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- (71) Applicant (for all designated States except US): CARRIER CORPORATION [US/US]; One Carrier Place, Farmington, Connecticut 06034 (US).
- (72) Inventor; and
- (75) Inventor/Applicant (for US only): STAKELBECK, Oliver [DE/DE]; Hamsterweg 26, 65307 Bad Schwalbach (DE).
- (74) Agent: KSNH Patentanwälte Klunker-Schmitt-Nilson.Hirsch; Destouchesstraße 68, 80796 München (DE).

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(54) Title: REFRIGERATED SALES CABINET

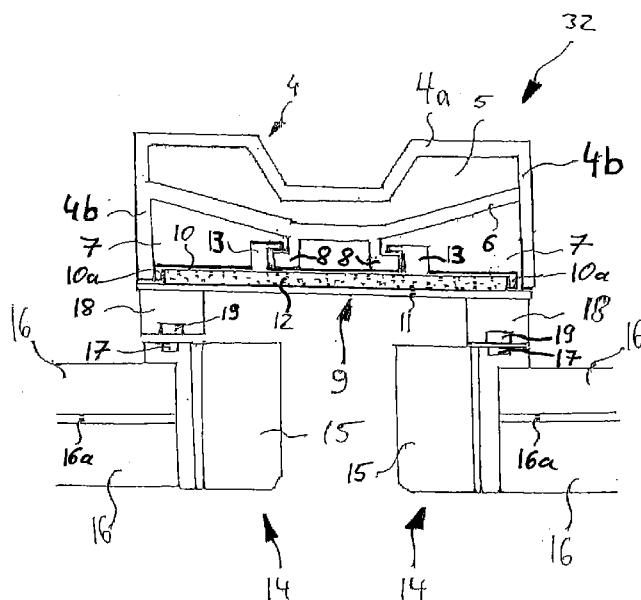


Fig. 2

(57) Abstract: A refrigerated sales cabinet (20) comprises a cabinet body (22) providing a refrigerated sales space for supporting refrigerated goods to be sold, a door frame (21) having a top post (34), a bottom post (36), and at least two upright posts (32), and at least one door (14). At least one of the posts (32, 34, 36) has a cold main body (4) and an insulating front element (9) comprising, from back to front, a rear panel (10) which is attached to the cold main body (4), a layer of a nanoporous aerogel material (12), and a front panel (11) forming the front surface of the post (32, 34, 36). Said insulating front element (9) provides a thermal insulation against the cold main body (4) of the post (9) and reduces condensation at the front surface of the front panel (11).

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Refrigerated Sales Cabinet

5 The present invention relates to a refrigerated sales cabinet.

A refrigerated sales cabinet as it is known in the art comprises a cabinet body, side panels, a door frame and at least one door, wherein the side panels are installed on the sides of the cabinet body, the door frame is installed on the cabinet body, the door is installed on the
10 door frame, and sealing strips are provided between the cabinet door and the door frame.

The front surface of the door frame, which is exposed to ambient conditions, is cooled when the refrigerated sales cabinet is operated and humid ambient air condensates at this front surface causing water droplets to appear, which is uncomfortable for the customers.
15 Therefore, there is a need to prevent the temperature of this surface to fall below the dew point temperature.

A door frame according to the prior art comprises an electrical heating element, which serves to keep the temperature of the front surface above the dew point in order to prevent
20 the condensation of water on the door frame. The electrical energy consumed by such an electrical heating element is very high and considerably contributes to the total energy consumed by the refrigerated sales cabinet in operation.

It therefore would be beneficial to reliably avoid condensation at the front surface of a
25 door frame of a refrigerated sales cabinet, whereas at the same time the electrical energy consumption is minimized.

A refrigerated sales cabinet according to an embodiment of the invention comprises a cabinet body providing a refrigerated sales space for supporting refrigerated goods to be sold
30 therein; a door frame having a top post, a bottom post, and at least two upright posts; and at least one door. At least one of the posts has a main body providing a structural frame member, which is cooled to low temperatures when the refrigerated sales cabinet is operated as it is exposed to the cooled goods presentation space, and an insulating front element. Said insulating front element comprises, from back to front, a rear panel attached to the
35 cold main body, a layer of a thermally insulating nanoporous aerogel material, and a front panel forming the front surface of the post. Said insulating front element provides a ther-

mal insulation against the cold main body of the post and thereby avoids condensation at the front surface of the front panel.

5 The disclosure of the invention will become more easily understood with reference to the accompanying drawings. It is appreciated by those skilled in the art that the accompanying drawings are exemplary only and are not intended to limit the scope of protection of the invention. In the drawings:

10 Fig. 1 shows an exploded view of a refrigerated sales cabinet of the front-access type with doors and a door frame according to an embodiment of the invention, and

Fig. 2 shows a horizontal cross section through one of the upright posts of the door frame and part of adjacent doors.

15 Figs. 1 and 2 and the following discussion describe particular embodiments of the invention so as to teach those skilled in the art how to produce and use the best modes of the invention. In order to teach the principle of the invention, several conventional aspects have been simplified or omitted. Those skilled in the art should understand that variations originating from these embodiments also fall within the scope of the invention. Those
20 skilled in the art should understand that the features to be described below can be combined in various ways so as to form numerous variations of the invention. Therefore, the invention is not limited to the following particular embodiments and is merely defined by the appended claims and their equivalents.

25 A refrigerated sales cabinet 20 of the front-access type with doors 14 and a door frame 21 according to an exemplary embodiment of the invention is shown in Fig. 1.

The refrigerated sales cabinet 20 as shown in Fig. 1 comprises a cabinet body 22, a left side panel 30, a right side panel 31, a door frame 21 and a plurality of doors 14. The cabinet body 22 comprises a bottom part 26, a roof plate 24, a rear wall 27 and a plurality of
30 shelves 28 arranged in between.

A complete refrigeration circuit comprising a compressor, a condenser, an expansion device and an evaporator may be installed in the cabinet body 22, in order to provide a
35 standalone refrigerated cabinet which only needs to be connected to an electric power supply for operation.

Alternatively, only one or more evaporators may be installed within the cabinet body 22, the evaporators being configured to be fluidly connected to an external refrigeration circuit provided in the building in which the refrigerated sales cabinet is to be installed.

- 5 The refrigerated sales cabinet may be a cooling sales cabinet which is configured to cool the goods presentation space to cooling temperatures above 0°C.

Alternatively, the refrigerated sales cabinet may be a freezing sales cabinet, which is configured to cool the goods presentation space to freezing temperatures below 0 °C, in particular to temperatures below -15 °C in order to store and present frozen goods to potential customers.

The left side panel 30 and the right side panel 31 are respectively installed on the left and right hand side of the cabinet body 22. The door frame 21, which comprises a plurality of vertical extending upright posts 32, a horizontal top post 34 and a horizontal bottom post 36, respectively connecting the upright posts 32 to each other, is installed on a front side of the cabinet body 22.

A plurality of cabinet doors 14 is installed on the front side of the door frame 21. The cabinet body 22, the left side panel 30, the right side panel 31, the door frame 21 and the cabinet doors 14 are installed together to form a refrigerated goods storage and presentations space which is closed by and accessible through the doors 14.

Figure 2 shows a horizontal cross section through one of the upright posts 32 of the door frame 21 and portions of two adjacent doors 14.

The doors 14 are for example insulated glass doors 14 respectively comprising two glass panels 16 separated by an intermediate vacuum layer 16a. The glass panels 16 are supported by an outer frame member 15, which may be an extruded element made of plastic or metal, for example aluminium.

In accordance with an embodiment of the invention each upright post 32 includes a main body 4 providing a structural frame member, which may be made of aluminium or another high strength material and which is cooled to low temperatures when the refrigerated sales cabinet 20 is operated as it is exposed to the cooled goods presentation space, and an insulating front element 9. The cross section of the cold main body 4 is basically C-shaped, when looked at in the cross-section, comprising a rear portion 4a and two side portions 4b.

The side portions 4b are arranged basically parallel to each other and perpendicular to the rear portion 4a. An internal support member 6 is arranged within the cold main body 4 extending basically parallel to the rear portion 4a and providing an elongated first hollow space 5 within the cold main body 4, the first hollow space 5 being defined by the internal support member 6, the rear portion 4a and the two side portions 4b. Optionally, the first hollow space 5 may be filled with an insulating material, e.g. a thermally insulating foam, in order to enhance the thermally insulating properties of the upright post 32.

A front side of the internal support member 6 facing the doors 14 is provided with two first bracket members 8 extending opposite to each other in a plane extending basically parallel to the plane of the doors 14 when they are arranged in the closed position parallel to the door frame 21. An insulating front element 9 is mounted to the internal support member 6 by means of corresponding second bracket members 13 provided at the rear side of the rear panel 10 engaging with the first bracket members 8 provided at the internal support member 6. The mutual engagement of the bracket members 8, 13 allows a convenient and secure installation of the insulating front element 9 within the cold main body 4 of the upright post 32.

The insulating front element 9 includes a rear panel 10 facing the internal support member 6 and comprising the corresponding second bracket members 13. The rear panel 10 is basically planar comprising side wall strips 10a so as to have a C-shape when looked at in the cross-section and extends basically parallel to the rear portion 4a of the cold main body 4 spanning the distance between the two side portions 4b, thereby providing two further elongated hollow spaces 7, which are respectively defined by the rear panel 10 of the insulating front element 9, one of the side portions 4b of the cold main body 4 and the internal support member 6.

A layer comprising a nanoporous aerogel 12 is provided on the front side of the C-shaped rear panel 10 of the insulating front element 9 facing the doors 14.

The insulating front element 9 further comprises a basically planar front panel 11, which is provided on the front side of the nanoporous aerogel 12 facing the doors 14 opposite to the rear panel 10. As a result, the nanoporous aerogel 12 is enclosed within the insulating front element 9 in between the rear panel 10 and the front panel 11. This enclosure within the insulating front element 9 protects the nanoporous aerogel 12 from being damaged, e.g. by the doors 14 or clumsy customers hitting the upright post 32, and further allows an easy installation of the nanoporous aerogel 12 at the cold main body 4 of the upright post 32.

The first and second panels 10, 11 of the insulating front element 9 may be made of any suitable plastic or metallic material, e.g. Aluminium or PVC, or a combination thereof.

5 Sealing elements 18, which may be made of an elastic material such as rubber, are mounted to front panel 11 of the insulating front element 9 about the periphery of the door openings for defining a sealing and stop surface for the doors 14 in order to provide an air seal between the doors 14 and the upright post 32 of the door frame 21, when the doors 14 are in their respective closed positions. Alternatively or additionally sealing elements 18 may
10 be mounted to the doors 14. The sealing elements 18 are configured to prevent the exchange of cool air from the refrigerated goods storage and presentation space of the refrigerated sales cabinet 20 with warm ambient air.

A magnet 19 may be provided in, on or below the sealing element 18 in order to attract the
15 metallic outer frame member 15 locking the doors 14 securely in the closed position in order to avoid an undesired opening of the doors 14. If the outer frame member 15 is made of plastic or a non magnetic metal, a further magnet 17 or an element 17 comprising a magnetic metal may be provided in or on the outer frame member 15 in order to be attracted by the magnet 19 provided in on or below the sealing element 18.

20 Alternatively or additionally a mechanical lock, which is not shown in the figures, may be provided in order to securely lock the doors 14.

An exemplary embodiment of the invention has been described with reference to the upright posts 32 of the door frame 21. The skilled person, however, will easily understand
25 that the idea of the invention may be analogously applied to the top and bottom posts 34, 36, which extend horizontally between the upright posts 32, as well, in order to avoid the generation of condensation water on the complete front surface of the door frame 21.

30 According to exemplary embodiments, as explained herein, a thermally insulating front element is positioned at the front of at least one of the posts of the door frame of the refrigerated sales cabinet, in order to avoid the heat transfer through the upright post and to keep the front surface temperature above the dew point. In particular, such thermally insulating front element comprises a layer of nanoporous aerogel material having a porous
35 structure and providing exceptional thermal insulation properties. Due to the exceptional thermal insulation properties it is not necessary to heat the door frame in order to avoid condensation of ambient air at the door frame.

The inventors have discovered that instead of heating the posts of the door frame of a refrigerated sales cabinet, an insulating front element as defined in the claims and as described herein can be provided, which is – contrary to what was believed until the present invention was made – capable to reliably avoid condensation at the front surface of such posts. Until the point in time when the present invention was made, there was no insulating front element known or available which could reliably avoid condensation at the front surface of such posts while being subject to constant cooling from the back of the refrigerated sales cabinet. None of the available insulating techniques was able to provide a sufficient insulation at that particular position that could reliably avoid condensation over time.

In an embodiment the nanoporous aerogel material of the layer of nanoporous aerogel material has a porous structure with a pore size in the range of some nanometers, particularly of 1 to 10 nanometers. A nanoporous aerogel material having a porous structure with a pore size in said range comprises good thermally insulating properties. In particular, the thermal insulation properties of such a nanoporous aerogel are better than those of any classical thermal insulation materials as they are known to be used for the insulation of buildings, for example.

Aerogel materials are synthetic porous materials derived from a gel, in which the liquid component of the gel has been replaced with a gas. Aerogel materials are solids with an extremely low density and an extremely low thermal conductivity. Aerogel materials often have a translucent nature and feel like expanded polystyrene (styrofoam) to the touch. Aerogel materials are produced by extracting the liquid component of a gel through supercritical drying. This allows liquid to be slowly drawn off without causing the solid matrix in the gel to collapse from capillary action, as would happen with conventional evaporation.

Aerogel materials are rigid, dry materials and do not resemble a gel in their physical properties. Aerogel materials can have a dendritic microstructure in which spherical particles of average size of 2-5 nm are fused together into clusters. These clusters form a three-dimensional highly porous structure of almost fractal chains. The average size and density of the pores can be controlled during the manufacturing process.

The nanoporous aerogel materials are good thermal insulators because they have a very small heat transfer in regard of convection, conduction and radiation. They are good con-

ductive insulators because they are composed almost entirely from a gas, and gases are very poor heat conductors.

5 A particularly suitable nanoporous aerogel material is a silica aerogel material, which is a silica-based substance, derived from silica gel. The lowest density aerogel is a silica nanofoam of 1 mg/cm³. The density of air is 1.2 mg/cm³ (at 20°C and 1 atm). By convention, the mass of air is excluded when the micro-lattice density is calculated. Allowing for the mass of the interstitial air, the true, unevacuated density of the micro-lattice is approximately 2.1 mg/cm³. The silica aerogel material has remarkable thermal insulative properties, having an extremely low thermal conductivity: from 0.03 W/mK down to 0.004 W/mK.

15 An example of a suitable nanoporous aerogel material is formed by the nanoporous silica aerogel insulation mat named Spaceloft manufactured by the company Aspen Aerogel.

In an embodiment said layer of nanoporous aerogel material is sandwiched between said rear panel and said front panel. In an alternative embodiment said rear panel and said front panel together with two respective side wall strips completely enclose said layer of nanoporous aerogel material. Such a configuration securely fixes the nanoporous aerogel material and protects it from being damaged. It further allows an easy and convenient installation of the nanoporous aerogel material.

25 In an embodiment the rear panel and/or the front panel comprise a plastic material, particularly PVC. A plastic material, such as PVC, provides a cheap lightweight material with good thermal insulating properties.

30 In an embodiment the insulating front element is attached to the cold main body of the post by means of a snap-on connection, particularly by a fastening bracket provided at the rear side of the rear panel that engages with a corresponding fastening bracket provided at the cold main body. A snap-on connection allows an easy installation and deinstallation of the front element to and from the post, respectively.

35 Optionally the fastening bracket may be provided in the form of a rail extending along the length of the post. Such a rail may be produced by extrusion and provides a secure fixture over the whole length of the post.

In an embodiment the door is formed as a pivotable door being pivotable between a closed position and at least one open position, said pivotable door having a first side portion connected with a hinge and a pivotable second side portion opposite to the first side portion. In the closed position the door rests with the rear side of its second side portion against one of the upright posts, and with the rear sides of its upper and lower portions against the top and bottom posts, respectively. A pivotable door in its closed position isolates the refrigerated sales space from the environment in order to avoid cold air from flowing out of the refrigerated sales space thereby reducing the energy needed for cooling the refrigerated sales space. In its open position a pivotable door allows an easy and convenient access to the refrigerated sales space and the goods stored and presented therein.

In an embodiment the rear sides of the second side portion, of the upper portion and/or of the lower portion of the door, that, in the closed position of the door, respectively rest against the upright, top and/or bottom posts, are respectively provided with sealing elements, and/or the front sides of the upright, top and/or bottom posts are respectively provided with sealing elements. Sealing elements provided between the door and the posts enhance the insulating properties of the door in its closed position.

The front surface of the upright post may provide a stop for the door in order to define the position of the door in its closed position.

In an embodiment the second side portion of the door and the associated upright post, particularly a sealing element provided at the associated upright post, comprise a pair of two magnets or a combination of a magnet and an element of magnetic material, in order to hold the door in its closed position. Such an arrangement of at least two magnets and/or a magnet and an element of magnetic material reliably prevents the door from being accidentally opened or not completely closed, which would allow cold air to flow out of the refrigerated sales space thereby increasing the energy needed for cooling the refrigerated sales space.

In an embodiment at least one pair of two doors with mirror-inverted pivoting directions is provided, one door being arranged besides the other, wherein the pivotable second end portions of both doors are facing each other, such that both doors, in their respective closed positions, rest with the rear sides of their second side portions against the same upright post. Such an arrangement of adjacent doors allows a convenient access to the goods stored within the refrigerated sales space.

In an embodiment the doors respectively comprise at least one pane of glass, allowing to look into the refrigerated sales space without opening at least one of the doors.

5 In an embodiment the refrigerated sales cabinet is configured to cool the refrigerated sales space down to freezing temperatures below 0 °C, in particular to temperatures below -15 °C. This allows to store and present frozen goods to potential customers. Good thermal insulation properties of the insulating front element are in particular important at such low temperatures in order to reduce condensation at the front surface of the refrigerated sales cabinet.

10

The refrigerated sales cabinet may be a standalone refrigerated cabinet comprising a complete refrigeration circuit which needs to be connected only to an electric power supply for operation. Alternatively the refrigerated sales cabinet may comprise only at least one evaporator to be fluidly connected to an external refrigeration circuit which is installed in
15 the building in which the refrigerated sales cabinet is placed.

While the invention has been described with reference to an exemplary embodiment, it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted for elements thereof without departing from the scope of the invention. In addition, modifications may be made to adapt a particular situation or material
20 to the teachings of the invention without departing from the essential scope thereof. Therefore, it is intended that the invention is not limited to the particular embodiment disclosed, but that the invention will include all embodiments falling within the scope of the appended claims.

25

List of Reference Numerals

	4	main body of a post
	4a	rear portion of a post
5	4b	side portions of a post
	5	first hollow space
	6	support member
	7	second hollow space
	8	first fastening bracket
10	9	insulating front element
	10	rear panel
	10a	side wall strip
	11	front panel
	12	layer of nanoporous aerogel material
15	13	second fastening bracket
	14	door
	15	outer frame member
	16	door panel
	16a	vacuum layer
20	17	magnet or element comprising magnetic metal
	18	sealing strip
	19	magnet
	20	refrigerating sales cabinet
	22	cabinet body
25	21	door frame
	24	roof plate
	26	bottom part
	27	rear wall
	28	shelves
30	30	left side panel
	31	right side panel
	32	upright post
	34	top post
	36	bottom post

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Claims

- 5 1. Refrigerated sales cabinet (20), comprising:
a cabinet body (22) providing a refrigerated sales space for supporting refrigerated goods to be sold therein;
a door frame (21) having a top post (34), a bottom post (36), and at least two upright posts (32);
10 at least one door (14);
wherein at least one of the posts (32, 34, 36) has a cold main body (4) and an insulating front element (9),
said insulating front element (9) comprising, from back to front, a rear panel (10) which is attached to the cold main body (4), a layer comprising a nanoporous aerogel material (12), and a front panel (11) forming the front surface of the post (32, 34, 36),
15 said insulating front element (9) providing a thermal insulation against the cold main body (4) of the post (9).
2. Refrigerated sales cabinet (20) of claim 1, wherein the nanoporous aerogel material of the layer of nanoporous aerogel material (12) has a porous structure with a pore size in the
20 range of some nanometers, particularly of 1 to 10 nanometers.
3. Refrigerated sales cabinet (20) of claim 1 or 2, wherein the nanoporous aerogel material is a silica aerogel material being a silica-based substance, derived from silica gel, and
25 having a thermal conductivity between 0.03 W/mK and 0.004 W/mK.
4. Refrigerated sales cabinet (20) of any of the preceding claims, wherein said layer of nanoporous aerogel material (12) is sandwiched between said rear panel (10) and said front panel (11), and/or wherein said rear panel (10) and said front panel (11) together with
30 two respective side wall strips (10a) completely enclose said layer of nanoporous aerogel material (12).
5. Refrigerated sales cabinet (20) of any of the preceding claims, wherein the rear panel (10) and/or the front panel (11) comprise a plastic material, particularly PVC.
35
6. Refrigerated sales cabinet (20) of any of the preceding claims, wherein the insulating front element (9) is attached to the cold main body (4) of the post (32, 34, 36) by means of

a snap-on connection (8, 13), particularly by a second fastening bracket (13) provided at the rear side of the rear panel (10) that engages with a corresponding first fastening bracket (8) provided at the cold main body (4).

5 7. Refrigerated sales cabinet (20) of any of the preceding claims, wherein the door (14) is formed as a pivotable door (14) being pivotable between a closed position and at least one open position, said pivotable door (14) having a first side portion connected with a hinge and a pivotable second side portion opposite to the first side portion; and/or wherein
10 the door (14), in the closed position, rests with the rear side of its second side portion against one of the upright posts (32), and with the rear sides of its upper and lower portions against the top and bottom posts (34, 36), respectively.

8. Refrigerated sales cabinet (20) of claim 7, wherein the rear sides of the second side portion, of the upper portion and/or of the lower portion of the door (14) that respectively
15 rest against the upright, top and/or bottom posts (32, 34, 36), when the door (14) is in its closed position, are provided with at least one sealing element (18), and/or wherein the front sides of the upright, top and/or bottom posts (32, 34, 36) are respectively provided with at least one sealing element (18).

20 9. Refrigerated sales cabinet (20) of claim 7 or 8, wherein the second side portion of the door (14) and the associated upright post (32), particularly a sealing element (18) provided at the associated upright post (32), comprise a pair of two magnets (17, 19) or a combination of a magnet (17) and an element (19) comprising a magnetic material, in order to hold the door (14) in the closed position.

25 10. Refrigerated sales cabinet (20) of any of claims 7 to 9, wherein at least one pair of two doors (14) with mirror-inverted pivoting directions is provided, one besides the other, wherein the pivotable second end portions of both doors (14) are facing each other, such that, in the closed position, both doors (14) rest with the rear sides of their second side portions
30 against the same upright post (32).

11. Refrigerated sales cabinet (20) of any of the preceding claims, wherein the refrigerated sales cabinet (20) is configured to cool the refrigerated sales space down to freezing temperatures below 0 °C, in particular to temperatures below -15 °C.

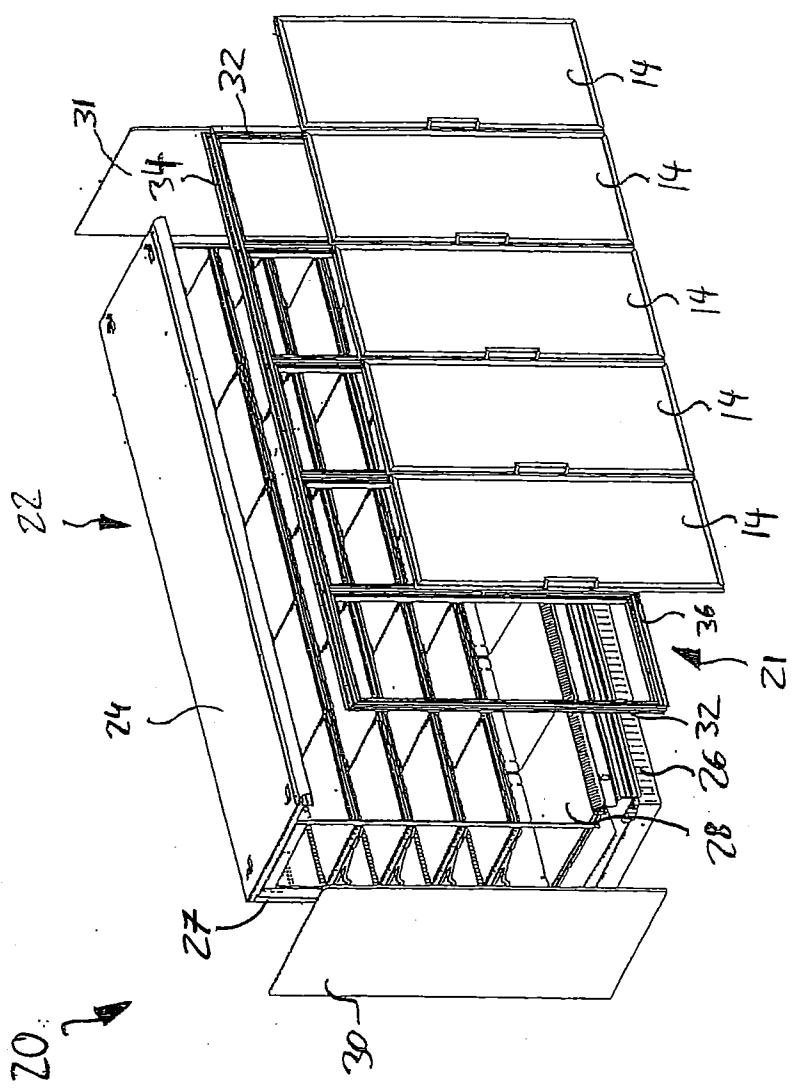


Fig. 1

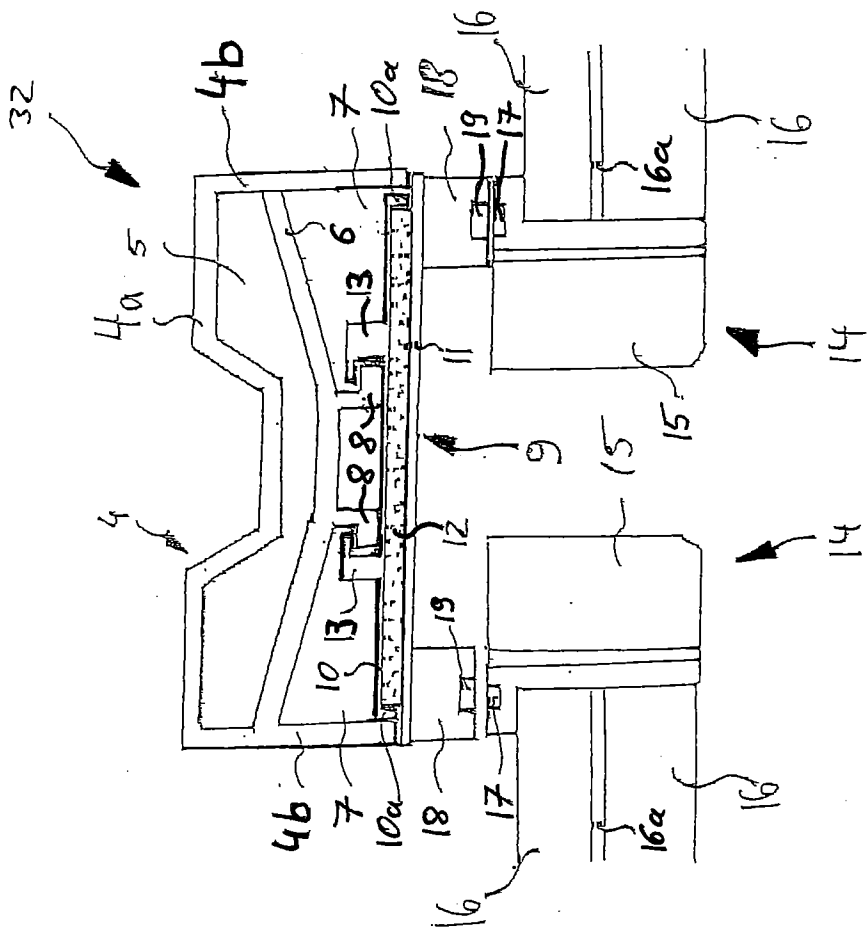


Fig. 2

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2012/065069

A. CLASSIFICATION OF SUBJECT MATTER
INV. A47F3/04 F25D23/08
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A47F F25D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 891 912 A (BOCKWINKEL GERALD J [US]) 9 January 1990 (1990-01-09) page 2, line 6 - line 10; figures 1-8 -----	1-11
A	GB 640 892 A (BRITISH THOMSON HOUSTON CO LTD) 2 August 1950 (1950-08-02) page 2, line 6 - line 10 -----	1-11



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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"P" document published prior to the international filing date but later than the priority date claimed

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Date of the actual completion of the international search

31 May 2013

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07/06/2013

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Vehrer, Zsolt

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2012/065069

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4891912	A	09-01-1990	AU 621863 B2 26-03-1992
			AU 3242789 A 26-07-1990
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			NO 893310 A 18-07-1990
			US 4891912 A 09-01-1990

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