



(11) **EP 1 747 414 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention
of the grant of the patent:
20.11.2013 Bulletin 2013/47

(51) Int Cl.:
F25D 23/02 ^(2006.01) **F25D 17/04** ^(2006.01)
A23L 3/015 ^(2006.01)

(21) Application number: **05742980.5**

(86) International application number:
PCT/EP2005/052216

(22) Date of filing: **13.05.2005**

(87) International publication number:
WO 2005/114071 (01.12.2005 Gazette 2005/48)

(54) **VACUUM STORAGE COMPARTMENT CONSTRUCTION IN COOLING APPARATUS**

VAKUUMSPEICHERKAMMERKONSTRUKTION IN EINER KÜHLVORRICHTUNG

CONSTRUCTION D'UN COMPARTIMENT DE STOCKAGE PAR VIDE DANS UN APPAREIL DE
REFROIDISSEMENT

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IS IT LI LT LU MC NL PL PT RO SE SI SK TR**

(30) Priority: **13.05.2004 GB 0410718**

(43) Date of publication of application:
31.01.2007 Bulletin 2007/05

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Description

[0001] The present invention relates to cooling apparatus and has particular reference to vacuum storage compartment construction in cooling apparatus.

[0002] It has been proposed, e.g. in WO 01/81842 A1 and in US 5 271 240 A, to include in cooling apparatus, particularly domestic refrigerators, freezers and refrigerator/freezer combinations, vacuum storage compartments for storage of foodstuffs in a vacuum environment. Such an environment offers the possibility of retarding deterioration of the stored products by, amongst other factors, reducing aerobic bacterial growth and photosynthesis. Compartments of that kind should preferably be evacuated automatically when products are placed in storage and returned to atmospheric pressure to allow removal of products via a closable access opening of the compartment. Accordingly, the compartments should be simple to evacuate and repressurise, capable of withstanding subatmospheric pressure levels in the order of 200 millibars absolute for lengthy periods of time and with repeated cycling, and relatively easy to keep hygienic and to clean. The requirement of sustained maintenance of an internal underpressure should be met in part by a minimum number of potential points of leakage. In wider terms, such compartments should be simple and economic to produce, light in weight and, if possible, capable of universal use in cooling apparatus of different designs, specifically a compartment construction usable without modification or significant modification in different apparatus configurations.

[0003] US 5271240 A discloses a cooling apparatus with an evacuable storage compartment according to the preamble of claim 1.

[0004] In US 5 271 240 A, the vacuum storage compartment is rectangular in cross section, with flat side walls, top and bottom walls. These flat walls must be thick in order to withstand atmospheric pressure at the outside, making the apparatus expensive.

[0005] WO 01/81842 A1 proposes a cooling apparatus in which an evacuable storage compartment is defined by a cylindrical container having a back wall and a tubular wall extending between said back wall and an access opening. The tubular wall is highly resistant against outside pressure, but the circular cross section of the compartment is inconvenient for storing goods inside.

[0006] The principal object of the Invention is therefore to provide cooling apparatus having a storage compartment which may be capable of universal use and which is of robust yet simple construction to withstand differential pressure without undue susceptibility to leakage.

[0007] Subsidiary objects of the invention include low-cost construction with a relatively small number of parts so as to facilitate mass production and assembly. Further objects and advantages are evident from the following description.

[0008] According to the present invention there is provided cooling apparatus provided with an evacuable

storage compartment defined by a separately constructed box unit comprising an integral structure, which forms two side walls, a top wall, a bottom wall and a back wall of the unit and bounds a front access opening, and an openable door sealably closing the access opening, wherein at least one of the walls includes at least one integral stiffening rib.

[0009] The stiffening rib promotes resistance of the wall to deformation under differential pressure loading.

[0010] A storage compartment in the form of a separately constructed box unit represents a self-contained module with a capability of use in different types or variations of cooling apparatus, including refrigerators, freezers and refrigerator/freezer combinations. This is of particular advantage in the case of product ranges containing models which may have different sizes and fits of internal equipment, but the same fundamental features, such as refrigerating, freezing and vacuum storage compartments. The unit may then be able to be used with little or no modification in all products within the range, which represents a significant advantage with respect to manufacturing cost. This advantage is combined with the intrinsically strong and robust compartment construction achieved by an integral structure forming all of the walls of the box unit. This one-piece design eliminates all potential points of leakage otherwise present at wall junctions and provides a substantial reduction in the number of parts necessary for making up the unit, which is of benefit for low-cost manufacture and assembly. The integral structure can, at the time of production, be readily provided with integrated features associated with mounting of the door and supply of air to and extraction of air from the compartment.

[0011] The capability of the box unit to resist the load induced by evacuation of the interior and by maintenance of an appropriate level of underpressure may be enhanced by each of the side, top and bottom walls, formed by the integral structure being curved so as to be convex at the outside of the unit. The structure then has a construction, at least in part, simulating a pressure vessel with walls bowed outwardly to prevent collapse or buckling due to underpressure at the concave faces. The strength of the structure may be further increased if one or more of the junctions of the walls is radiussed so as to eliminate abrupt transitions; this feature also assists maintenance of hygiene by reducing food traps and eases the task of cleaning.

[0012] The door can be mounted on the integral structure in any desired manner, but, in one particularly advantageous embodiment, mounting is on a drawer movable in the unit, for example slidable on guides formed on inner surfaces of the side walls. Opening of the door thus permits convenient removal of products deposited in the drawer. The guides, for example in the form of runners, can be integral parts of the side walls.

[0013] The unit preferably comprises sealing means for sealing the door relative to a surround which is formed by the integral structure and encircles the access open-

ing. The sealing means can, for example, be incorporated in a recess which is provided in the surround and in which the door engages when closing the access opening.

[0014] The door itself can be transparent at least in part, for example made partly or entirely of glass, to permit inspection of the contents of the compartment. The integral structure, however, is preferably a plastics material moulding, which can be readily produced by cooperating male and female moulds of simple form without undercuts or movable parts.

[0015] An additional feature of the unit can be connections provided in the back wall of the structure for the supply of air to and removal of air from the compartment. The connections can consist of, for example, pipe or hose coupling elements mounted in apertures in the back wall or formed integrally with that wall.

[0016] An embodiment of the present invention will now be more particularly described by way of example with reference to the accompanying drawings, in which:

[0017] Fig. 1 is a schematic sectional side view of a refrigerator incorporating a vacuum storage compartment, in an embodiment of the invention; and

[0018] Fig. 2 is an exploded schematic perspective view, to enlarged scale, of a box unit defining the storage compartment.

[0019] Referring now to the drawings there is shown in Fig. 1, in highly schematic form, a refrigerator 10 comprising a thermally insulating housing 11 enclosing a cooled storage space 12 for storage of items at atmospheric pressure. The space 12 is closed by a door 13. The housing 11 additionally contains a vacuum storage compartment 14 accessible at the housing exterior by way of a door 15. The compartment 14 is defined by a separately constructed, i.e. entirely self-contained, box unit 16 which is mounted in the housing 11 and is described in more detail further below, the unit being closed by a respective door. Located below the compartment 14 is a space 17 accommodating conventional components of an evaporating and condensing circuit of the refrigerator as well as a vacuum pump and associated ducts and control elements for the vacuum storage compartment 14.

[0020] Fig. 2 shows the box unit 16, which defines the storage compartment 14, separately and to enlarged scale. In addition, the unit is shown in exploded illustration to assist understanding of the unit construction. The basic component of the unit is an integral structure 18 which consists of a one-piece moulded part of plastics material and which forms two mutually opposite side walls 19, a top wall 20, a bottom wall 21, a back wall 22 and a front surround 23 encircling an aperture 24 which serves as an access opening to the interior of the unit 16. Each of the side walls 19, top wall 20 and bottom wall 21, as well as optionally the back wall 22, is curved so as to be convex at its outer face and thereby impart to the unit increased resistance to collapse or deformation under load, in particular an internal underpressure. In addition, one or more of the walls incorporates an integral stiffening

rib 25 or rib pattern - shown by way of example at the top wall 20 - to further increase resistance to distortion under load. The junctions of the various walls are radiussed so as to optimise the strength of the structure 18 by removing bend locations. Radiussed junctions at the inside of the unit also assist cleaning and eliminate traps for food residues.

[0021] The box unit 16 is completed by the afore-mentioned respective door, which is referenced 26 and which closes the aperture 24. When closed, the door 26 nests in a recess 27 in the surround 23 and sealingly co-operates with a resilient seal 28 mounted in the recess, so that the interior of the storage compartment is then hermetically sealed from the atmospheric pressure otherwise prevailing within the refrigerator housing 11. The door 26 can comprise a panel of transparent material, for example glass, to afford the user a view of items stored in the compartment 14. The door 26 is carried by a drawer 29 which is guided on runners 30 integrally formed at the inner surfaces of the two side walls 19 of the unit 16. On opening of the door 26, for example by means of a hand-grip (not shown), the drawer 29 slides out to provide easy access to products stored in the compartment.

[0022] The back wall 22 of the integral structure 18 includes two connections 31 for vacuum pipes, hoses or other conduits for extraction of air from the compartment in an evacuation phase, as well as maintenance of an evacuated state in a storage phase, and feed of air to the compartment to restore atmospheric pressure so that the door can be opened for removal and insertion of products.

[0023] Use of the vacuum storage compartment 14 in operation of the refrigerator 10 is self-evident from the foregoing description. Access to the compartment is gained by opening the external door 15 after which, and following pressurisation of the compartment, the internal door 26 can be opened. After closure of the door 26, the compartment can be evacuated again. Pressurisation and evacuation can be carried out automatically by detectors responsive to operation of the door 26 and/or door 15 and to the pressure level. The detectors can be, for example, mechanical switches and pressure switches. Manually actuated switches can also be provided for control exclusively by a user and/or for overriding automatic operation.

[0024] The refrigerator of the embodiment hereinbefore described incorporates a vacuum storage compartment of a construction that readily withstands the level of underpressure encountered in use and, subject to maintenance of effective door sealing, offers effective and long-term vacuum tightness. The basic part of the box unit 16, i.e. the integral structure 18, is inexpensive and simple to make, thus compatible with large-scale production, and can be easily provided with integrated features, such as the drawer runners and duct couplings, in the moulding phase. The compartment constitutes a self-contained module of a kind potentially capable of universal use for different models of refrigerator without requir-

ing modification. In the event of modification, however, this may be able to be achieved by redesign and replacement of a single mould tool.

Claims

1. Cooling apparatus provided with an evacuable storage compartment defined by a separately constructed box unit comprising an integral structure, which forms two side walls, a top wall, a bottom wall and a back wall of the unit and bounds a front access opening, and an openable door sealably closing the access opening, **characterised in that** at least one of the walls includes at least one integral stiffening rib.
2. Apparatus as claimed in claim 1, wherein at least one of the walls is curved so as to be convex at the outside of the unit.
3. Apparatus as claimed in claim 2, wherein the side, top and bottom walls are each curved so as to be convex at the outside of the unit.
4. Apparatus as claimed in any one of the preceding claims, wherein at least one of the junctions of the walls is radiussed.
5. Apparatus as claimed in any one of the preceding claims, wherein the door is mounted on a drawer movable in the unit.
6. Apparatus as claimed in claim 5, wherein the drawer is slidable on guides formed on inner surfaces of the side walls.
7. Apparatus as claimed in any one of the preceding claims, wherein the unit comprises sealing means for sealing the door relative to a surround which is formed by the integral structure and encircles the access opening.
8. Apparatus as claimed in claim 7, wherein the door when closed engages in a recess in the surround.
9. Apparatus as claimed in any one of the preceding claims, wherein the door is transparent at least in part.
10. Apparatus as claimed in any one of the preceding claims, wherein the integral structure comprises a plastics material moulding.
11. Apparatus as claimed in any one of the preceding claims, wherein the back wall of the structure is provided with connections for the supply of air to and removal of air from the compartment.

12. Apparatus as claimed in any one of the preceding claims, wherein the apparatus is a refrigerator, a freezer or a refrigerator/freezer.

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Patentansprüche

1. Kühlvorrichtung, welche mit einer evakuierbaren Speicherkammer versehen ist, die durch eine separat ausgebildete Kasteneinheit definiert ist, die eine einstückige Struktur, welche zwei Seitenwände, eine Deckenwand, eine Bodenwand und eine Rückwand der Einheit bildet und eine vordere Zugangsöffnung begrenzt, und eine öffnbare Tür, welche die Zugangsöffnung dicht verschließt, umfasst, **dadurch gekennzeichnet, dass** mindestens eine der Wände mindestens eine angeformte Versteifungsrippe aufweist.
2. Vorrichtung nach Anspruch 1, wobei mindestens eine der Wände gekrümmt ist, sodass sie an der Außenseite der Einheit konvex ist.
3. Vorrichtung nach Anspruch 2, wobei die Seitenwände, die Decken- und die Bodenwand jeweils gekrümmt sind, sodass sie an der Außenseite der Einheit konvex sind.
4. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei mindestens eine der Verbindungsstellen der Wände abgerundet ist.
5. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei die Tür auf einem Einschub angebracht ist, der in der Einheit beweglich ist.
6. Vorrichtung nach Anspruch 5, wobei der Einschub auf Führungen gleiten kann, die an Innenflächen der Seitenwände ausgebildet sind.
7. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei die Einheit Dichtmittel zum Abdichten der Tür bezüglich einer Einfassung umfasst, welche von der einstückigen Struktur gebildet wird und die Zugangsöffnung umrandet.
8. Vorrichtung nach Anspruch 7, wobei die Tür, wenn sie geschlossen ist, in eine Vertiefung in der Einfassung eingreift.
9. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei die Tür wenigstens teilweise durchsichtig ist.
10. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei die einstückige Struktur ein Kunststoffformteil umfasst.

11. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei die Rückwand der Struktur mit Anschlüssen für die Zuführung von Luft und die Abführung von Luft in die bzw. aus der Kammer versehen ist.
12. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei die Vorrichtung ein Kühlschrank, ein Gefrierschrank oder ein Kühlgefriergerät ist.

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Revendications

1. Appareil de refroidissement prévu avec un compartiment de stockage évacuable défini par une unité de boîte construite séparément comprenant une structure intégrée, qui forme deux parois latérales, une paroi supérieure, une paroi inférieure et une paroi arrière de l'unité et relie une ouverture d'accès frontale, et une porte ouvrable fermant de manière étanche l'ouverture d'accès, **caractérisé en ce qu'**au moins une des parois inclut au moins une nervure raidisseuse intégrée.
2. Appareil selon la revendication 1, dans lequel au moins une des parois est incurvée de façon à être convexe à l'extérieur de l'unité.
3. Appareil selon la revendication 2, dans lequel les parois latérales, supérieure et inférieure sont chacune incurvées de façon à être convexes à l'extérieur de l'unité.
4. Appareil selon l'une quelconque des revendications précédentes, dans lequel au moins une des jonctions des parois est arrondie.
5. Appareil selon l'une quelconque des revendications précédentes, dans lequel la porte est montée sur un tiroir mobile dans l'unité.
6. Appareil selon la revendication 5, dans lequel le tiroir est coulissant sur des guides formés sur des surfaces intérieures des parois latérales.
7. Appareil selon l'une quelconque des revendications précédentes, dans lequel l'unité comprend un moyen d'étanchéité pour fermer la porte de façon étanche par rapport à un environnement qui est formé par la structure intégrée et encercle l'ouverture d'accès.
8. Appareil selon la revendication 7, dans lequel la porte, lorsqu'elle est fermée, s'engage dans un renfoncement dans l'environnement.
9. Appareil selon l'une quelconque des revendications précédentes, dans lequel la porte est transparente

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au moins en partie.

10. Appareil selon l'une quelconque des revendications précédentes, dans lequel la structure intégrée comprend un moulage de matériau plastique.

11. Appareil selon l'une quelconque des revendications précédentes, dans lequel la paroi arrière de la structure est prévue avec des connexions pour l'arrivée d'air dans le et la sortie d'air du compartiment.

12. Appareil selon l'une quelconque des revendications précédentes, dans lequel l'appareil est un réfrigérateur, un congélateur ou un réfrigérateur/congélateur.

[Fig.]

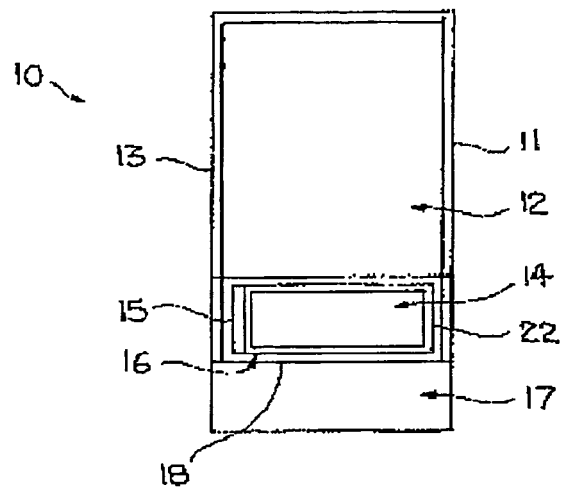


FIG. 1

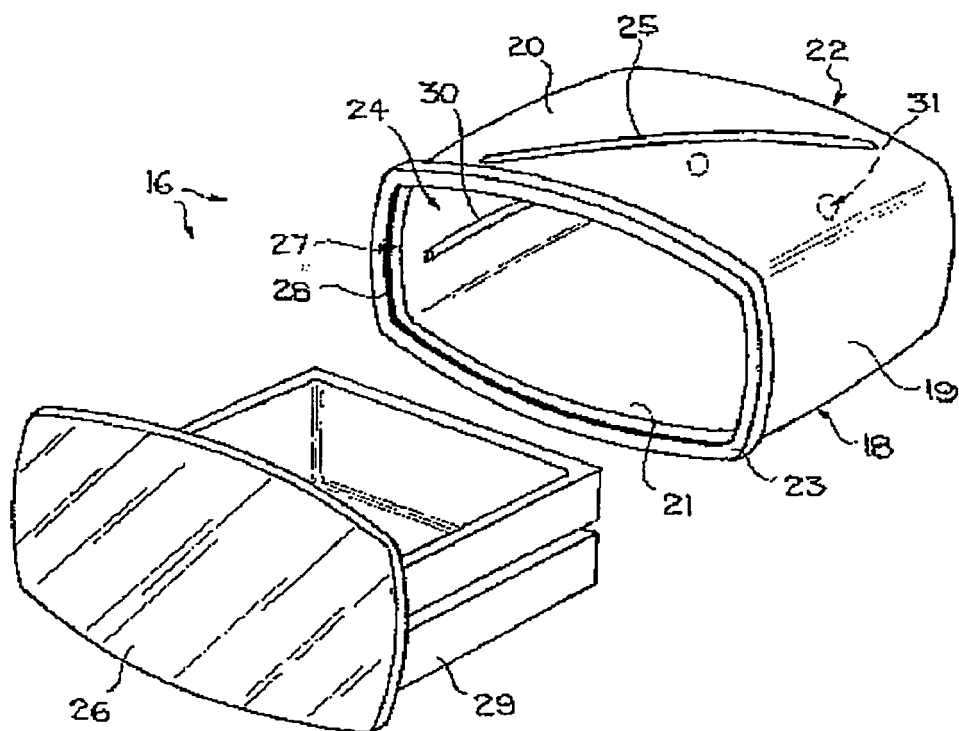


FIG. 2

REFERENCES CITED IN THE DESCRIPTION

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