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REFRIGERATION APPARATUS

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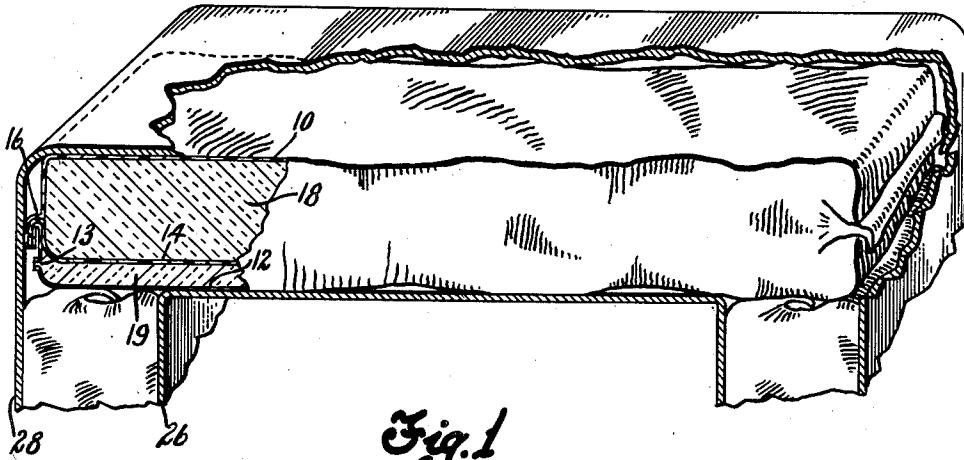


Fig. 1

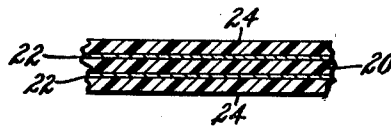


Fig. 2

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REFRIGERATION APPARATUS

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7 Claims. (Cl. 20—4)

This invention relates to a refrigerating apparatus and more particularly to an improved insulation for use in connection with the walls of refrigerators or the like which makes use of the insulating properties of a low heat conductivity gas confined within the hermetically sealed bag.

Related subject matter is disclosed in the co-pending applications Serial Numbers 496,525 filed March 24, 1955, and 517,581 filed June 23, 1955, and assigned to the assignee of the present invention.

One of the problems involved in utilizing a gas filled bag as an insulation medium which is placed between a pair of spaced walls, as for example, the inner and outer walls of a refrigerator cabinet, is that of allowing for the expansion of the gas therebetween due to changes in the external conditions of temperatures and pressure so as to prevent a rupture of the bag or a distortion or bulging of the walls. A further problem is to insure that substantially all of the space between the walls is occupied by an insulating material having a heat conductivity coefficient less than that of air, at all external conditions of temperature and pressure to which the apparatus may be exposed in use whereby a maximum insulating effect is obtained for a given amount of insulating space.

In general, one approach to overcoming the above problems is to interpose a quilt or layer of compressible insulation material between the bag and one of the walls so that as the gas filled bag expands, the quilt, due to its compressible nature, will take up the increased volume of the bag and thereby prevent subjecting the walls and the bag to undue pressure. It is highly desirable to associate the bag and the quilt so as to form a unitary insulation member and thereby avoid handling two or more separate insulation members in the assembly of the refrigerator apparatus.

It is an object of the present invention to overcome the above problems by providing a unitary bag having at least two side by side compartments, separated from each other by a common imperforate wall or membrane, charging one of the compartments with an insulating filler material and a gas of low heat conductivity and hermetically sealing the same, and incasing in the other compartment a cushion or layer of compressible insulation material. The outer wall of the gas filled compartment and the inner wall or membrane thereof are formed of a material or materials impervious to the passage of the insulating gas, air and moisture therethrough, and the outer wall of the other compartment is preferably substantially impervious to the passage of moisture therethrough but is sufficiently pervious to the passage of air to permit the compartment to "breathe" to equalize the pressure between the latter compartment and the atmosphere.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred form of the present invention is clearly shown.

Figure 1 is a perspective view with parts broken away showing a form of bag type insulation associated with the

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walls of a refrigerator cabinet. Figure 2 is an enlarged partial cross sectional view of a bag wall.

Referring now to the drawings, Figure 1 shows a preferred form of a bag insulation structure made in accordance with the present invention. It consists of a two-compartment bag having outer walls 10 and 12 and an intermediate wall 14, preferably heat sealed together at the edges thereof as indicated at 16. The compartment 18 formed by the outer wall 10 and the inner wall or membrane 14 is preferably filled with a porous solid insulation medium such as relatively loose rock wool or fiberglass and is further charged with a gas having a low heat conductivity coefficient such as dichlorodifluoromethane or sulfur hexafluoride, which is hermetically sealed therein. The wall 10 and inner membrane 14 are preferably formed of a flexible material which is impervious to the passage of the insulating gas, air and moisture therethrough.

The walls 10 and 14 may be advantageously made of a laminated structure as shown in Figure 2 wherein a thin filler or layer of Mylar 20 (a polyester of ethylene glycol and terephthalic acid) which is suitably impervious to the passage of the insulating gas, is coated on both sides with vapor deposited aluminum or other suitable metal 22 which in turn is coated with a thin layer 24 of a material impervious to the passage of air or moisture, such as polyethylene, Saran (a copolymer of vinyl chloride and vinylidene chloride) or Hycar vinyl (a mixture of vinyl chloride-vinyl acetate copolymer and butadiene-acrylonitrile copolymer). The laminated walls of this construction are suitably impervious to the passage of the insulating gas, air and moisture and may be readily heat sealed.

In the other compartment 19 is incased a suitable compressible, solid porous material such as a quilt or layer of rock wool or fiberglass, sponge rubber and the like. The outer wall 12 is preferably formed of a moisture impervious material such as polyethylene having one or more pinholes or breather openings as indicated at 13 which are of sufficient size to permit the passage of air and substantially prevent the passage of moisture therethrough. The materials used as the outer coatings of walls 10 and 14 and the wall 12 should, of course, be chemically compatible so that they may be readily heat sealed together.

It is to be understood that the insulation bag shown in Figure 1 is, in use, placed between rigidly spaced inner and outer walls 26 and 28 of a refrigeration cabinet or the like. It may readily be seen that when the bag wall 12 is disposed adjacent one wall 26 of the cabinet while the bag wall 10 is disposed adjacent the other cabinet wall 28, no appreciable air space is confined by the cabinet walls. Further should the gas in compartment 18 expand due to an increase in the surrounding temperature or a reduction of the atmospheric pressure, the increase in volume thereof is taken up by the compressible nature of the adjacent compartment 19 whereby undue stresses on the bag and the walls of the cabinet are effectively prevented. A bag made of the material described is relatively tough and able to resist being punctured during normal handling and assembly operations. However should additional protection be desired, the bag may be further incased in a suitable paper bag without materially increasing the cost thereof.

The insulation bag of the present invention has a basic advantage in being of relatively simple construction and being readily manufactured. In making the bag it is only necessary to form three layers of appropriate materials corresponding to the walls 10, 14 and 12 as described above, in the form of a pile, and heat sealing all but one edge thereof. After the two resulting compartments are suitably charged as described above, the remaining edge is heat sealed to form the completed insulation bag.

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In manufacturing the bag it is preferable that the compartment containing the insulating gas be filled and sealed before the insulation is placed in the compartment 19 so that the compartment 18 can be checked for leaks more conveniently.

It may also be seen that in some instances, particularly when a relatively thick insulation bag is required which is to be subjected to relatively extreme changes in temperature and pressure, a bag may be advantageously used having a plurality of compartments wherein a compressible layer is disposed in compartments on each side of the bag or as an intermediate compressible layer.

The bag insulation units of the present invention may be made of any suitable size so as to permit a convenient assembly of a given insulation structure and as shown in Figure 1, a plurality of bags are preferably arranged in edge to edge relationship.

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

What is claimed is as follows:

1. In a refrigerator, an outer wall, an inner wall, an insulation between said walls, said insulation comprising a unitary bag having at least two side by side compartments separated from each other by a common membrane, a first of said compartments containing a filler having voids and a gas having a thermal conductivity less than that of air filling said voids, said first mentioned compartment being formed of substance impervious to the passage of said gas, air and moisture therethrough, the other of said compartments incasing a compressible insulation material whereby said first mentioned compartment may expand against said other compartment, said other compartment having an outer wall thereof made of a material substantially impervious to the passage of moisture therethrough and having breather openings therein for equalizing the pressure between said other compartment and the atmosphere.

2. In a refrigerator, an outer wall, an inner wall, insulation between said walls, said insulation comprising the unitary bag having a first wall comprising polyethylene, and second and intermediate walls each formed of a plurality of layers including a layer comprising a polyester of ethylene glycol and terephthalic acid and a layer of material taken from the class consisting of polyethylene, vinyl chloride-vinylidene chloride copolymer and a mixture of vinyl chloride-vinyl acetate copolymer and butadiene-acrylonitrile copolymer, said second and intermediate walls forming a hermetically sealed first compartment, a filler in said first compartment having voids, said voids being filled with gaseous dichlorodifluoromethane, said first and intermediate walls forming a second compartment, said second compartment incasing a compressible insulation material whereby said first mentioned compartment may expand against said other compartment, said first bag wall having a breather opening therein for equalizing the pressure between said second compartment and the atmosphere.

3. In a refrigerator, an outer wall, an inner wall, insulation between said walls, said insulation comprising a unitary bag having a first wall comprising polyethylene, second and intermediate walls each formed of a plurality of layers including a layer comprising polyethylene and a layer comprising a polyester of ethylene glycol and terephthalic acid, said second and intermediate walls forming a first hermetically sealed compartment, a filler in said first compartment having voids, said voids being

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filled with gaseous dichlorodifluoromethane, said first and intermediate walls forming a second compartment, said second compartment incasing a compressible insulation material whereby said first mentioned compartment may expand within said other compartment, said first bag wall having a breather opening therein for equalizing the pressure between said second compartment and the atmosphere.

4. In a refrigerator, an outer wall, an inner wall, spaced from said outer wall, insulation between said walls, said insulation comprising a unitary bag having at least two side by side compartments separated from each other by a common membrane a first of said compartments being hermetically sealed and containing a loose inert fibrous filler material and a gas having a thermal conductivity less than that of air, said first compartment being formed of substance impervious of the passage of air, moisture and said gas therethrough, the other of said compartments enclosing a compressible vaporous material whereby said first compartment may expand toward said other compartment, said other compartment having an outer wall formed of a substance capable of substantially preventing the passage of moisture therethrough and having breather means for equalizing the pressure between said other compartment and the atmosphere.

5. Bag insulation adapted to be interposed between inner and outer walls of a refrigerator comprising a unitary bag having at least two side by side compartments separated from each other by a common membrane, a first of said compartments containing a filler having voids and a gas having a thermal conductivity less than that of air filling said voids, said first mentioned compartment being formed of substance impervious to the passage of the said gas, air and moisture therethrough, the other of said compartments incasing a compressible insulation material whereby said first mentioned compartment may expand against the said other compartment, said other compartment having an outer wall thereof made of a material substantially impervious to the passage of moisture therethrough and having breather openings therein for equalizing the pressure between said other compartment and the atmosphere.

6. Bag insulation adapted to be interposed between inner and outer walls of a refrigerator, comprising a unitary bag having a hermetically sealed compartment and a vented compartment separated by common flexible means, said sealed compartment containing a filler having voids therein and a gas in said voids having a thermal conductivity less than that of air, said vented compartment enclosing a compressible insulation against which said sealed compartment may expand.

7. An insulation structure comprising a pair of wall members arranged in spaced relation, an insulation member between said members, comprising an integral flexible bag having a hermetically sealed portion and a vented portion separated by common flexible means, said sealed portion containing a filler having voids and a gas in said voids, said vented portion incasing a compressible insulation whereby expansion of said sealed portion is relieved by said compressible insulation.

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