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REFRIGERATING APPARATUS

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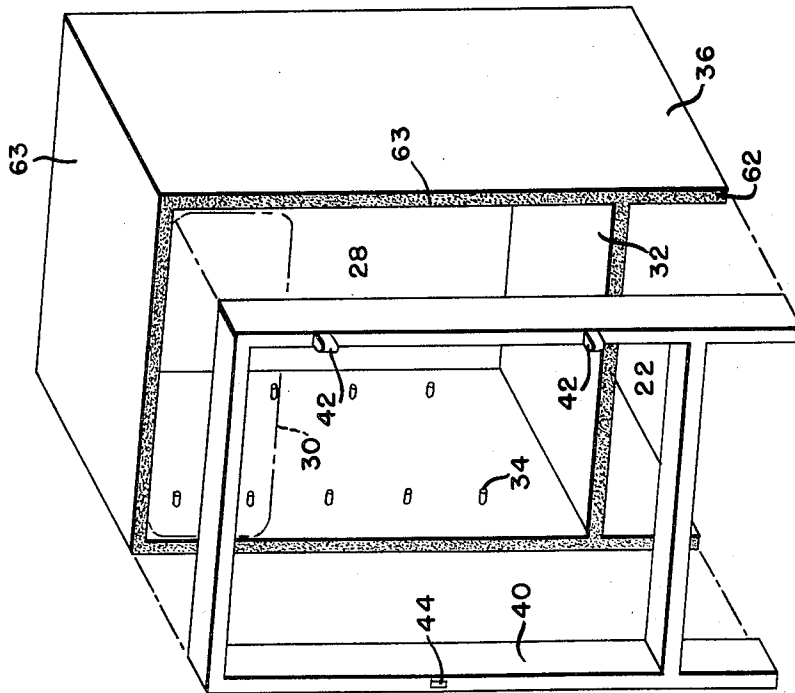


Fig. 3

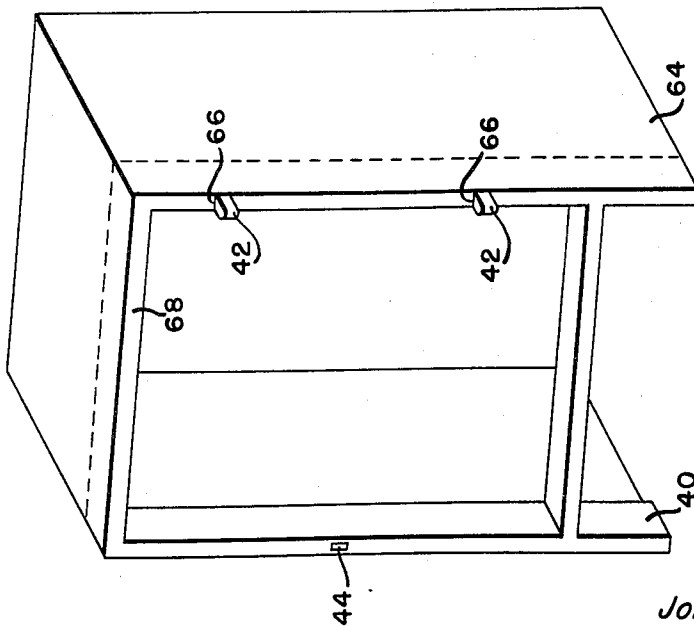


Fig. 4

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REFRIGERATING APPARATUS

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6 Claims. (Cl. 62—264)

This invention pertains to refrigerating apparatus and especially to insulated cabinets having foamed plastic walls as insulation and which are usable for refrigerators and other storage purposes.

It has been suggested that conventional refrigerator cabinets be insulated with foamed closed cell polyurethane plastic. However, after this material is foamed in place it is so inert and adherent that it becomes economically unfeasible to remove it. Therefore, if the filling and foaming of the insulation spaces is not properly done, an expensive cabinet shell must be scrapped.

It is an object of this invention to provide an insulated cabinet arrangement wherein the parts to which the foamed insulation is adherent may be sufficiently inexpensive that in the event that the formation of the foamed insulation is defective, it will be possible to scrap the insulation and the parts adherent to it without great loss.

It has been customary in refrigerator cabinets to place the refrigerant conduits and the electric wiring in the insulation space. Since such foamed insulation must be considered permanently lodged in the walls, this is not expedient when foamed cast-in-place insulation is used.

It is another object of this invention to provide an accessible avenue for refrigerant conduits and electrical wiring in a refrigerator cabinet having foamed-in-place insulation.

It is another object of this invention to provide a new form of refrigerator cabinet especially adapted to the use of foamed-in-place plastic insulating material.

These and other objects are attained in the forms shown in the drawing in which the foamed insulation is foamed or cast in place between an inexpensive liner of thin plastic material and an outer shell of inexpensive paper of fibreboard suitably treated for moisture resistance and including a sizing containing polyvinyl alcohol. This portion contains none of the expensive parts of the refrigerator cabinet. To provide for the hinges, the thermostatic control, latch and the lighting of the cabinet, there is a hollow rectangular frame member which telescopes over the front edges of the aforementioned shell and liner. This rectangular frame member, preferably of a suitable plastic, has cast into it the hinge members, the latch keeper and the supporting means for the interior light and the thermostatic control. Its hollow construction provides an avenue through which the refrigerant conduits may extend between the motor-compressor unit below and the refrigerant evaporator within. The hollow construction also provides an avenue through which the electrical conductors may extend from the motor-compressor unit to the thermostat and the electrical lighting. The frame also supports a door switch for controlling the light. The hinges support a conventional type door carrying a door seal making sealing engagement with the rectangular frame.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings,

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wherein a preferred form of the present invention is clearly shown.

In the drawings:

Figure 1 is a perspective view of a refrigerator cabinet embodying my invention;

Figure 2 is a fragmentary horizontal sectional view taken along the lines 2—2 of Figure 1;

Figure 3 is an exploded perspective view showing the elementary construction of the cabinet;

Figure 4 is a perspective view of a modified form of cabinet shell; and

Figure 5 is a fragmentary vertical sectional view through one of the hinges.

Referring now to the drawings and more particularly to Fig. 1, there is shown a refrigerator cabinet 20 provided with a machine compartment 22 beneath containing a sealed motor-compressor unit 24 and an air cooled condenser 26. The cabinet 20 also includes an insulated storage compartment 28 provided with a refrigerant evaporator 30 in its upper portion. The basic construction of the cabinet is better shown in Figs. 2 and 3 in which the main portion of the cabinet is composed of a thin plastic box-shaped inner liner 32 having an open side and provided with integral pegs 34 or other suitable protrusions for supporting the various removable shelves 38 illustrated in Fig. 1. The outer portion of this main portion of the cabinet is provided by a thin shell 36 of inexpensive paper or fibreboard preferably including a sizing containing polyvinyl alcohol and waterproofing materials. The interior of this outer shell may be treated to the extent necessary to adhere to and contain the plastic foamed material. If necessary, this outer shell may be externally supported and the inner liner 32 internally supported during the introduction of the foamed plastic so as to insure that its walls are perfectly plane or of the shape desired.

The insulation space between the outer shell 36 and the plastic liner 32 preferably is filled with a foamed polyurethane plastic having high structural and insulating properties. This is foamed and cast in place within the walls and adheres to and serves to bind the plastic liner and the paper or fiber outer shell together so as to form a single structural unit in which, after it is set, the foamed plastic material supports and reinforces both the liner 32 and the outer shell 36 so that even though made much thinner and weaker than is conventional, they are sufficient to withstand all the forces encountered in normal usage and the handling of the cabinet during manufacturing and delivery. Examples of such foamed plastic are as follows:

Example I

An ethylene glycol-adipic acid polyester was prepared having a hydroxyl number of about 430, an acid number of about 150 and a negligible water content. A portion of the polyester was reacted with the toluene diisocyanate to produce an isocyanate modified ester having an isocyanate equivalent of about .80 per 100 grams of the isocyanate-modified polyester. A mixture of 100 parts by weight of the above-mentioned isocyanate-modified polyester, .50 part by weight of polyoxyethylene sorbitan monopalmitate, and 30 parts of trichloromonofluoromethane (F-11) was placed in a first tank and kept cool, such as below 50° F.

A mixture of 60 parts by weight of the polyester, 12 parts by weight of ethylene glycol, .25 part by weight of dimethyl ethanolamine and .25 part by weight of polyoxyethylene sorbitan monopalmitate emulsifier was placed in a second tank. The components from the first and second tanks were mixed in a ratio of 130.50 parts by weight of the first to 72.50 parts by weight of the second as or immediately before they are introduced into

the insulation space between the inner liner 32 and the outer shell 36. This space is substantially closed while the mixture foams as it rises in temperature to 250° F. and solidifies to produce a foamed insulation adhering and supporting both the liner 32 and the shell 36 and filling the insulation space between them. This insulation has a density of about 2 lbs. per cu. ft. and a "k" factor at 70° F. of about .100 B.t.u.-inch/hr.-sq. ft.-° F. as determined by the guard ring hot plate method.

Example II

The process of Example I was repeated using trichlorotrifluoroethane (F-113) having a boiling point of about 118° F. instead of the trichloromonofluoromethane (F-11) to produce a foam insulation having a similarly determined "k" factor of .100 B.t.u.-inch/hr.-sq. ft.-° F.

It is apparent that the foaming of the material described in the above examples, I and II results in the main from the vaporization of the liquid trichloromonofluoromethane (F-11) or the trichlorotrifluoroethane (F-113) due to the exothermic heat of reaction. Other liquids such as monochloroethane, monochloromonofluoroethane (F-151a), monochlorodifluoroethane (F-142a), and dichlorotrifluoroethane (F-133e) having boiling points ranging from 48° F. to 95° F. and coefficients of thermal conductivity substantially less than carbon dioxide may also be used.

The structure so far described is relatively inexpensive and may be inspected soon after the foaming of the insulation takes place. If any defects are ascertained, this shell may be scrapped immediately with a minimum of loss. After the foam insulated structure has passed inspection, the paperboard or fiberboard 36 may be suitably treated to render it gas-tight to prevent the ingress of air into the foam insulation 62 and to prevent the egress of the insulating gas from the cell structure thereof.

For example, if the shell 36 has not previously been sized with polyvinyl alcohol, it may be coated or sprayed with a solution thereof or covered with a laminated film of polyvinyl alcohol and polyvinyl chloride or polyethylene or an ester of ethylene glycol and terephthalic acid popularly known by the trade name "Mylar." This coating or film is designated by the reference character 63. Also, it may be provided with an outer coating of an enamel or lacquer over the paperboard or fiberboard 36 and over the coating 63, if applied. This shell, however, is substantially inert and has no provisions for the refrigerant conduits extending from the motor-compressor unit 24 and the condenser 26 located in the machine compartment 22 with the refrigerant evaporator 30 located in the upper portion of the compartment 28. Further, to keep its cost low, this shell makes no provision for hinges, latches, thermostatic controls or interior lighting.

According to my invention, I provide a hollow rectangular frame 40, preferably formed of a suitable plastic such as high impact polystyrene which has cast into it the hinges 42 and the keeper or latch mechanism 44 for the door latch. This rectangular frame 40 is preferably U-shaped in cross-section, as shown in Fig. 2, with the legs of the U extending on both sides of the front edges of the liner 32 and the outer shell 36 in a telescoping arrangement. The legs of the U may be tapered to a fine edge, as shown, so as to make a pleasing blend of the two structures. Sufficient space is provided in the closed end of the frame for the refrigerant conduits 46, 48 extending between the evaporator 30 within the liner 32 and the motor-compressor 24 and the condenser 26 in the machine compartment 22 beneath. Also mounted on the inner surface of the frame 40 is an interior light 50 controlled by the door switch 52 also mounted on the frame 40. In addition, a thermostat having a dial control knob 54 is also mounted on the inner side of the rectangular frame 40, as shown in Fig. 1. Electrical conductors 56 extend from the machine compartment

22 through the closed front portion of the frame 40, as shown in Fig. 2 to the light 50, the door switch 52 and the thermostat 54. A capillary tube 55 extends from the thermostat 54 through the closed front portion of the frame 40 to the evaporator 30.

To assure the proper relationship between the liner 32, the frame 40, the refrigerant conduits 46, 48 and the wiring 56 there is provided a U-shaped channel member 58 of a plastic similar to that of the frame 40, having its legs extending in the opposite direction into contact with the inner closed end of the frame 40, as shown in Fig. 2. This channel member 58 preferably has bonded to its rear side a layer of elastomeric sponge material 60 extending into sealing engagement with the front surface of the foamed insulation 62, as shown in Fig. 2.

With this type of construction, should there be any necessity for the removal of either the refrigerant conduits 46 or 48 or the wiring 56, the rectangular frame 40 may be pulled away from the foamed insulation 62, as shown in Fig. 3, and the channel 58 removed from the frame 40 to expose the refrigerant conduits 46, 48 and the wiring 56. After the rectangular frame 40 is assembled to the shell and liner, the outer surface of the shell 36 and the frame 40 may be coated with a suitable decorative material such as enamel or lacquer.

The door 70 is provided with inwardly turned recesses 72 receiving the hinges 42. The door 70 is also provided with upper and lower slidable hinge pins 74 and 76 which slide toward each other into the hinges 42, as shown in Fig. 5. The hinge pins 74 are L-shaped and receive fastening screws 78 extending through the narrow slots 80 in the doors by which they are held in place.

The door 70 is provided with a handle 82 and a latch mechanism or keeper 84. Either the keeper or the latch mechanism may be used in alternative arrangements on the frame 40 and the door 70. The door 70 is also provided with a conventional door seal 88 contacting and sealing against the front face of the frame 40.

If a porcelain coated outer finish is desired, a metal outer shell 64 shown in Fig. 4 coated with porcelain having notches 66 or openings to allow the hinges 42 to protrude, may be slipped over the assembled rectangular frame 40 and the outer shell 36. It has an inwardly turned front flange 68 extending over and contacting the front surface of the top and sides of the rectangular frame 40. It also provides an aperture through which the latch keeper 44 may protrude. The wiring then is made accessible by removing this outer porcelain shell 64 and also the rectangular frame 40. In this way, cabinets may be made very economically using the foamed plastic insulation material as a structural material binding the inner liner 32 and the outer shell together to form an inexpensive self-supporting frameless cabinet element.

While the forms of embodiment of the invention as herein disclosed constitute preferred forms, it is to be understood that other forms might be adopted, as may come within the scope of the claims which follow.

What is claimed is as follows:

1. An insulated cabinet including a box shaped member having an open side and five insulated walls, a second open rectangular member of molded plastic extending around said open side and forming a face for the edge of said insulated walls, said second member being fastened to and aligned with said box shaped member on its open side, an insulated door for closing said open side, hinge means connecting an edge portion of said door and one side of said second member, refrigerating means for said cabinet including an evaporator within said cabinet and compressing and condensing means located outside said insulated walls and having refrigerant supply and return conduits extending from said compressing and condensing means through said second member to said evaporator, said second member having a passageway receiving said conduit means, a thermostat control switch mounted on

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said second member and electrical conductors extending to said switch and from said switch through said passage-way to said compressing and condensing means.

2. An insulated cabinet including a box shaped member having an open side and five insulated walls, a second open rectangular member of molded plastic extending around said open side and forming a face for the edge of said insulated walls, said second member being fastened to and aligned with said box shaped member on its open side, an insulated door for closing said open side, hinge means connecting an edge portion of said door and one side of said second member, a lighting apparatus mounted upon said second member directed to illuminate the interior of said cabinet, a door switch means mounted upon said second member, said second member having a passage extending from said switch means to said lighting apparatus, and electrical conductor means extending through said passage connecting to said lighting apparatus and said door switch means.

3. An insulated cabinet including a box shaped member having an open side and five insulated walls enclosing a compartment, a first open rectangular member extending around said open side at the front of said five walls, elastomeric material located between said first member and the five walls around said open side, said first rectangular member having a groove for receiving connections, a second open rectangular member forming the front facing edges of the cabinet and having a rearwardly facing cavity with its inner and outer walls enveloping said first member and said elastomeric material and the front edges of said five walls.

4. An insulated cabinet including a box-shaped inner liner having an open side, an outer shell including top and bottom and rear and side walls surrounding but spaced from said inner liner, said side walls extending below said bottom wall to form a compartment beneath the bottom wall, a self-sustaining insulating plastic foam material extending throughout the space between and being bonded to the adjacent surfaces of said inner liner and the outer shell throughout the space therebetween to form a unitary self-sustaining structure, an open rectangular one piece member of a molded plastic resin extending across and over the insulation at the front edges of said inner liner and outer shell and having integral flange portions extending within and in contact with the front portion of said inner liner and integral flange portions extending outside and over and in contact with the front edges of said outer shell, said one piece member being removable from said outer shell, a door for closing the front of said structure, and hinge means con-

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necting said door and said rectangular member of plastic resin.

5. An insulated cabinet including a box-shaped member having an open side and five insulated walls enclosing a compartment, a first open rectangular member extending around said open side at the front of said five walls, elastomeric material located between said first member and the five walls around said open side, said elastomeric material being bonded to one of said members, a second open one piece rectangular member generally U-shaped in the cross section having a face portion and integral inner and outer flange portions extending within and without the front portion of said box-shaped member and the elastomeric material and said first rectangular member, said first rectangular member having a portion in contact with said elastomeric material and forward projecting portions at both its edges extending into contact with the inner face of the front of said second rectangular member to provide a cavity extending along and between said first and second rectangular members, said second rectangular member being removable from said box-shaped member to provide access to said cavity.

6. An insulated cabinet including a self-sustaining box-shaped member having an open side and five insulated walls containing substantially rigid self-sustaining insulation including top and bottom walls and side walls extending below the bottom wall, a second open one piece rectangular member of molded plastic resin extending around said open side and forming a face for the front edge of said insulated walls, said second member being fastened to and aligned with said box-shaped member on its open side and extending below the bottom wall co-extensively with said side walls, an insulated door for closing said open side, hinge means connecting an edge portion of said door and one side of said second member, and an ornamental outer shell substantially coextensive with said top and side walls and extending over and covering said second member and said box-shape member.

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