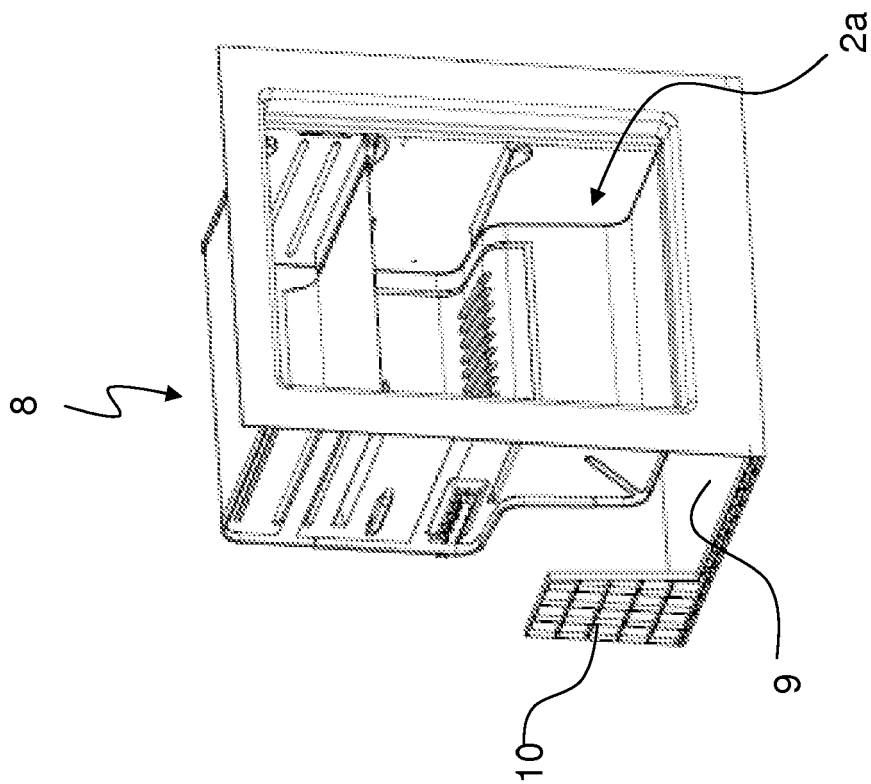


Fig. 6



EUROPEAN SEARCH REPORT

Application Number
EP 10 17 0147

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	WO 01/38805 A2 (ELECTROLUX SARL [LU]; BRAUNS ULI [DE]) 31 May 2001 (2001-05-31)	1-5,8-15	INV. F25D23/06 F25D23/00
Y	* page 1, lines 1-5 * * page 1, line 24 - page 2, line 17 * * figure 3 *	6,7	
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			TECHNICAL FIELDS SEARCHED (IPC)
			F25D F25B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 2 September 2010	Examiner Salaün, Eric
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 10 17 0147

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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02-09-2010

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