

(19)



(11)

EP 1 756 491 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:

12.10.2016 Bulletin 2016/41

(51) Int Cl.:

F25D 17/04 ^(2006.01)

(86) International application number:

PCT/EP2005/052215

(21) Application number: **05752783.0**

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

(87) International publication number:

WO 2005/114070 (01.12.2005 Gazette 2005/48)

(54) VACUUM STORAGE COMPARTMENT CONSTRUCTION IN COOLING APPARATUS

EVAKUIERBARE LAGERFACHKONSTRUKTION IN KÜHLVORRICHTUNGEN

CONSTRUCTION D'UN COMPARTIMENT DE STOCKAGE SOUS VIDE DANS UN DISPOSITIF
SOUS VIDE

(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 0410717**

(43) Date of publication of application:

28.02.2007 Bulletin 2007/09

(73) Proprietor: **BSH Hausgeräte GmbH**

81739 München (DE)

(72) Inventors:

- **NAYLOR, Simon James**
Cambridge Cambridgeshire CB1 7SF (GB)

- **SHIRGAONKAR, Sameer**

London SW12 9NW (GB)

- **NEAVE, James Beeching**

SE10 8JT LONDON (GB)

- **MIDDLETON, Max William**

E11 2RG LONDON (GB)

(56) References cited:

WO-A-90/13779

DE-A1- 3 618 802

DE-A1- 19 931 920

NL-C2- 1 018 805

US-A- 2 116 813

US-A- 2 894 845

US-A- 6 090 422

US-A- 6 148 875

US-A1- 2003 151 339

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

EP 1 756 491 B1

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 US 2 116 813A to include in cooling apparatus, particularly in a domestic refrigerator, 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. US 6 148 875 teaches that compartments of that kind should 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. In wider terms, such compartments should be efficient in their utilisation of the internal space of the cooling apparatus so that the storage volume in the adjoining primary storage space at atmospheric pressure is not unduly compromised. Efficiency of space utilisation also applies to the compartment interior, which should not be reduced under the load caused by underpressure, in particular by inward deflection of boundary walls. Structural rigidity of the compartment is thus of substantial importance.

[0003] DE 199 31 920 A1 discloses a refrigerator with a vacuum storage compartment which is at least partly transparent so as to allow monitoring of the state of stored products and a visual check or reminder of the particular products in storage. Such a facility would be particularly desirable in conjunction with a design suitable for universal use in cooling apparatus, specifically a compartment construction usable without modification or significant modification in different apparatus configurations.

[0004] The principal object of the present invention is to provide cooling apparatus having a storage compartment which permits inspection of stored contents without requiring opening the compartment and consequent disruption of the internal vacuum while making efficient use of the internal space of the cooling apparatus.

[0005] Subsidiary objects of the invention include ease of cleaning and a space-saving construction. Further objects and advantages are evident from the following description.

[0006] According to the present invention there is provided cooling apparatus as defined in claim 1

[0007] 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 con-

taining 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 a manufacturing cost. This advantage is combined with the facility of external inspection of the contents of the compartment via the transparent member, or transparent members if more than one wall is so formed. Inclusion of a transparent member implies a fabricated construction of the unit, which could give rise to the possibility of reduced structural resistance to the internal underpressure of the compartment; this possibility is eliminated by support of the member by the integrally constructed structure, which provides further walls of the compartment and may have, for example, an inherently strong, partly box-shaped form. Thus, the box unit can be made up of just the integral structure, the transparent member and the door. This allows construction of the unit from a minimum of components so as to minimise points of potential vacuum degradation due to leakage. The reduced number of components of the compartment also favours economy of manufacture.

[0008] The transparent member can form the entire top wall or merely part of the top wall, for example a filler element in a frame. The box unit preferably has a second such wall similarly formed at least in part by a transparent member and supported by the structure, this second wall being disposed opposite the first-mentioned wall, thus a bottom wall of the unit. It is desirable for the or each such transparent member to be hermetically sealed to the structure to ensure vacuum tightness of the compartment.

[0009] The door can also be formed at least in part by a transparent member, which either represents the entire door or, preferably, a filler element in frame. The or each such transparent member can comprise a glass panel, preferably of toughened glass. Glass panels have a high degree of rigidity and thus readily resist the loads imposed by vacuum. They are also inexpensive to produce, but less easy to integrate into a construction unless, as provided by the present invention, supported by an integral structure forming a number of further walls of the unit.

[0010] The door is preferably mounted on a movable drawer, which can be slidable on guides formed on the structure, for example runners integrally formed on inner surfaces of mutually opposite side walls of the unit. Either the front wall or the door, or both, can have sealing means for sealing the access opening when the door is closed.

[0011] Each wall of the box unit is preferably substantially planar so as to impart to the unit a compact form compatible with the usually confined interior space of cooling apparatus. The overall cuboid shape that results is readily capable of incorporation into housings of different types of cooling apparatus, such housings generally having a cuboid internal and external form.

[0012] The integral structure preferably comprises a

plastics material moulding, which is compatible with inexpensive mass production and consistent with production techniques in the construction of a cooling apparatus, for example refrigerators. Such a moulding can be double-skinned at least in part and can include internal reinforcing, for example bracing ribs between the skins.

[0013] An additional feature of the unit can be connections at a rear side thereof for 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 a rear wall of the structure or formed as integral parts of that wall.

[0014] An embodiment of the present invention will now be more particularly described by way of example with reference to the accompanying drawings, in which: **[016]** Fig. 1 is a schematic sectional side view of a refrigerator incorporating a vacuum storage compartment, in an embodiment of the invention; and **[017]** Fig. 2 is an exploded schematic perspective view, to enlarged scale, of a box unit defining the storage compartment.

[0015] 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 described in more detail further below and which is mounted in the housing, 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.

[0016] 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, for example, an internally reinforced, double-skinned moulded part of plastics material forming a rear wall 19, two mutually opposite side walls 20 and a front wall 21. The structure 18 can thus have a high level of inherent stiffness, yet be light in weight and economic to produce, and can be designed to take into account hygiene, for example by provision of radiussings to eliminate traps for contaminants and food residues.

[0017] The front wall 21 has an aperture 22 which serves as an access opening to the interior of the unit 16. The access opening is closed by a door 23 which incorporates a glass pane 24 approximately coincident in its perimeter with the boundary of the aperture 22. The door 23 is carried by a drawer 25 guided on runners 26 integrally formed at the inner surfaces of the two opposite side walls 20 of the unit 16. On opening of door 23, for

example by means of a handgrip (not shown), the drawer 25 slides out to provide easy access to products stored in the compartment. Sealing of the door 23 relative to the front wall 21 of the unit 16 and thus hermetic separation of the evacuated environment of the vacuum storage compartment 14 from the atmospheric pressure which otherwise prevails within the refrigerator housing 11 is provided by a resilient seal 27 encircling the aperture 22 in the front wall 21. The seal can also be mounted on the door.

[0018] The box unit 16 is completed by a top wall 28 and bottom wall 29, each of which consists of a panel of toughened glass hermetically sealed to the structure 18. The two glass panels, which are intrinsically very rigid and thus highly resistant to flexure when loaded by vacuum, impart additional stiffness to the unit. The panels can be secured by any appropriate means, including adhesive and/or a mechanical fastening system. Inspection of items stored in the compartment 14 is readily possible via at least the top panel, as well as by way of the glass pane 24 in the door 23. The top panel can, in addition, be used as a bottom shelf of the atmospheric pressure storage space 12.

[0019] The rear wall 19 of the integral structure 18 includes two connections 30 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 items.

[0020] 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 23 can be opened. After closure of the door 23 the compartment can be evacuated again. Pressurisation and evacuation can be carried out automatically by detectors responsive to operation of the door 23 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.

[0021] 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 allows inspection of stored contents via glazing which does not compromise compartment strength. The compartment constitutes a self-contained module of a kind potentially capable of universal use for different models of refrigerator without modification, universality being promoted by the flat-sided construction of the box unit. The compartment is, in addition, a relatively low-cost item suitable for both medium-scale and mass production.

Claims

1. Cooling apparatus provided with an atmospheric pressure storage space (12) and an evacuable storage compartment (14) defined by, and **characterized by**, a separately constructed box unit (16) having at least one wall (28) formed at least in part by a transparent member for compartment (14) inspection of items in the evacuable storage, wherein the at least one wall is a top wall (28) of the unit and is used as a bottom shelf of the atmospheric pressure storage space (12), an openable door (23) sealably closing an access opening of the compartment and a plurality of further walls formed by an integrally constructed structure (18) supporting the transparent member, said plurality of further walls comprising a front wall (21) with an aperture (22) defining the access opening, a back wall (19) and two mutually opposite side walls (20) of the unit.
2. Apparatus as claimed in claim 1, wherein the unit has a second wall (29) formed at least in part by a transparent member also supported by the structure (18), the second wall being disposed opposite the first-mentioned wall (28) so formed.
3. Apparatus as claimed in any one of the preceding claims, wherein the or each transparent member is hermetically sealed to the structure (18).
4. Apparatus as claimed in any one of the preceding claims, wherein the door (23) is formed at least in part by a transparent member (24).
5. Apparatus as claimed in any one of the preceding claims, wherein the or each transparent member comprises a glass panel.
6. Apparatus as claimed in claim 5, wherein the panel is of toughened glass.
7. Apparatus as claimed in any one of the preceding claims, wherein the door (23) is mounted on a movable drawer (25).
8. Apparatus as claimed in claim 7, wherein the drawer (25) is slidable on guides (26) formed on inner surfaces of walls (20) of the structure (18).
9. Apparatus as claimed in any one of claims 7 to 8, wherein at least one of the front wall (21) and the door (23) has sealing means (27) for sealing the access opening when the door (23) is closed.
10. Apparatus as claimed in any one of the preceding claims, wherein each wall (19, 20, 21, 28, 29) of the unit (16) is substantially planar.

11. Apparatus as claimed in any one of the preceding claims, wherein the structure (18) comprises a plastics material moulding.

12. Apparatus as claimed in claim 11, wherein the moulding at least in part is double-skinned with internal reinforcing.

13. Apparatus as claimed in any one of the preceding claims, wherein the unit (16) is provided at a rear side (19) thereof with connections (30) for supply of air to and removal of air from the compartment.

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

Patentansprüche

1. Kühlvorrichtung, die versehen ist mit einem unter atmosphärischem Druck stehenden Lagerraum (12) und einem evakuierbaren Lagerfach (14), definiert durch und **gekennzeichnet durch** eine separat konstruierte Kasteneinheit (16) mit wenigstens einer Wand (28), die wenigstens teilweise von einem durchsichtigen Element zur Sichtprüfung von Artikeln in dem evakuierbaren Lagerfach (14) gebildet wird, wobei die wenigstens eine Wand eine obere Wand (28) der Einheit ist und als ein unteres Regalbrett des unter atmosphärischem Druck stehenden Lagerraums (12) verwendet wird, einer zu öffnenden Tür (23), die eine Zugangsöffnung des Faches dichtend schließt, und mehreren weiteren Wänden, die von einer einstückig aufgebauten Struktur (18) gebildet werden, die das durchsichtige Element stützt, wobei diese mehreren weiteren Wände eine Vorderwand (21) mit einem die Zugangsöffnung definierenden Durchbruch (22), eine Rückwand (19) und zwei einander gegenüberliegende Seitenwände (20) der Einheit umfassen.

2. Vorrichtung nach Anspruch 1, wobei die Einheit eine zweite Wand (29) aufweist, die wenigstens teilweise von einem durchsichtigen Element gebildet wird, das ebenfalls von der Struktur (18) gestützt wird, wobei die zweite Wand gegenüber der genannten ersten so ausgebildeten Wand (28) angeordnet ist.

3. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei das oder jedes durchsichtige Element gegenüber der Struktur (18) hermetisch abgedichtet ist.

4. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei die Tür (23) wenigstens teilweise von einem durchsichtigen Element (24) gebildet wird.

5. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei das oder jedes durchsichtige Element eine Glasplatte umfasst.
6. Vorrichtung nach Anspruch 5, wobei die Platte aus vorgespanntem Glas besteht. 5
7. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei die Tür (23) an einer beweglichen Schublade (25) angebracht ist. 10
8. Vorrichtung nach Anspruch 7, wobei die Schublade (25) auf Führungen (26) gleiten kann, die an Innenflächen der Wände (20) der Struktur (18) ausgebildet sind. 15
9. Vorrichtung nach einem der Ansprüche 7 bis 8, wobei die Vorderwand (21) und/oder die Tür (23) Dichtmittel (27) zum Abdichten der Zugangsöffnung aufweist, wenn die Tür (23) geschlossen ist. 20
10. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei jede Wand (19, 20, 21, 28, 29) der Einheit (16) im Wesentlichen eben ist. 25
11. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei die Struktur (18) ein Kunststoffformteil umfasst.
12. Vorrichtung nach Anspruch 11, wobei das Formteil wenigstens teilweise doppelwandig mit innerer Verstärkung ist. 30
13. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei die Einheit (16) an ihrer Rückseite (19) mit Anschlüssen (30) zur Zuführung von Luft in das und Abführung von Luft aus dem Fach versehen ist. 35
14. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei die Vorrichtung ein Kühlschranks, ein Gefrierschranks oder ein Kühlgefriergerät ist. 40

Revendications

1. Appareil de refroidissement pourvu d'un espace de rangement sous pression atmosphérique (12) et d'un compartiment de rangement pouvant être mis sous vide (14), défini et **caractérisé par** : 50

une unité formant boîte fabriquée séparément (16) présentant au moins une paroi (28) constituée au moins en partie d'un élément transparent pour inspection des articles se trouvant dans le compartiment de rangement pouvant être mis sous vide (14), dans lequel ladite au moins une paroi est une paroi supérieure (28) 55

de l'unité et sert d'étagère inférieure de l'espace de rangement sous pression atmosphérique (12), une porte pouvant être ouverte (23) fermant hermétiquement une ouverture d'accès du compartiment et une pluralité d'autres parois constituées d'une structure fabriquée d'une seule pièce (18) supportant l'élément transparent, ladite pluralité d'autres parois comprenant une paroi avant (21) dotée d'une ouverture (22) définissant l'ouverture d'accès, une paroi arrière (19) et deux parois latérales de l'unité, opposées l'une à l'autre (20).

2. Appareil selon la revendication 1, dans lequel l'unité présente une deuxième paroi (29) constituée au moins en partie d'un élément transparent également supporté par la structure (18), la deuxième paroi étant disposée en regard de la première paroi (28) ainsi formée.
3. Appareil selon l'une quelconque des revendications précédentes, dans lequel l'élément ou chaque élément transparent est hermétiquement scellé à la structure (18).
4. Appareil selon l'une quelconque des revendications précédentes, dans lequel la porte (23) est constituée, au moins en partie, d'un élément transparent (24).
5. Appareil selon l'une quelconque des revendications précédentes, dans lequel l'élément ou chaque élément transparent comprend un panneau de verre.
6. Appareil selon la revendication 5, dans lequel le panneau est constitué de verre trempé.
7. Appareil selon l'une quelconque des revendications précédentes, dans lequel la porte (23) est montée sur un tiroir mobile (25).
8. Appareil selon la revendication 7, dans lequel le tiroir (25) peut coulisser sur des guides (26) formés sur des surfaces intérieures des parois (20) de la structure (18).
9. Appareil selon l'une quelconque des revendications 7 et 8, dans lequel ladite au moins une paroi avant (21) et la porte (23) comportent un moyen formant étanchéité (27) destiné à obturer de manière étanche l'ouverture d'accès, lorsque la porte (23) est fermée.
10. Appareil selon l'une quelconque des revendications précédentes, dans lequel chaque paroi (19, 20, 21, 28, 29) de l'unité (16) est sensiblement plane.
11. Appareil selon l'une quelconque des revendications

précédentes, dans lequel la structure (18) comprend un moulage en matière plastique.

12. Appareil selon la revendication 11, dans lequel le moulage est doté au moins en partie d'une double peau avec renforcement interne. 5
13. Appareil selon l'une quelconque des revendications précédentes, dans lequel l'unité (16) est pourvue, sur son côté arrière (19), de raccordements (30) destinés à l'alimentation en air du compartiment et à l'évacuation d'air depuis celui-ci. 10
14. Appareil selon l'une quelconque des revendications précédentes, l'appareil étant un réfrigérateur, un congélateur ou un réfrigérateur-congélateur. 15

20

25

30

35

40

45

50

55

FIG. 1

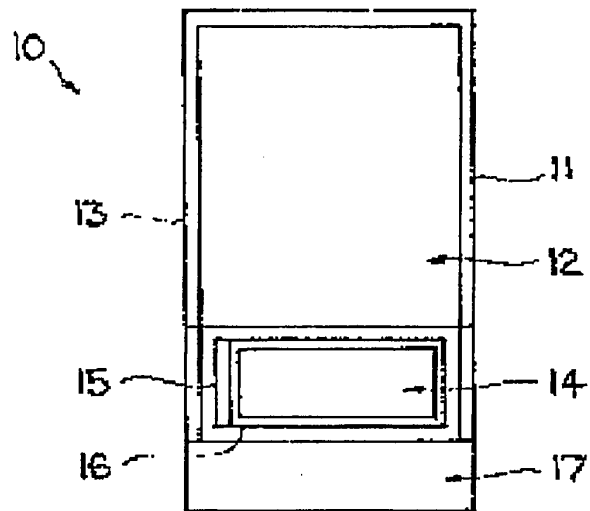
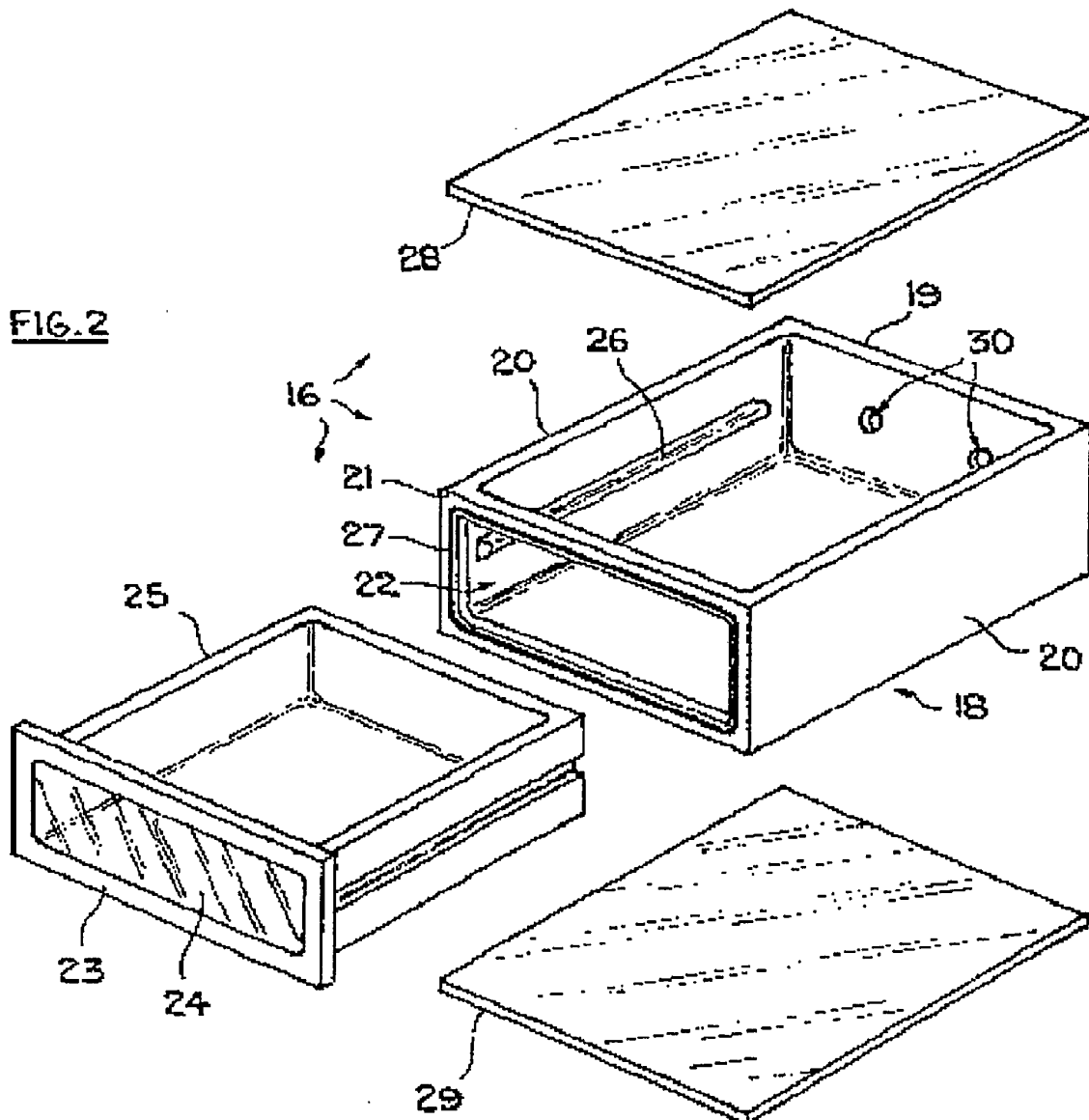


FIG. 2



REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 2116813 A [0002]
- US 6148875 A [0002]
- DE 19931920 A1 [0003]