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(54) Refrigerating appliance with fixed evaporator plane

(57) A refrigerating appliance or refrigeration apparatus (1) is described, being of a type comprising at least one refrigeration cell (2) being accessible through a door (3), said cell (2) comprising an evaporator tower (4), said tower (4) comprising at least one evaporator shelf (5)

being arranged in said cell (2), a holder (6) being firmly fastened to said evaporator shelf (5) on the side of the evaporator shelf (5) adjacent to said door (3); said holder (6) comprises a single rod-shaped body (7) on which protrusions (8) and/or recesses (9) are integrated adapted to secure said holder (6) to opposite walls of said cell (2).

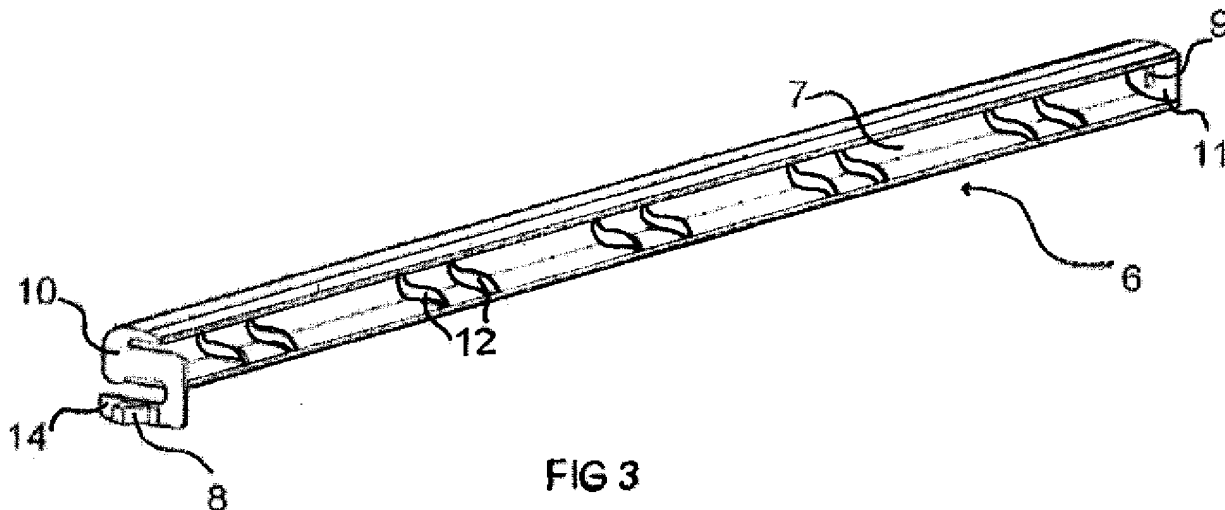


FIG 3

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Description

[0001] The present invention relates to a refrigerating appliance or refrigeration apparatus according to the preamble of claim 1.

[0002] Although not being subject to any strict limitations, the present invention is typically applied to freezers or combined refrigerators for domestic use.

[0003] Refrigeration apparatus for domestic use comprise one or more refrigeration cells being accessible through a door which allows a user to open/close the cell.

[0004] Upright refrigeration apparatus typically include support shelves within the refrigeration cell, such as e.g. metal grids and glass and/or plastic trays, allowing a user to lay down foodstuff to be kept in the refrigerator; sometimes there are also extractable drawers adapted to contain foodstuff to be kept in the refrigerator.

[0005] Chest refrigeration apparatus are typically provided with partitions within the refrigeration cell.

[0006] Such elements may be arranged horizontally or vertically within the refrigeration cell and are retained by means of guides; horizontal elements are generally supported by support ledges, such as e.g. brackets.

[0007] There have been for many years on the market refrigeration apparatus whose refrigeration cells comprise an evaporator tower including one or more planes or shelves adapted to cool the environment within the refrigeration cell.

[0008] The evaporator shelves are arranged horizontally in the refrigeration cell and may be used in place of support shelves for laying down the foodstuff; in chest apparatuses, the evaporator shelves may be arranged vertically and used as partitions for dividing the foodstuff to be preserved.

[0009] The evaporator shelves are suitably secured in such a way as to reduce their vibration during the operation of the refrigeration apparatus, thereby also reducing its noise level; fastening the evaporator shelves is also useful to prevent the evaporator tower from breaking during the transportation of the refrigeration apparatus; finally, securing the shelves is also advantageous to allow the user to lay down foodstuff on them without these undergoing structural modifications caused by the weight of the food.

[0010] Said shelves may be secured by using several techniques being known to those skilled in the art.

[0011] For instance, according to the Patent EP0534107 the evaporator shelves within the refrigeration cell are secured through two plastic holders which are plugged into the evaporator shelf and slid into side ledges supporting the evaporator shelf.

[0012] The holders are secured to the wall by shape and/or force through a pin which, being mounted on an elastic tongue, is inserted into a matching recess being present on the cell wall.

[0013] Also, according to the above-mentioned document, each holder has a pocket-like structure within which a crosspiece is secured which covers the profile

of the evaporator shelf adjacent to the door.

[0014] The above-described solution is disadvantageous in that it requires the presence of support ledges for securing the holder to the walls of the refrigeration apparatus and to the evaporator shelf; besides, it requires a crosspiece for securing the holders to the walls and therefore consists of three distinct parts which must be assembled during the manufacturing stage; such a multiplicity of parts also implies an intensive use of plastic material.

[0015] Another example of a method of securing evaporator shelves is given by the Philips freezer model AFB9709PH. Unlike the above-described solution, according to this method the holder comprises a single body consisting of a central crosspiece, which is secured to the front side of the evaporator shelf, and two side arms, which are secured through an elastic tongue to the support ledges of the evaporator shelf itself. The described holder does not require any pins, pegs and/or other mechanical means for being secured to the wall of the refrigeration cell.

[0016] It may be inferred from the above description that such a solution is quite bulky due to the fact that the side arms must necessarily have an adequate length to ensure a firm and solid fixing.

[0017] Document DE3802140 discloses an example of a small holder not employing any side arms for the fixing to the support ledges.

[0018] This document, in fact, describes a solution wherein an evaporator shelf is supported and blocked through a pair of pegs inserted into the front areas of opposite walls of the refrigeration cell. Each peg has a reception zone wherein the evaporator shelf is caught; the peg is secured to the wall through two rigid pins which are inserted into suitable recesses on the walls of the refrigeration cell.

[0019] However, this solution has the drawback of using at least two distinct and separate elements for supporting the evaporating shelf; moreover, the evaporator shelf is not supported for its whole width between the opposite walls of the refrigeration cell.

[0020] The general object of the present invention is to provide a solution for refrigeration apparatus which ensures an adequate fixing of the evaporator shelves and which is at the same time both simple and economical to implement.

[0021] A first specific object of the present invention is to limit the vibration of the evaporator shelves during the operation of the refrigeration apparatus, thereby reducing the operational noise level.

[0022] A second specific object of the present invention is to provide a robust securing of the evaporator shelves, so as to allow the user to lay foodstuff directly on the evaporator shelves.

[0023] A third specific object is to limit the risk of damage or breakage of the evaporator tower during the transportation of the refrigeration apparatus.

[0024] These objects are substantially achieved by the

refrigeration apparatus having the features described in the independent claim 1; advantageous aspects of the present invention are detailed in dependent claims.

[0025] The idea at the basis of the present invention is to use a holder consisting of single body, thereby securing the evaporator shelf to the walls of the refrigeration cell without using any support ledges or additional elements.

[0026] The teaching of the present invention allows to reduce the quantity of material required, decreases the number of components, simplifies the assembly operations and hence decreases the costs.

[0027] Further objects, features and advantages of the present invention will become apparent from the following description and from the annexed drawings, wherein:

Fig. 1 shows a schematic and simplified drawing of a refrigeration apparatus, specifically a freezer with open door, with various drawers being arranged one on top of the other for containing foodstuff to be frozen;

Fig. 2 shows a schematic and simplified drawing of two refrigeration apparatus, specifically an upright freezer and a chest freezer, with the doors open and the drawers removed in order to make clearly visible the various evaporator shelves of a single evaporator tower, the latter being visible in the upright freezer only;

Fig. 3 shows a holder according to the present invention;

Fig. 4 shows several combinations of protrusions and recesses according to the present invention;

Fig. 5 shows several cross-sections of a holder according to the present invention, displaying various techniques for securing the evaporator shelf to the holder.

[0028] Said description and said drawings are to be considered as non-limiting examples.

[0029] Fig. 1 shows a refrigeration apparatus for domestic use, indicated as a whole with reference number 1, being fitted with a door 3 for opening/closing the refrigeration apparatus 1. The refrigeration apparatus 1 shown in Fig. 1 comprises a refrigeration cell 2 comprising six drawers, each of which is indicated with reference number 15. Said drawers 15 are used by the user for keeping foodstuff to be preserved at the low temperatures reached by the refrigeration apparatus 1.

[0030] Fig. 2 shows an upright refrigeration apparatus and a chest refrigeration apparatus; by analogy with Fig. 1, said apparatus are indicated as a whole with reference number 1. In the upright apparatus of Fig. 2 there are five evaporator shelves, each of which is indicated with reference number 5, belonging to a single evaporator tower, indicated as a whole with reference number 4. In the chest apparatus of Fig. 2 there are three evaporator shelves, each of which is designated 5 by analogy with the upright apparatus. In this example, the shelves are

arranged perpendicularly to the base of the apparatus.

[0031] In Fig. 3, reference number 6 indicates as a whole a rod-shaped holder comprising a single body 7 and two ends 10 and 11; such a holder may be entirely obtained, for instance, through molding of a plastic material.

[0032] The end 10 comprises a protrusion 8, e.g. having a rectangular cross-section, being integrated with an elastic tongue 14; on the end 11, being opposite to the end 10, a recess 9 is obtained which, in the example of Fig. 3, is a slot having an elongated shape.

[0033] Fig. 4 shows by way of example some variant embodiments of the protrusions 8 and recesses 9. For instance, one may employ a different number of protrusions and recesses (e.g. one or two or three) as well as protrusions and recesses having different shapes (e.g. circular or polygonal).

[0034] In Fig. 3, the inner portion of the single body 7 of the holder 6 comprises a plurality of appropriately shaped ribs 12, e.g. made of a plastic material and obtained during the molding of the body 7.

[0035] Fig. 5 shows some examples of alternative embodiments of these ribs 12.

[0036] The technical features of the present invention are as follows.

[0037] In general, the refrigeration apparatus according to the present invention comprises at least one refrigeration cell being accessible through a door; said refrigeration cell comprising an evaporator tower; said tower comprising at least one evaporator shelf being arranged within said cell and one holder being firmly secured to the evaporator shelf on the side of the evaporator shelf adjacent to the door. The holder comprises a single rod-shaped body incorporating protrusions and/or recesses adapted to secure said holder to opposite walls of the cell.

[0038] From the example of the annexed drawings it is apparent that the door adapted to open and close the cell is mounted appropriately depending on the structure of the refrigeration apparatus. In an upright freezer, the door is mounted on the side of the freezer cabinet; when the freezer is in its vertical operational position, the door can be opened to the right or to the left in relation to the user's position, and in relation to the position of its hinges (not illustrated for simplicity's sake). In a chest freezer, instead, the door is opened upward in relation to the user's position. In both cases, when the door is closed the refrigeration cell is isolated from the external environment, so that inside the refrigeration cell the temperature set for preserving the foodstuff contained therein can be reached. The temperature setting takes place through a thermostat being present inside the refrigeration apparatus, which is adjustable by the user; for simplicity's sake, said thermostat is not shown in the illustration.

[0039] The evaporator shelves, shown by way of example in Fig. 2, are in one case parallel to the base of the refrigeration apparatus and in the other case perpendicular to the base of the refrigeration apparatus. The

evaporator shelves stay in position because they form together an evaporator tower having a rigid metal structure being typically secured to at least one wall of the refrigeration cell. For simplicity's sake, the means for securing the evaporator tower are not shown in the annexed drawings and will not be described in the following because they are known to those skilled in the art.

[0040] A refrigerant circulates within the structure of the evaporator tower, and consequently within the evaporator shelves, which typically consist of hollow structures, such as pipes. Such fluid allows to obtain a low temperature inside the refrigeration apparatus.

[0041] As said, the evaporator shelves stay in their proper position because they are typically secured to at least one wall of the cell; said shelves are also blocked by means of structures, hereafter referred to as "holders", typically made of a plastic material.

[0042] As said, such a holder comprises protrusions and recesses; the protrusions may be pins, whereas the recesses may be seats; pins and seats are adapted to be coupled together.

[0043] Said seats may advantageously have a shape adapted to house matching pins; advantageously, for instance, the shape of the seat is circular if the pin is circular, whereas the shape of the seat is square if the pin is square, so as to ensure a better coupling between the two elements thanks to the conjugated profiles of the same.

[0044] Equally advantageously, the seat may have a shape adapted to house, for instance, a number of pins which may be coupled together to the shape of the seat; by way of example, the seat may have an elongated shape into which two circular pins may be inserted, as shown in Figs. 4A and 4D.

[0045] In the light of the above description of the seats, it is apparent that the pins may have a different shape as well, e.g. they may be circular or square or elongated or tooth-shaped (triangular or trapezoidal, as shown in Fig. 3), so as to be correctly coupled to the respective seats; more complex shapes may even be used, such as a cross, a star or a hollow cylinder.

[0046] Such protrusions and recesses are preferably located at the ends of said holder and may be integrated therewith.

[0047] The holder is preferably a single body whose length is approximately equal to the distance between the opposite walls of the refrigeration apparatus to which said single body adapted to be secured through said protrusions and recesses.

[0048] Said single body of the holder is preferably adapted to house the side of the evaporator shelf adjacent to the door of the refrigeration cell.

[0049] Advantageously, the protrusions are movable.

[0050] According to a preferred embodiment example of the present invention, such movable protrusions are pins being integrated on elastic tongues, as shown by way of example in Fig. 3. In this way, the tongues obtained as appendices from the holder end ensure the necessary

mobility for inserting the pin into the respective seat. The limited surface of contact with the rest of the holder end facilitates the elastic movement of the tongue. It is clear that said elastic movement is restricted by the mechanical limits due to the properties of the material used for manufacturing the holder.

[0051] According to another example of embodiment, the movable protrusions are sliding pins being opposed by a coil spring, as shown by way of example in Fig. 4G.

[0052] Thanks to this feature, it is possible to use a holder whose length matches exactly the distance between the two parallel and opposite walls to which the holder is to be secured, in that the movable pins comprising coil springs are adapted to recede into the holder body so as to allow the holder to be included precisely within said distance. When the holder reaches its correct position, the pins are adapted to return to their extracted idle position under the action of the coil springs, in that the pins are aligned with the seats into which they must be coupled, i.e. inserted.

[0053] A substantially similar effect is obtained at lower manufacturing costs by means of pins being integrated on elastic tongues; in the example of Fig. 3, the retraction of the tongue 14, and therefore of the pin 8 being integrated therewith, is caused by the pressure exerted by the walls of the refrigeration cell (during the insertion of the holder) onto the pin, which is provided with a draft in the insertion direction.

[0054] According to another advantageous embodiment, the protrusions are fixed.

[0055] These two different typologies of protrusions, i.e. movable and fixed, when coupled to respective recesses, lead to various embodiment configurations of the present invention being equally advantageous for the purpose of securing the holder to the two opposite walls of the refrigeration apparatus. Fig. 4 schematically shows some examples of such configurations.

[0056] According to a first possible configuration, on a first end of the holder subject of the present invention there is at least one movable protrusion adapted to be coupled to at least one recess being present on the wall of the refrigeration cell adjacent to said first end, whereas on a second end, being opposite to the first end of the holder, there is at least one fixed protrusion adapted to be coupled to at least one recess being present on the wall of said cell adjacent to said second end.

[0057] According to a second possible configuration, the holder may have on each end at least one movable protrusion adapted to be coupled to at least one recess on the wall of the refrigeration cell adjacent to the end of the holder subject of the invention.

[0058] According to a third possible configuration, the holder may have on its first end at least one recess adapted to be coupled to at least one movable protrusion on the wall of the refrigeration cell adjacent to said first end of the holder, whereas on its second end, being opposite to the first end, there is at least one recess adapted to be coupled to at least one fixed protrusion on the wall of

the refrigeration cell adjacent to said second end.

[0059] According to a fourth possible configuration, the holder may have on both ends at least one recess adapted to be coupled to at least one movable protrusion on the wall of the refrigeration cell adjacent to the ends of the holder.

[0060] The different embodiments described herein are advantageous for the purposes of the present invention regardless of the configuration of the protrusions and of the seats, provided that these are located at the holder ends. Such a feature is advantageous to ensure a correct alignment of the holder, thereby allowing the holder to be properly connected to the side of the evaporator shelf.

[0061] As said, the holder may be an element comprising a single body being typically made of a plastic material and having a shape adapted to house the side of the evaporator shelf adjacent to the door of the refrigeration apparatus; the single body of Fig. 3 comprises a "U" profile adapted to house the side of the evaporator shelf; the holder body is terminated on the longer side by two ends; said ends incorporate the protrusions and/or recesses.

[0062] The holder, subject of the present invention, is secured to the evaporator shelf in order to reduce its vibration during the operation of the refrigeration apparatus and to prevent the shelf structure from being buckled under the weight of the food laid on it by the user. The achievement of these objects is in particular due to the fact that the single body of the holder comprises, within its "U" profile, means adapted to fasten said holder to the side of the evaporator shelf adjacent to the door.

[0063] The means used to secure the holder to the side of the evaporator shelf may be, for example, ribs like those shown in Fig. 3, whose shape allows the side of the evaporator shelf adjacent to the door to find an appropriate seat so that it can be secured by shape and/or force.

[0064] Further possible embodiments of the means for securing the holder to the evaporator shelf are shown schematically in Fig. 5. The illustrated examples clearly show how the side of the evaporator shelf can find its fixed housing thanks to the advantageous shape of the ribs.

[0065] In fact, the ribs may have such a profile as to cover almost completely the circumference of the pipe representing the side of the evaporator shelf adjacent to the door (Figs. 5A and 5B).

[0066] With such a configuration, the holder is secured to the side of the evaporator shelf adjacent to the door through a pressure, so that the aperture of the ribs becomes elastically deformed, thereby allowing the pipe of the shelf side to be inserted in the correct position. Thus, the holder is secured to the shelf due to the coupling between the profile of the ribs and the profile of the pipe representing the side of the evaporator shelf.

[0067] According to a further embodiment of the ribs according to the present invention, said ribs consist, for example, of protrusions obtained within the single body

of the holder and being present on the two opposite sides of the U-shaped single body, thus facing each other (Fig. 5C). When the holder is pressed onto the side of the evaporator shelf, the distance between the protrusions facing each other increases due to their elastic movement, so that the side of the evaporator shelf can be positioned correctly inside the single body of the holder.

[0068] Many other embodiments are possible which exploit the shape of the pipe representing the side of the evaporator shelf adjacent to the door. Figs. 5D, 5E and 5F show three of these alternative embodiments based on respective ribs 12D, 12E and 12F.

[0069] The ribs may be present within the single body of the holder, e.g. in a limited number, as shown in Fig. 3 displaying ten ribs, or else there may be a single rib being appropriately sized. For instance, one may conceive a single rib whose length approximately matches the length of the holder, and therefore the length of the side of the evaporator shelf, or the length of the rib may be limited to just a portion of the length of the side of the evaporator shelf.

[0070] As previously described, according to the present invention the holder may be secured to the two opposite walls of the refrigeration apparatus through protrusions and recesses being integrated on the ends of the holder itself, as is the case of the example of Fig. 3.

[0071] Besides, the protrusions being present on at least one end of the holder may advantageously be shaped in such a way as to prevent said evaporator shelf from rotating when said protrusions are coupled to respective recesses, as is the case of the example of Fig. 3.

[0072] According to an advantageous aspect of the present invention, at least two protrusions may be used at one end of the holder so as to prevent the holder from rotating when the protrusions are coupled to the same seat or to distinct seats.

[0073] The teachings of the present invention have been described herein as non-limiting examples with reference to refrigeration apparatus for domestic use, but it should be understood that such teachings may also be advantageously applicable, for example, to apparatus for industrial use.

Claims

1. Refrigeration apparatus (1) of a type comprising at least one refrigeration cell (2) being accessible through a door (3), said cell (2) comprising an evaporator tower (4), said tower (4) comprising at least one evaporator shelf (5) being arranged in said cell (2), a holder (6) being firmly secured to said evaporator shelf (5) on the side of the evaporator shelf (5) adjacent to said door (3), **characterized in that** said holder (6) comprises a single rod-shaped body (7) incorporating protrusions (8) and/or recesses (9) adapted to secure said holder (6) to opposite walls of said cell (2).

2. Refrigeration apparatus (1) according to claim 1, **characterized in that** said protrusions (8) are pins and said recesses (9) are seats, said pins and said seats being adapted to be coupled together.
3. Refrigeration apparatus (1) according to claim 1 or 2, **characterized in that** said body (7) is approximately as long as the distance between said opposite walls and is adapted to be secured to said opposite walls.
4. Refrigeration apparatus (1) according to claim 1 or 2 or 3, **characterized in that** said protrusions (8) and recesses (9) are located at the ends (10, 11) of said holder (6).
5. Refrigeration apparatus (1) according to one of the previous claims, **characterized in that** at least one of said protrusions (8) is movable.
6. Refrigeration apparatus (1) according to one of the previous claims, **characterized in that** at least one of said protrusions (8) is fixed.
7. Refrigeration apparatus (1) according to one of claims 1 to 6, **characterized in that** on a first end (10,11) of said holder (6) there is at least one movable protrusion (8) adapted to be coupled to at least one recess (9) on a wall of said refrigeration cell (2) adjacent to said first end (10, 11), and on a second end (10, 11) of said holder (6), being opposite to said first end (10, 11), there is at least one fixed protrusion (8) adapted to be coupled to at least one recess (9) on a wall of said cell (2) adjacent to said second end (10, 11).
8. Refrigeration apparatus (1) according to one of claims 1 to 6, **characterized in that** on each end (10, 11) of said holder (6) there is at least one movable protrusion (8) adapted to be coupled to at least one recess (9) on a wall of said cell (2) adjacent to said end (10, 11).
9. Refrigeration apparatus (1) according to one of claims 1 to 6, **characterized in that** on a first end (10,11) of said holder (6) there is at least one recess (9) adapted to be coupled to at least one movable protrusion (8) on a wall of said cell (2) adjacent to said first end (10, 11) of said holder (6), and on a second end (10, 11) of said holder (6), being opposite to said first end (10, 11), there is at least one recess (9) adapted to be coupled to at least one fixed protrusion (8) on a wall of said cell (2) adjacent to said second end (10, 11).
10. Refrigeration apparatus (1) according to one of claims 1 to 6, **characterized in that** on each end (10, 11) of said holder (6) there is at least one recess (9) adapted to be coupled to at least one movable protrusion (8) on a wall of said cell (2) adjacent to said ends (10, 11).
11. Refrigeration apparatus (1) according to one of the previous claims, **characterized in that** said body (7) has a shape adapted to house said side of said evaporator shelf (5).
12. Refrigeration apparatus (1) according to claim 11, **characterized in that** said body (7) comprises a "U" profile adapted to house said side of said evaporator shelf (5).
13. Refrigeration apparatus (1) according to claim 12, **characterized in that** said body (7) comprises, within said "U" profile, means (12) adapted to be secured said holder (6) to said side of said evaporator shelf (5).
14. Refrigeration apparatus (1) according to one of the previous claims, **characterized in that** at least one of said protrusions (8) is shaped in such a way as to prevent said holder (6) from rotating when said protrusion is coupled to a recess.
15. Refrigeration apparatus (1) according to one of the previous claims, **characterized in that** there are at least two protrusions (8) at one end of said holder (6), so as to prevent said holder (6) from rotating when said protrusions are coupled to the same seat or to distinct seats.
16. Refrigeration apparatus (1) according to one of claims 5 to 15, **characterized in that** said movable protrusion (8) consists of at least one pin being integrated with an elastic tongue.
17. Refrigeration apparatus (1) according to one of claims 5 to 15, **characterized in that** said movable protrusion (8) consists of at least one sliding pin being opposed by a coil spring (13).

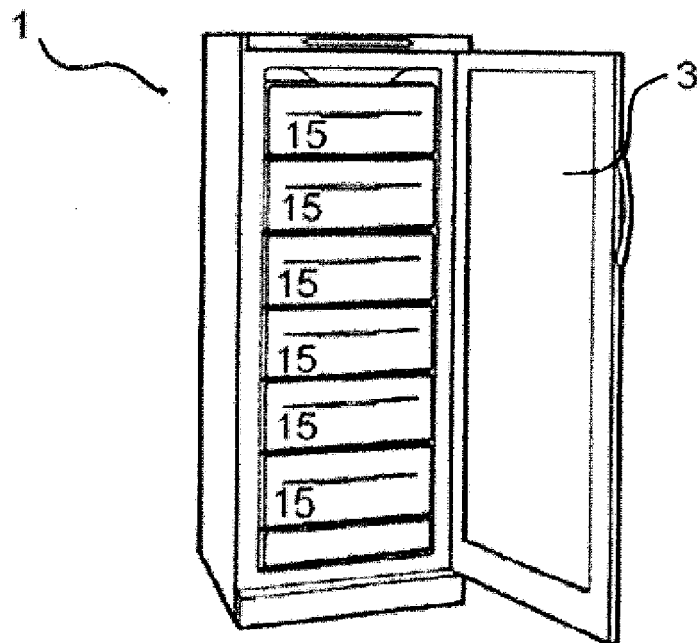


FIG. 1

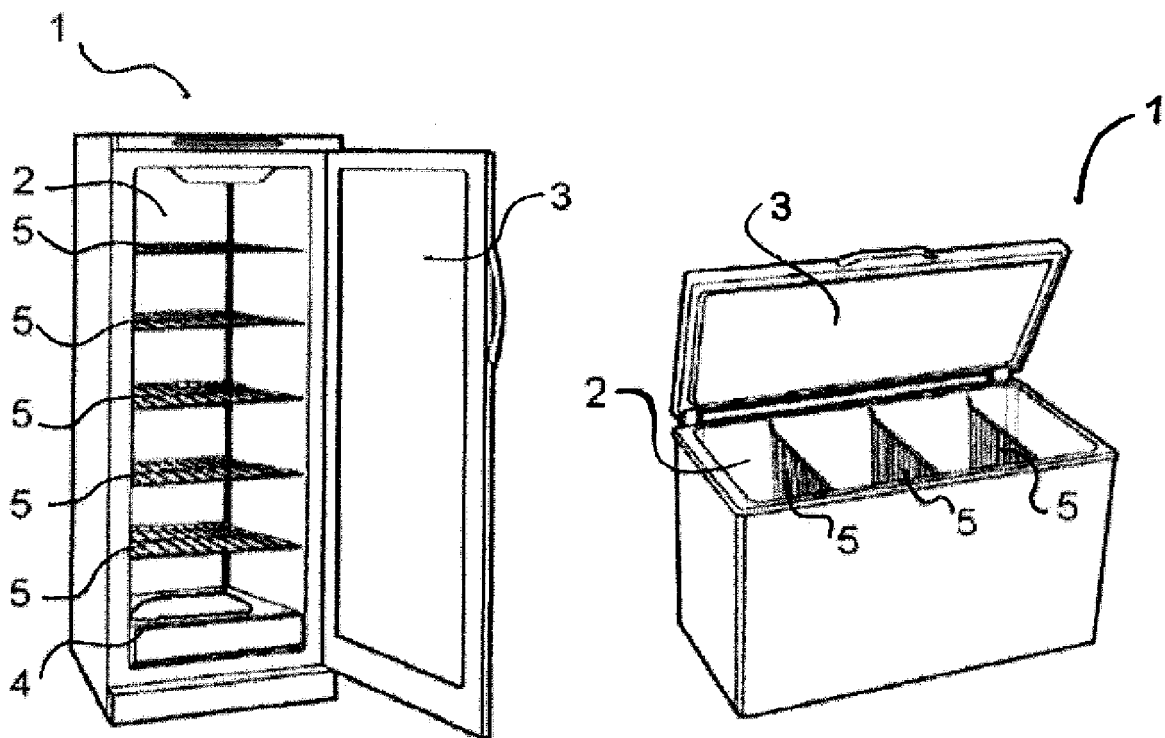
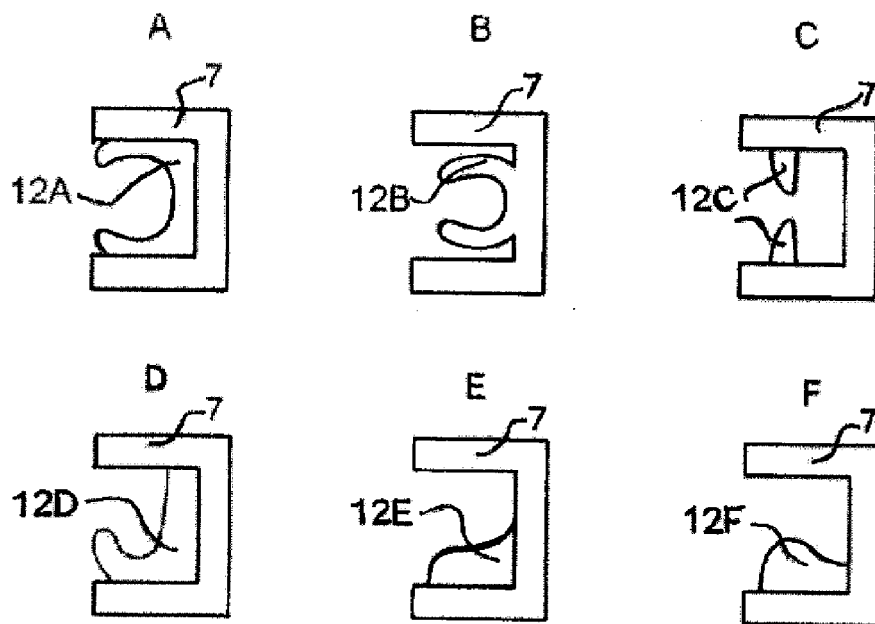
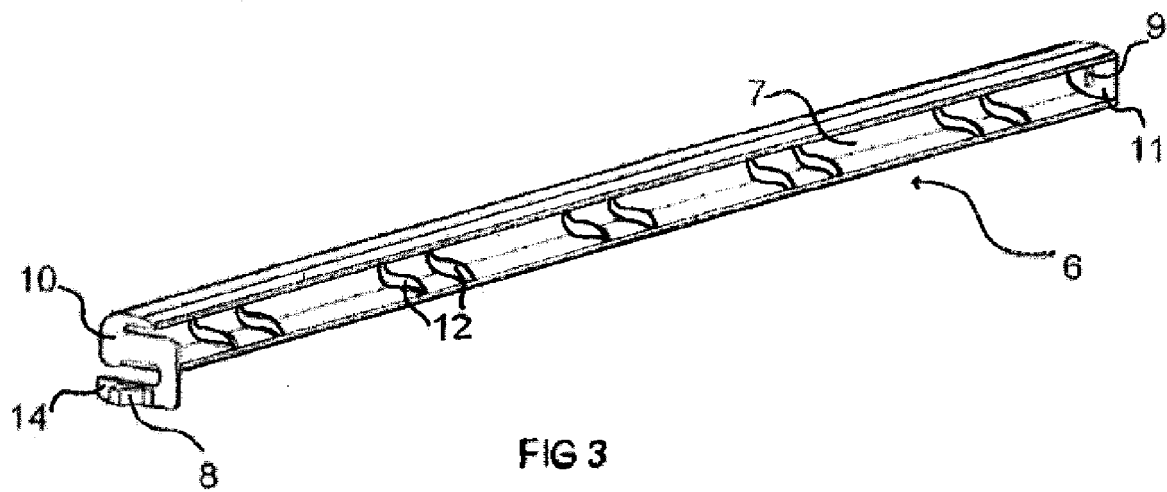


FIG. 2



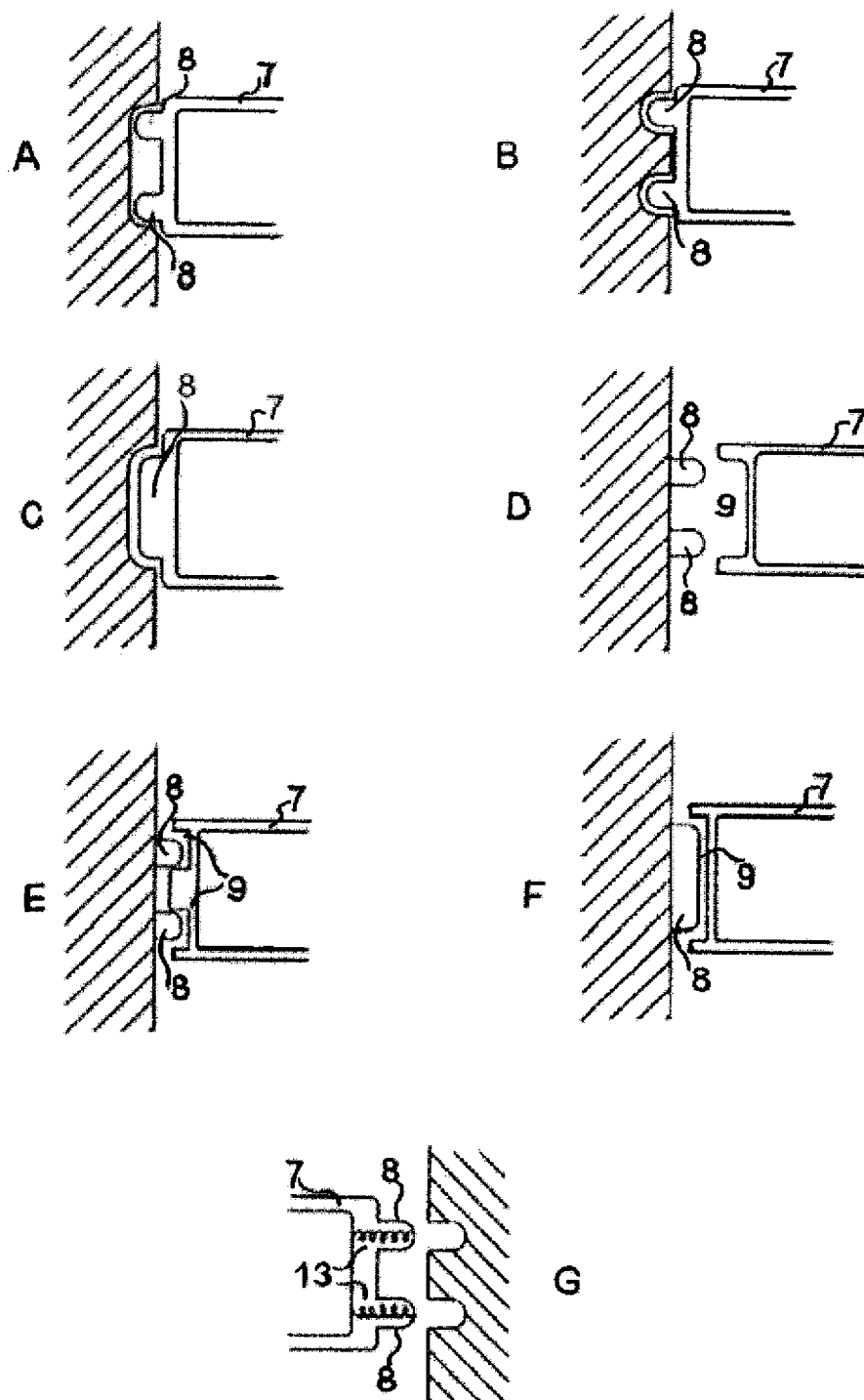


FIG. 4



DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 7 February 2006	Examiner Zanotti, L
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			

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

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