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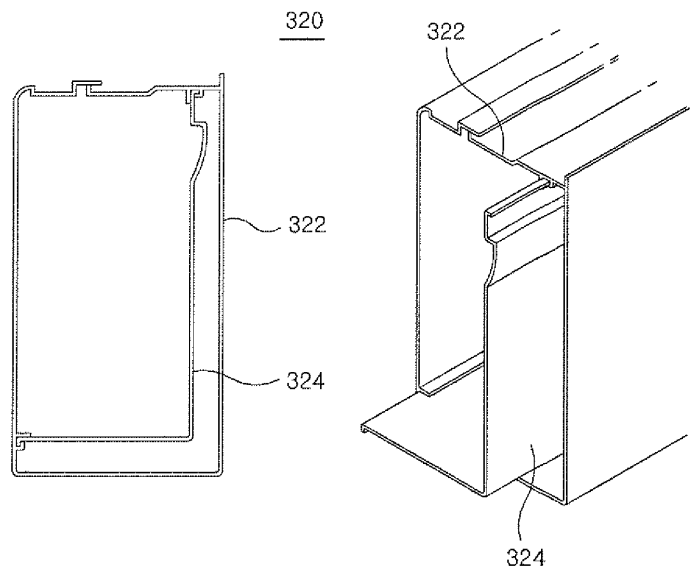
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(54) **DEPTH-ADJUSTABLE ICE COMPARTMENT FOR REFRIGERATOR AND METHOD FOR MANUFACTURING THE SAME**

(57) A method for manufacturing a refrigerator (100) includes providing a main body including a food storage space and a cold air generator, installing an ice compartment (210) in the food storage space, the ice compartment being configured to produce ice, and installing a door on the main body, the door being configured to openably close the food storage space, wherein installing the ice compartment includes forming a housing (212) of the ice compartment by extrusion molding, manufacturing a

front end frame (214) and a rear end frame (216) which are respectively coupled to front and rear ends of the housing of the ice compartment, respectively coupling the front end frame and the rear end frame to the front and rear ends of the ice compartment (210), and performing a urethane foaming process to include thermal insulation in some of the space in the housing of the ice compartment.

FIG.3B



Description

Related Application

[0001] This application claims priority to Korean Patent Application No. 10-2015-0085877, filed June 17, 2015, hereby incorporated by reference in its entirety.

Field of the Invention

[0002] Embodiments according to the present invention relate to a depth-adjustable ice compartment for a refrigerator and a method for manufacturing the ice compartment.

Background

[0003] Generally, a refrigerator is an apparatus for low temperature storage of food and other items and may be configured to provide both freezing storage and cold storage of those items. For this, refrigerators include a cooling device or cold air generator. A cooling cycle is used in operating the cooling device or cold air generator.

[0004] According to the cooling cycle, cold air is generated as refrigerant repeatedly circulates through the various stages of the cooling cycle including compression, condensation, expansion (decompression), and evaporation. The cold air supplied into the refrigerator is uniformly distributed inside the refrigerator by convection, whereby food and other items in the refrigerator can be stored under desired temperature conditions. A main body of the refrigerator has a rectangular structure that is open on a front surface thereof. A refrigerator compartment and a freezer compartment are provided in the main body of the refrigerator. Typically, a refrigerator compartment door and a freezer compartment door are provided on the front surface of the main body so as to selectively open or close those compartments of the refrigerator.

[0005] Fig. 1A illustrates a refrigerator 100 and an ice compartment 110 provided in the refrigerator 100. As shown in Fig. 1B, the ice compartment 110 includes an ice maker 120. Ice produced by the ice maker 120 is stored in the ice compartment 110.

[0006] Fig. 1C illustrates inner and outer housing plates 112, 114, 116, and 118 for an ice compartment that are manufactured using molds by injection molding in accordance with a conventional technique. However, in the case where the ice compartment is manufactured by injection molding, the per-unit cost of production using injection molding is comparatively high. Further, four sets of large-sized molds are required to produce four housing plates. A separate assembly process after the inner and outer housing plates have been manufactured is also needed. Therefore, there is a problem with conventional ice compartments due to higher production costs including the molding cost, the material cost, etc.

[0007] Moreover, because the inner and outer housing plates manufactured by injection molding have constant,

predetermined sizes and shapes corresponding to the sizes of the molds, ice compartments produced by assembling the inner and outer housing plates also have a constant size and shape. Thus, it is difficult to diversify the depths of ice compartments. Therefore, the conventional technique cannot satisfy recent requirements for refrigerators having different sizes and shapes, for example, built-in refrigerators or counter-depth refrigerators, which are reduced in depth in order to fit with kitchen structures (e.g., relatively shallow cabinets) or other kitchen furniture.

[0008] Fig. 1D illustrates the ice compartment 110 produced by assembling the inner and outer housing plates 112, 114, 116, and 118 manufactured by injection molding in accordance with the conventional technique. After the ice compartment has been produced by assembling the inner and outer housing plates with each other, a urethane foaming process is performed to provide thermal insulation in the upper, lower, left, and right spaces between the inner and outer housing plates. In the conventional technique, there is a likelihood of urethane liquid leaking out through gaps formed in junctions 122 and 124 between the inner and outer housing plates. Reference numerals 124a and 124b show enlargements of the junctions 124. As can be understood from the enlargements, there is a fine gap in each junction at which the inner and outer housing plates are coupled to each other.

[0009] In addition, another problem is that the volume of the ice compartment is increased because it is produced by assembling parts formed by injection molding. Also, the appearance of the ice compartment is unattractive due to an inclined portion (draft angle) formed to enable a product to be easily separated from a mold during the injection molding process.

Summary of the Invention

[0010] In view of the above, embodiments according to the present invention provide an integrated ice compartment that can be manufactured in various depths and is reduced in size.

Brief Description of the Drawings

[0011] The objects and features of the present invention will become apparent from the following description of embodiments given in conjunction with the accompanying drawings, in which:

Fig. 1A is a front view showing a typical refrigerator; Fig. 1B is an enlarged sectional view of an ice compartment of Fig. 1A; Fig. 1C is a view showing inner and outer housing plates for the ice compartment that are formed by injection molding in accordance with a conventional technique; Fig. 1D shows a cross-sectional view of the ice compartment manufactured by assembling the inner and

outer housing plates of Fig. 1C with each other and an enlarged view of the junction between the inner and outer housing plates;

Figs. 2A to 2D are views illustrating an ice compartment in accordance with an example embodiment of the present invention;

Figs. 3A to 3C are sectional views and perspective views illustrating various embodiments of the ice compartment in accordance with the present invention; and

Fig. 4 is a flowchart showing an example of a method for manufacturing a refrigerator in an embodiment according to the present invention.

Detailed Description of the Embodiments

[0012] Hereinafter, example embodiments of the present invention will be described in detail with reference to the accompanying drawings which form a part of the disclosure.

[0013] In describing the embodiments of the present invention, a detailed description of known functions or constructions related to the present invention will be omitted if it is deemed that such description would make the gist of the present invention unnecessarily vague.

[0014] Fig. 2A is a partial perspective view illustrating an ice compartment 210 in accordance with an example embodiment of the present invention. Unlike a conventional ice compartment manufactured by assembling a plurality of inner and outer housing plates with each other, the ice compartment 210 in accordance with the present example embodiment is integrally formed through a single extrusion molding process.

[0015] Fig. 2B is a cross-sectional view showing the ice compartment 210 that is manufactured by extrusion molding and is provided with a thermal insulator formed only in a sidewall and the bottom of the ice compartment 210 by foaming urethane according to the present example embodiment. Here, the sidewall and the bottom of the ice compartment 210 that have a urethane foamed layer are not brought into contact with a main body of the refrigerator. That is, the sidewall and the bottom of the ice compartment 210 face into the food storage space (for example, they face into the freezer compartment), away from the inside surfaces of the main body of the refrigerator. Hereinafter, this sidewall and the bottom of the ice compartment 210 will be referred to together as free surface parts 220. In the ice compartment 210 in accordance with the present example embodiment, the urethane foaming process is conducted only for the free surface parts 220, unlike the conventional technique (refer to Fig. 1D) in which the four housing plates 112, 114, 116, and 118 manufactured by injection molding are assembled together to form the ice compartment 110 and then the urethane foaming process is performed for all of the four spaces, that is, the upper, lower, left, and right spaces, that are between the inner and outer housing plates. Therefore, the ice compartment 210 in accord-

ance with the present example embodiment can be reduced in size compared to that of the conventional technique, because only two sides of the ice compartment 210 include thermal insulator instead of all four sides. In detail, surfaces of the ice compartment 210 that make direct contact with the main body of the refrigerator use, as a thermal insulation means, a foamed layer provided in the main body of the refrigerator. Foamed layers are provided in only the free surface parts 220. Therefore, compared to the conventional technique, the width and the height of the ice compartment 210 can be reduced. In this specification, as shown in Fig. 2B, although the thermal insulation layers have been illustrated as being formed, through the urethane foaming process, in only the right sidewall and the bottom of the ice compartment 210, the present invention is not limited to this. For instance, depending on the position in which the ice compartment 210 is installed, a thermal insulation layer may be formed in a left sidewall or a ceiling surface of the ice compartment 210 through a urethane foaming process.

[0016] Fig. 2C is a perspective view of the ice compartment 210 in accordance with the example embodiment of the present invention. In accordance with the present example embodiment, the ice compartment 210 is integrally formed by extrusion molding. The extrusion molding includes supplying raw material into an extrusion machine, and extruding the material through a mold, thus forming an integrated body having a constant cross-sectional shape. Therefore, there is advantage in that a depth (length) 218 of the ice compartment 210 can be easily adjusted during manufacturing. As such, when extrusion molding is used, ice compartments having different depths or lengths can be easily manufactured without the need for a separate mold. Extrusion is halted when the desired depth/length is reached. Thus, manufacture of ice compartments for customized refrigerators such as built-in refrigerators or counter-depth refrigerators having a variety of depths is facilitated.

[0017] In an example embodiment of Fig. 2D, a housing 212 of the ice compartment 210 is integrally formed by an extrusion molding process. Each of a front end frame 214 and a rear end frame 216 of the ice compartment is formed by a mold through an injection molding process. As needed, the front end frame 214 and the rear end frame 216 may be manufactured through other appropriate processes known to those skilled in this art rather than through an injection molding process. The housing 212, the front end frame 214, and the rear end frame 216 of the ice compartment 210 can be assembled with each other by various coupling methods, e.g., using a protrusion locking structure, screws, adhesive or the like. After the assembly process has been completed, urethane is foamed in the free surface parts 220 of the ice compartment 210, thus forming the thermal insulation layers. In this way, the ice compartment 210 illustrated in Fig. 2D may be manufactured.

[0018] Figs. 3A to 3C illustrate various embodiments of the ice compartment manufactured by extrusion mold-

ing in accordance with the present invention. As shown in Fig. 3A, an ice compartment 310 may include a housing 312 and an inner separation plate 314 and may be manufactured in such a way that the housing 312 and the inner separation plate 314 are integrally formed through a single extrusion molding process. Alternatively, as shown in Fig. 3B, an ice compartment 320 may include a housing 322 and an inner separation plate 324 and may be manufactured in such a way that the housing 322 and the inner separation plate 324 are formed through separate extrusion molding processes and then assembled with each other. As a further alternative, as shown in Fig. 3C, an ice compartment 330 may include a housing 332 and an outer separation plate 334 and may be manufactured in such a way that the housing 332 is formed through an extrusion molding process, the outer separation plate 334 is formed through a separate extrusion molding process or an injection molding process, and then the housing 332 and the outer separation plate 334 are assembled with each other.

[0019] As described above, the present invention provides an integrated ice compartment that is configured such that its length or depth can be easily changed during manufacture, and its size can thereby be reduced compared to that of the conventional technique. Furthermore, the present invention provides a method for manufacturing the ice compartment.

[0020] Furthermore, in the present invention, extrusion molding is used to manufacture a housing of an ice compartment. Thereby, the molding cost, the material cost, and the number of parts of the housing can be reduced compared to those of the conventional ice compartment manufactured by injection molding. Further, because the housing of the ice compartment can be integrally formed, there is no possibility of urethane liquid leaking out of the housing through a gap between the parts of the housing. In addition, the volume of the ice compartment can be reduced because the thermal insulator may be used on only two of its sides. The appearance of the ice compartment can be improved because there is no need to form a separate draft angle.

[0021] Fig. 4 is a flowchart 400 of a method for manufacturing a refrigerator in an embodiment according to the present invention. The method may include steps in addition to those shown, and the order in which steps are performed may be different than that shown in the figure and described below.

[0022] In block 402, a main body including a food storage space and a cold air generator is provided.

[0023] In block 404, an ice compartment is installed in the food storage space. More specifically, in an embodiment, a housing of the ice compartment is formed by extrusion molding, a front end frame and a rear end frame which are respectively coupled to front and rear ends of the housing of the ice compartment are manufactured, the front end frame and the rear end frame are respectively coupled to the front and rear ends of the ice compartment, and a urethane foaming process for thermal

insulation in some of a space in the housing of the ice compartment, the some of the space separated from the rest of the space by a separation plate is performed.

[0024] In block 406, a door is installed on the main body, the door configured to openably close the food storage space.

[0025] While the invention have been shown and described with respect to the example embodiments, the present invention is not limited thereto. It will be understood by those skilled in the art that various changes and modifications may be made without departing from the scope of the invention as defined in the following claims.

[0026] Accordingly, the scope of the present invention should be interpreted based on the following appended claims, and all technical spirits within an equivalent range thereof should be construed as being included in the scope of the present invention.

Claims

1. A method for manufacturing a refrigerator, said method comprising:

providing a main body including a food storage space and a cold air generator;
installing an ice compartment in the food storage space, the ice compartment being configured to produce ice; and
installing a door on the main body, the door being configured to openably close the food storage space,
wherein installing the ice compartment comprises:

forming a housing of the ice compartment by extrusion molding;
manufacturing a front end frame and a rear end frame which are respectively coupled to front and rear ends of the housing of the ice compartment;
respectively coupling the front end frame and the rear end frame to the front and rear ends of the ice compartment; and
performing a urethane foaming process to include thermal insulation in some of a space in the housing of the ice compartment, the some of the space separated from the rest of the space by a separation plate.

2. The method of claim 1, wherein each of the front end frame and the rear end frame is manufactured by injection molding.

3. The method of claim 1, wherein forming the housing of the ice compartment comprises:

integrally forming the housing of the ice com-

- partment and the separation plate by extrusion molding.
4. The method of claim 1, further comprising:
- manufacturing the separation plate through a process separate from a process for forming the housing of the ice compartment, wherein the separation plate is manufactured by a process selected from the group consisting of extrusion molding and injection molding.
5. The method of claim 1, wherein the some of the space that is separated by the separation plate and that includes the thermal insulation forms a free surface part of the housing of the ice compartment.
6. The method of claim 1, wherein the some of the space that includes the thermal insulation is along only two sides of the ice compartment, the two sides facing into the food storage space.
7. A refrigerator, comprising:
- a main body including a food storage space and a cold air generator;
a door installed on the main body and configured to openably close the food storage space; and
an ice compartment installed in the food storage space and configured to produce ice,
wherein the ice compartment comprises a housing integrally formed by extrusion molding, and wherein a length of the housing of the ice compartment is predetermined depending on a size and an appearance of the refrigerator.
8. The refrigerator of claim 7, wherein the ice compartment comprises:
- a front end frame and a rear end frame configured to be respectively coupled to front and rear ends of the housing of the ice compartment, wherein each of the front end frame and the rear end frame is manufactured by injection molding and then assembled with the housing of the ice compartment.
9. The refrigerator of claim 7, wherein some of a space in the housing of the ice compartment is separated from the rest of the space in the housing by a separation plate, and wherein a urethane foaming process is performed to include thermal insulation in the some of the space that is separated by the separation plate.
10. The refrigerator of claim 9, wherein the separation plate is integrally formed with the housing of the ice compartment by extrusion molding.
11. The refrigerator of claim 9, wherein the separation plate is manufactured through a process separate from a process of forming the housing of the ice compartment, wherein the separate process is a process selected from the group consisting of extrusion molding and injection molding.
12. The refrigerator of claim 9, wherein the some of the space that is separated by the separation plate forms a free surface part of the housing of the ice compartment.
13. The refrigerator of claim 9, wherein the some of the space that includes the thermal insulation is along only two sides of the ice compartment, the two sides facing into the food storage space.

FIG. 1A

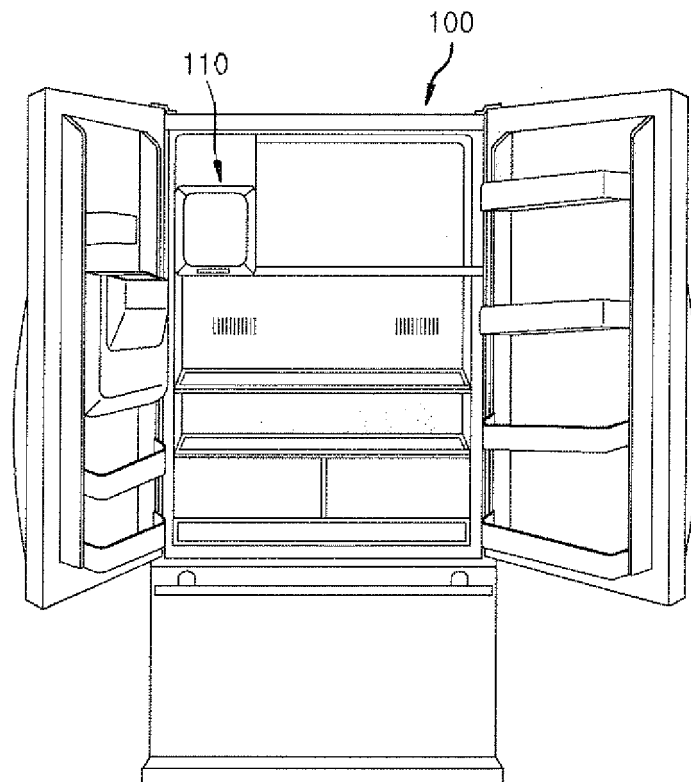


FIG. 1B

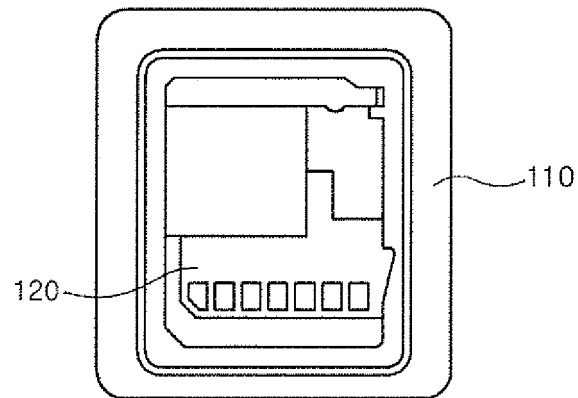


FIG. 1C

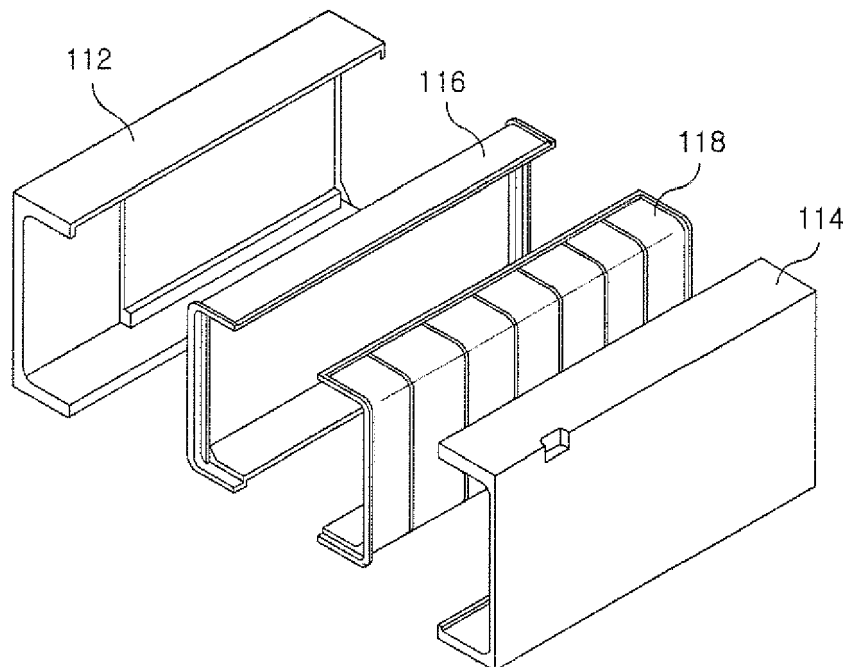


FIG. 1D

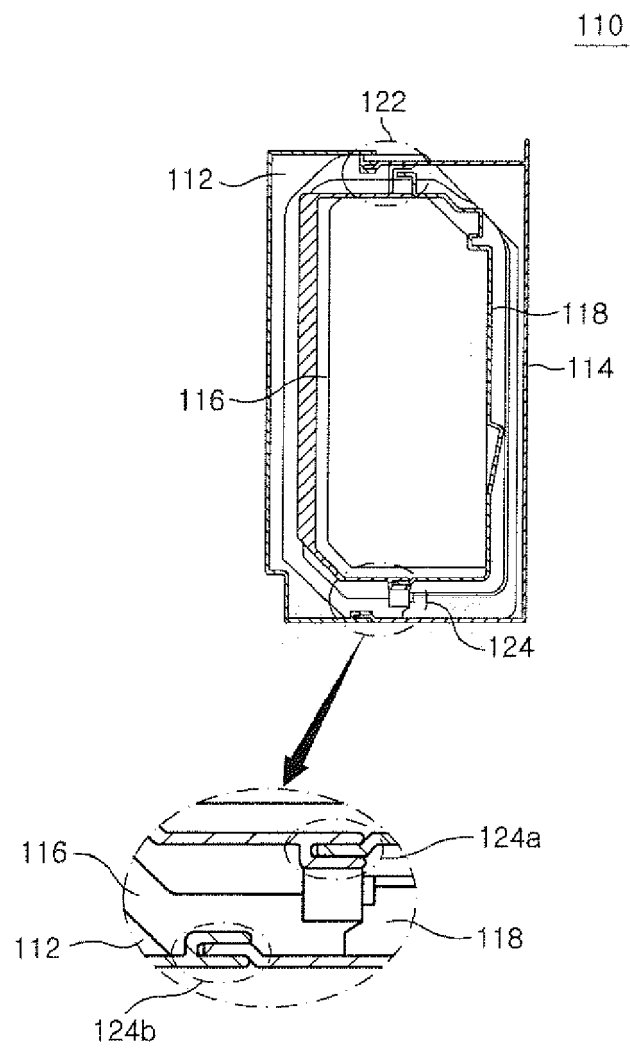


FIG. 2A

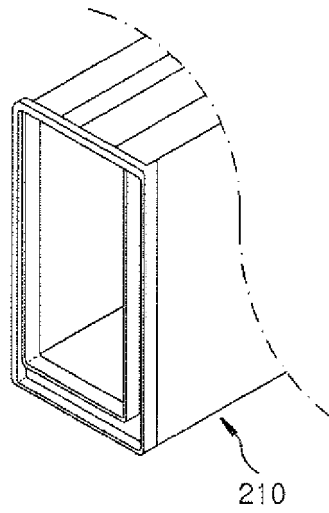


FIG. 2B

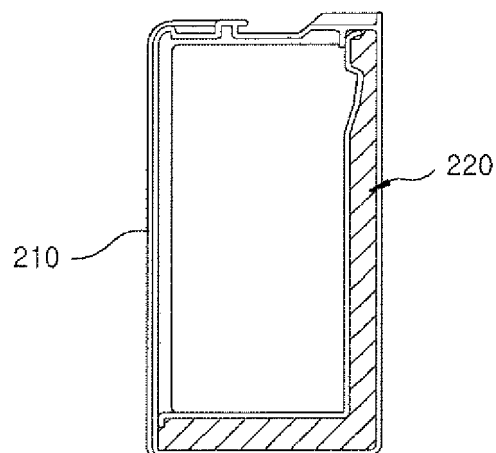


FIG. 2C

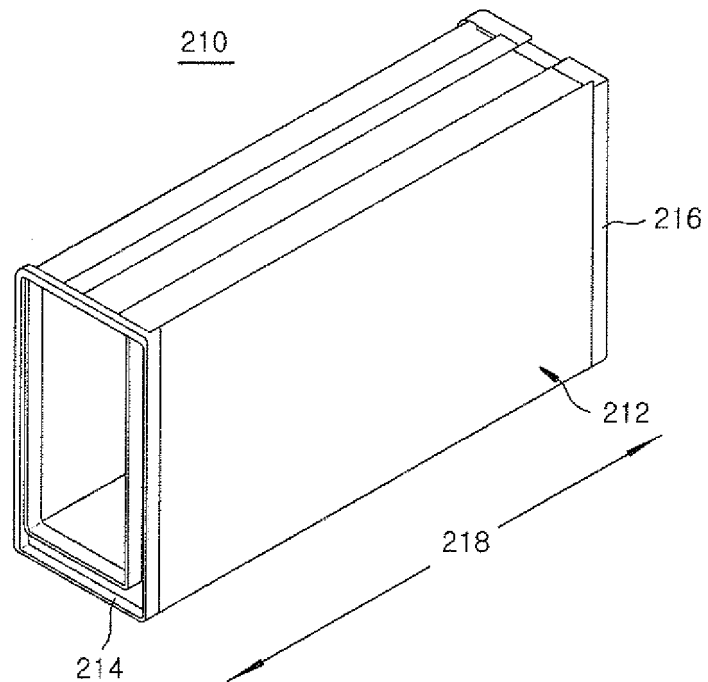


FIG. 2D

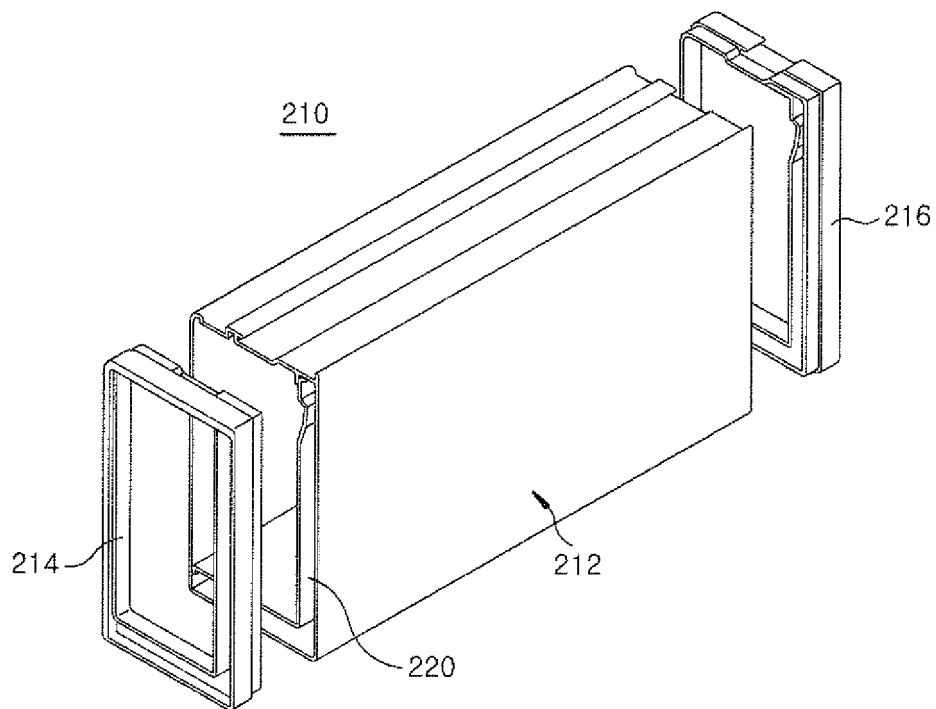


FIG. 3A

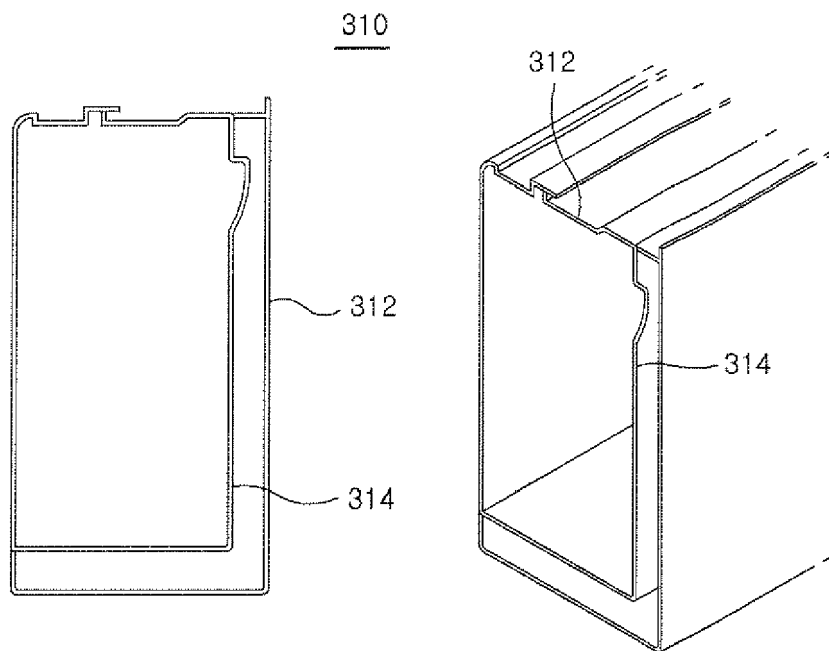


FIG. 3B

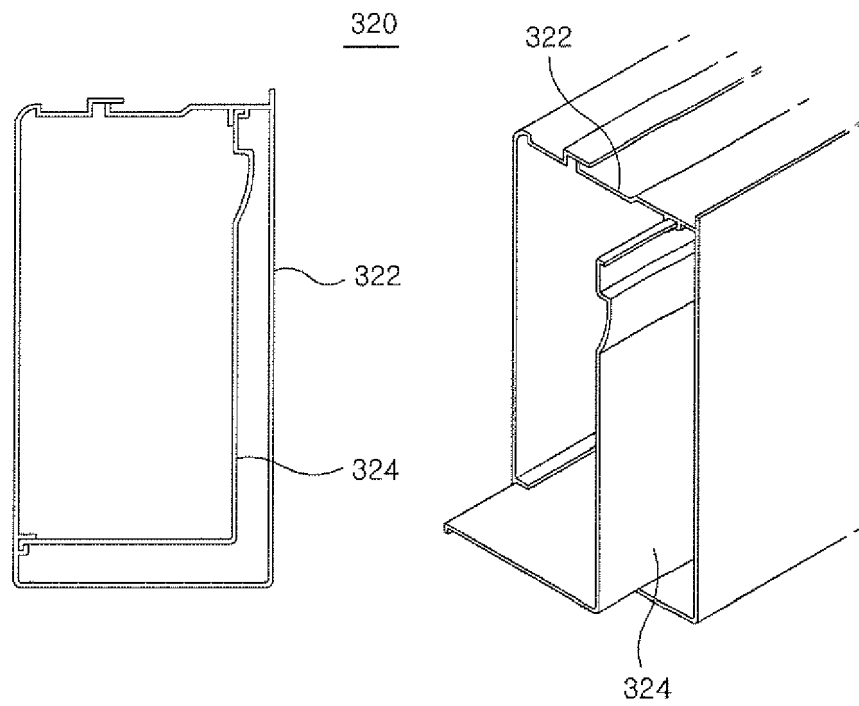


FIG. 3C

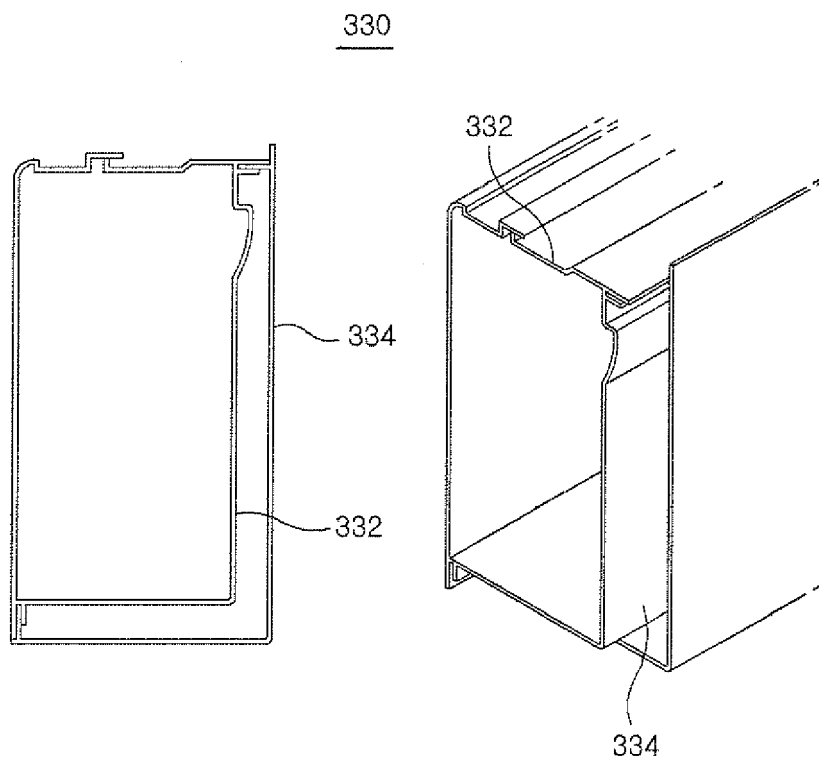
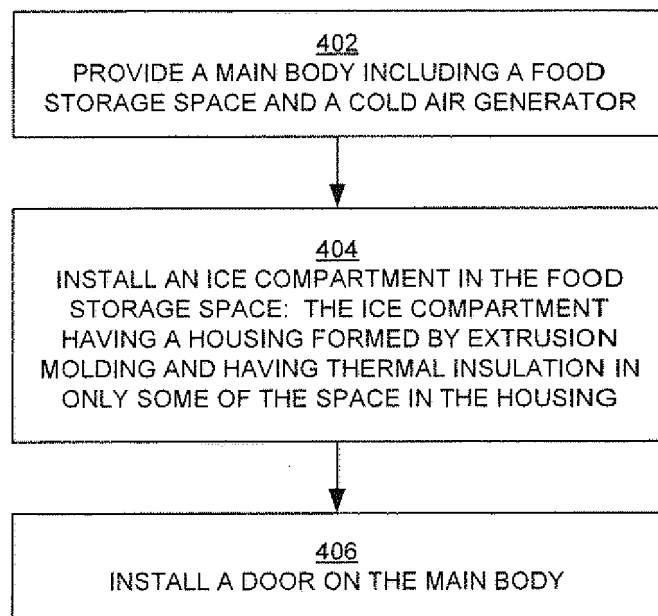


FIG. 4

400





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 Application Number
 EP 15 18 7266

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Y	* paragraphs [0061], [0062]; figures *	8-13	
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The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		13 October 2016	Vigilante, Marco
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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