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Eliason

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[54] INSULATED WALL CONSTRUCTION

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[52] **U.S. Cl.** **52/232,** 52/309, 161/161, 264/45

[51] **Int. Cl.**.....**E04c 2/24**

[58] **Field of Search**.....52/404, 405, 407, 52/232, 309; 220/9 F, 9 LG; 264/45; 156/78, 79, 77; 161/159–161

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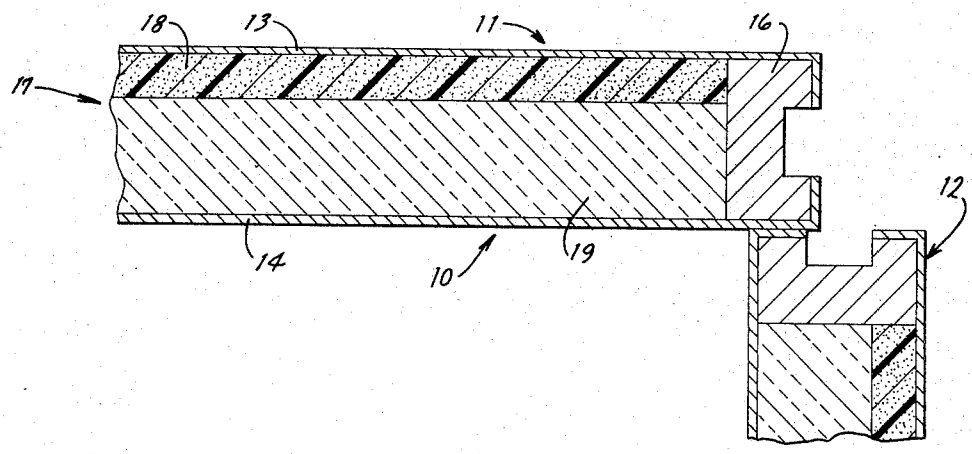
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Primary Examiner—John E. Murtagh
Attorney—Woodhams, Blanchard and Flynn

[57] **ABSTRACT**

An improved insulated wall construction, particularly preformed wall panels, having metal outer sheets spaced a predetermined distance apart and having heat insulating material disposed between and completely occupying the space between the metal sheets. The insulating material preferably includes at least a first layer of foamed plastic and a second layer of matted fiber glass positioned in parallel relationship between the spaced metal sidewalls. The layer of fiber glass preferably has an initial uncompressed thickness substantially equal to the spacing between the metal sheets but, during assembly of the panel, is compressed a substantial amount to occupy only a portion of the space between the sheets, the remaining portion of the space being occupied by one or more layers of foamed plastic. The compressed layer of fiber glass will readily expand to substantially completely occupy the space between the metal sheets in the event the foamed plastic layer is destroyed, as by a flash fire.

10 Claims, 6 Drawing Figures



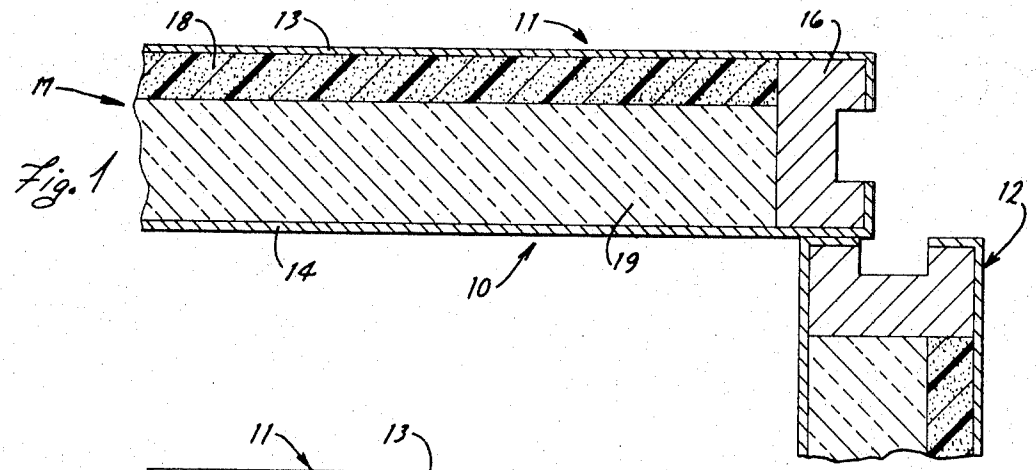


Fig. 1

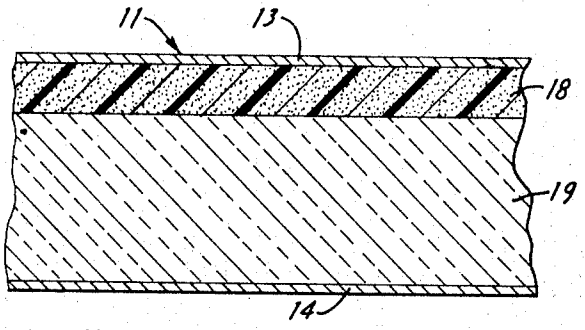


Fig. 3

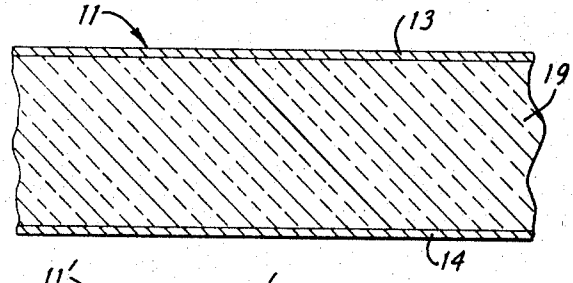


Fig. 2

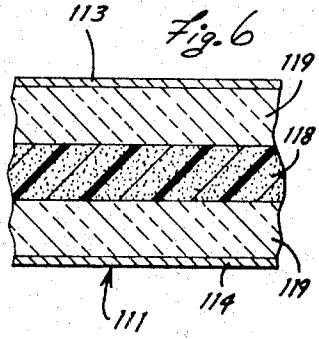


Fig. 6

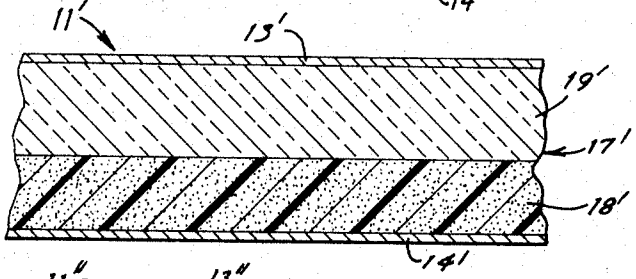


Fig. 4

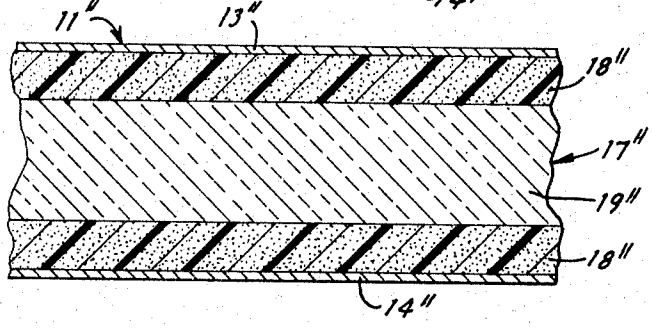


Fig. 5

INSULATED WALL CONSTRUCTION

FIELD OF THE INVENTION

This invention relates to an improved insulated wall construction and, in particular, to prefabricated panels having spaced apart metal side sheets or sidewalls and superimposed layers of foamed plastic and fiber glass positioned between and substantially occupying the space between the sidewalls for creating a thermal and moisture barrier.

BACKGROUND OF THE INVENTION

Various types of insulated wall constructions have been designed for residential and commercial buildings, and particularly for walk-in coolers of the type used in supermarkets, grocery stores and the like. Many known wall constructions have involved a layer of fiber glass disposed between a pair of spaced side sheets defining the space which is to be thermally isolated. However, in many use situations, such as walk-in coolers for storing meat and the like, the insulated wall construction must not only create an effective thermal barrier, but it must also create an effective moisture or vapor barrier. While insulated walls containing solely a layer of fiber glass do form an effective thermal barrier, they nevertheless do not form an effective vapor barrier and thus their use in walk-in coolers has been less than satisfactory.

Accordingly, in an attempt to provide an insulated wall construction which provides both a thermal and a vapor barrier, numerous wall constructions have been designed which utilize a layer of foamed plastic disposed between the interior and exterior side wheets. While foamed plastic does create an effective vapor barrier, it nevertheless does not result in the most efficient thermal barrier.

Also, utilization of foamed plastic as an insulating material can, in some circumstances, be extremely undesireable and harmful since foamed plastic will readily disintegrate if subjected to high temperatures, such as can occur during a flash fire. Also, the use of foamed plastic as a thermal insulating material does not enhance the fire proof characteristics of the construction inasmuch as foamed plastic is not fire resistant and accordingly does not create an effective fire barrier.

The use of foamed plastic as the sole insulating material for walls of coolers, particularly walk-in coolers, has not proven completely desireable since supermarkets and the like are subject to flash fires. Such fires, if located adjacent the cooler, can cause melting of the foam, thereby resulting in the insulating properties of the cooler wall being destroyed. Further, such flash fires often result in destruction of parts of the refrigeration system, namely, the motor or compressor of the system. If the walls of the cooler are not damaged by the fire, then very little heat will be transmitted into the cooler and the meat and assorted produce within the cooler can be maintained within the cooler for a substantial period of time, even though the refrigeration system for the cooler is inoperative. However, in the prior systems which have utilized foam filled walls, it has been discovered that the foamed plastic has melted during the flash fire, which thus destroys the insulating properties on the walls. In this situation, heat is rapidly transferred into the interior of the cooler and, accordingly, results in substantial loss and spoilage to

the meats and produce stored within the cooler. Alternately, in situations of this type, it has previously been necessary for all of the meat and produce within the cooler to be immediately transferred to a different cooler, which in itself is a costly and time consuming procedure.

Accordingly, it is an object of the present invention to provide an improved insulated wall construction which is capable of creating both a thermal and vapor barrier, while at the same time overcoming the above mentioned disadvantages as caused by the melting of a foamed plastic insulation layer.

Particularly, it is an object of the present invention to provide an improved insulated wall construction, particularly suitable for use in walk-in coolers, wherein the wall construction utilizes superimposed layers of foamed plastic and fiber glass disposed between the inner and outer side sheets for creating an effective thermal and moisture barrier therebetween, and wherein the fiber glass layer as installed within the wall is substantially compressed so that it has the capability of expanding to substantially totally occupy the space between the inner and the outer side sheets in the event the foamed layer melts.

A further object of the present invention is to provide an improved insulated wall construction, as aforesaid, which can be manufactured from prefabricated panels which have opposite sidewalls constructed from thin metal sheets and have the superimposed layers of fiber glass and foamed plastic disposed therebetween for creating the desired thermal and vapor barrier.

It is a further object of the present invention to provide an improved insulated wall construction for use in refrigerators and coolers, which wall construction provides effective thermal and vapor barriers, and which is also capable of being subjected to relatively high temperatures without effectively destroying the thermal barrier created by the wall, whereby the wall is effective in maintaining the interior of the cooler at the desired low temperature for a substantial period of time, even in situations where the refrigeration system for the cooler is inoperative.

These and other objects of the invention will be apparent to persons acquainted with structures of this type upon reading the following specification and inspecting the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary cross sectional view of an improved insulated wall panel constructed according to the present invention, particularly as same is applicable to a cooler or refrigerator of the walk-in type.

FIG. 2 is a fragmentary cross section of the wall illustrated in FIG. 1 after the occurrence of a flash fire which has caused melting of the foam layer.

FIG. 3 is a fragmentary cross sectional view of a modified wall construction according to the present invention.

FIG. 4 is a fragmentary cross sectional view of a further wall construction according to the present inventiOn.

FIG. 5 is a fragmentary cross sectional view of still a further modification of the wall construction according to the present invention.

FIG. 6 is a fragmentary cross sectional view of a further modification of the wall construction.

Certain terminology will be used in the following description for convenience in reference only and will not be limiting. For example, the words "rightwardly" and "leftwardly" will refer to directions in the drawings to which reference is made. Further, the words "inner" and "outer" will refer to the geometric center of the wall construction, and the words "interior" and "exterior" will refer to the sides of the wall construction as disposed within and without, respectively, of the cooler. Said terminology will include the words above specifically mentioned, derivatives thereof and words of similar import.

SUMMARY OF THE INVENTION

The objects and purposes of the present invention are met by providing an improved insulated wall construction which includes a pair of substantially parallel, spaced side sheets or sidewalls and suitable layers of insulating material disposed therebetween. The sidewalls are preferably constructed of sheet metal and are spaced a predetermined distance apart. Parallel, superimposed layers of insulating material are disposed between said sidewalls and preferably substantially totally occupy the predetermined distance between said sidewalls when the wall construction is assembled. The insulating material comprises a layer of foamed plastic and a superimposed layer of fiber glass, whereby said two layers create both a thermal and a vapor barrier. The fiber glass layer preferably has an initial uncompressed thickness substantially equal to the predetermined distance between said sidewalls. The layer of fiber glass is substantially compressed to occupy only a portion of said predetermined distance in the final assembled wall construction, with the remainder of said distance being occupied by the foamed plastic layer. The fiber glass layer, due to its compression, will readily expand to substantially totally occupy the predetermined distance between said sidewalls in the event the foamed layer melts. The wall construction is preferably formed as prefabricated panels, which panels can then be assembled and interconnected as desired to form a suitable insulated wall for a building, cooler or the like.

DETAILED DESCRIPTION

FIG. 1 illustrates therein an insulated wall construction **10** particularly suitable for use in the construction of walk-in coolers and the like. The wall construction **10** is preferably formed from a plurality of substantially identical prefabricated wall panels, such as the panels **11** and **12**.

Each wall panel, such as the panel **11**, has a pair of substantially parallel sidewalls **13** and **14** spaced apart by a predetermined distance. The sidewalls **13** and **14** will, for purposes of explanation, be referred to as the exterior and interior sidewalls, respectively. The sidewalls are preferably constructed from a thin metal material, such as **20** gauge sheet metal, and are spaced said predetermined distance apart by means of support members **16** which are disposed adjacent, and fixedly connected, to the edges of said sidewalls.

The interior of each panel is preferably provided with insulating means **17** disposed therein, which insulating means preferably provides both a thermal and a vapor barrier. The insulating means **17**, as illustrated in FIG. **1**, preferably includes a layer **18** of foamed plastic and a layer **19** of fibrous insulating material, such as fiber glass. The insulating layers **18** and **19** are preferably coextensive and parallel with the sidewalls **13** and **14** and have a thickness in the assembled condition at least equal to the predetermined spacing between the sidewalls so that the insulating means **17** will completely occupy and fill the space between the sidewalls.

In the finished panel, the fiber glass layer **19** preferably has an assembled thickness of at least approximately equal to one-half the predetermined distance between the sidewalls **13** and **14**. The fiber glass layer **19** is preferably formed from a mat of fiber glass which, prior to assembly of the panel, preferably has a relaxed uncompressed thickness at least substantially equal to the predetermined distance between the sidewalls **13** and **14**. During assembly of the panel, the fiber glass mat **19** is compressed a substantial amount to substantially reduce the thickness thereof, whereupon the resultant compressed mat **19** thus has a thickness substantially less than the predetermined distance between the sidewalls **13** and **14**. The remainder of said predetermined distance is occupied by the foamed plastic layer **18**.

The resultant panel construction, as illustrated in FIG. **1**, provides a highly desireable thermal insulation due to the low thermal conductivity of the fiber glass mat **19**. Further, the resultant assembled panel also provides a moisture or vapor barrier due to the low moisture transmission characteristics of the foamed plastic layer **18**. The foamed layer **18** is preferably constructed from either polyurethane or polystyrene since these materials provide the desired vapor barrier while also permitting ease of fabrication, economical manufacture and good thermal insulation at normal temperatures. However, other suitable foamed plastic materials could also be utilized.

In the embodiment illustrated in FIG. **1**, the foamed layer **18** is preferably positioned adjacent the exterior sidewall **13**, whereas the fiber glass layer **19** is positioned adjacent the interior sidewall **14**, which sidewall is positioned within the cooler or walk-in refrigerator. Positioning the foamed layer **18** adjacent the exterior sidewall prevents the ambient humidity or moisture of the environment, exteriorly of the cooler, from penetrating into the fiber glass, whereupon the desireable low thermal conductivity of the fiber glass is thus retained, thereby permitting the panel **11** to possess a minimum composite coefficient of thermal conductivity.

If the panel **11** is exposed to a relatively high temperature adjacent the exterior side thereof, such as would occur due to a flash fire disposed externally of the sidewall **13**, the temperature generated by the flash fire may be sufficient to cause the foam layer **18** to melt. The foamed layer **18** will either disintegrate or flow downwardly into the bottom of the panel thereby tending to leave a void or clearance between sidewall **13** and the fiber glass layer **19**. Such a clearance could destroy the thermal insulating properties of the panel, or could permit the fiber glass layer to collapse. However, since the fiber glass layer **19** is, during assembly, compressed so as to have a thickness substantially less

than its normal uncompressed thickness, the removal of the foamed layer **18** will permit the compressed fiber glass layer **19** to expand to substantially occupy the total space between the sidewalls **13** and **14**, substantially as illustrated in FIG. **2**. This expansion of the fiber glass layer thus results in the panel **11** retaining most of its thermal insulating properties, because the fiber glass layer continues to totally occupy the space between the sidewalls **13** and **14**. Thus, even though the foamed layer **18** may have disintegrated due to the occurrence of a flash fire, nevertheless the panel will still effectively act as a thermal insulator, and the fiber glass will additionally act as a suitable fire wall or barrier for preventing rapid spreading of the fire into the cooler.

In the embodiment illustrated in FIG. **1**, the foamed layer is illustrated as having a thickness of approximately 1 inch, whereas the compressed fiber glass layer has a thickness of approximately 2 ½ inches, which fiber glass layer is capable of expanding to occupy substantially the full 3 ½ inches between the sidewalls, if the foamed layer **18** should melt. However, in situations where it is desired to further increase the insulating properties of the wall, the thickness of the wall can be increased, such as illustrated in FIG. **3**, to permit an increase in the thickness of the compressed fiber glass layer **19**.

In the embodiment illustrated in FIG. **3**, the compressed fiber glass layer **19** is provided with a thickness of approximately 3 ½ inches, whereas the foamed layer **18** again has a thickness of approximately 1 inch, with the compressed fiber glass layer being capable of expanding to have a thickness of at least 4 ½ inches to totally occupy the space between the sidewalls in the event the foam layer melts.

FIG. **4** illustrates a wall panel **11'** which is similar to the wall panel **11** described above except that the panel **11'** has the foamed layer **18'** positioned adjacent the interior wall **14'** and the fiber glass layer **19'** positioned adjacent the exterior wall **13'**. Further, if desired, the foamed layer can constitute a larger portion of the overall wall thickness and, in the embodiment illustrated in FIG. **4**, the foamed layer is approximately 1 ½ inches thick and the compressed fiber glass layer is approximately 2 inches thick. However, the fiber glass layer **19'** is again compressed to a sufficient extent to enable it to expand and substantially totally occupy the space between the walls **13'** and **14'** for the reasons and under the circumstances explained above.

In some use situations, it may be desirable to provide a vapor barrier adjacent both sidewalls, and such a construction is illustrated in FIG. **5**. The panel **11''** illustrated in FIG. **5** is provided with a narrow foamed plastic layer **18''** positioned adjacent both of the sidewalls **13''** and **14''**, with a compressed fiber glass layer **19''** being sandwiched therebetween. The compressed fiber glass layer **19''** preferably has an uncompressed thickness at least substantially equal to the spacing between the sidewalls **13''** and **14''** so as to be capable of expanding sufficiently to totally occupy the space between the sidewalls in the event that either or both foamed layers **18''** should melt. The construction of FIG. **5** thus results in a wall having desirable low thermal conductivity characteristics, and also results in a wall which possesses a desirable moisture barrier adjacent each side of the wall for preventing transmission of moisture into the fiber glass from either side of the wall.

In the embodiment illustrated in FIG. **5**, each foamed layer **18''** has a thickness substantially less than the thickness of the compressed fiber glass layer **19''**. For example, each foam layer **18''** may have a thickness of approximately 1 inch, whereas the compressed fiber glass layer **19''** preferably has a thickness of approximately 2 ½ inches.

As is readily apparent from all of the above described embodiments, each insulated wall panel utilizes a fiber glass mat having a compressed thickness preferably greater than 50 percent of the spacing between the panel sidewalls and an uncompressed thickness substantially equal to the transverse spacing between the sidewalls. This desirable relationship thus results in the fiber glass mat being compressed to preferably less than 50 percent of its original unexpanded thickness, whereby the low thermal conductivity of the fiber glass mat is retained, while at the same time the mat will also freely expand back towards its original uncompressed thickness when the compression force thereon is relieved, such as would be caused by the melting of the foamed layer.

FIG. **6** illustrates a further variation of the present invention wherein the wall panel **111** has a foamed plastic layer **118** sandwiched between two fiber glass layers **119** which are disposed adjacent the interior and exterior sidewalls **114** and **113**, respectively. The two fiber glass layers **119** are each compressed to a sufficient extent that they are capable, when in their expanded condition, of totally occupying the space between the sidewalls.

The wall construction illustrated in FIG. **6** is highly desireable, particularly for use in refrigerators or coolers, wherein the exterior wall **113** is subjected to an ambient temperature which is highly variable, whereas the interior wall **114** is subjected to a rather low temperature which must be maintained fairly constant. Due to the provision of the fiber glass layer **119** adjacent the exterior wall **113**, which fiber glass layer functions as a first heat barrier, the exterior surface of the foamed layer **118** is maintained at a more uniform temperature and, accordingly, does not vary in accordance with the temperature variations of the ambient temperature adjacent the exterior sidewall **113**. The foamed layer **118**, which normally does not furnish as effective a thermal barrier as fiber glass, is thus maintained at a more uniform external temperature, whereupon the temperature differential across the foamed layer likewise remains fairly uniform, which in turn minimizes the temperature differential across the inner fiber glass layer. Thus, the temperature inside the cooler remains substantially constant and accordingly does not change even though the ambient temperature adjacent the exterior sidewall is subject to rather large and rapid fluctuations.

Under some circumstances, as where the width and height of a particular wall unit **10** are relatively large, it may be advantageous to furnish a brace structure for one or both sidewalls **13** and **14** of the wall unit in order, for example, to maintain a desired parallel relationship between said sidewalls.

The foregoing disclosure has referred to a layer **18** of foamed plastic which may be furnished in preformed

planks or by in situ foaming within the space between the layer **19** of fibrous material and the sidewall **13**, for example. The pre-compressed fibrous material will be held in the compressed condition by the foamed plastic furnished in either manner. Also, the expansion which occurs during the in situ foaming may be utilized to compress, or further compress, the fibrous layer for the reasons discussed above.

Although particular preferred embodiments of the invention have been disclosed in detail for illustrative purposes, it will be recognized that variations or modifications of the disclosed structures, including the rearrangement of parts, lie within the scope of the present invention.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. An insulated wall construction, comprising:

a pair of substantially parallel sidewalls spaced a predetermined transverse distance apart;

insulating means disposed between and substantially filling the space between said sidewalls to create an effective barrier for substantially restricting transmission of heat and moisture between said sidewalls;

said insulating means including a layer of foamed plastic disposed between said sidewalls in substantially parallel relationship thereto, said foamed layer having a thickness substantially less than the predetermined distance between said sidewalls; and

said insulating means also including a layer of compressed fibrous material disposed between said sidewalls in superimposed relation relative to said foamed plastic layer, said layer of fibrous material having a low coefficient of thermal conductivity and having an initial uncompressed thickness substantially equal to said predetermined distance whereby said layer of fibrous material is capable of expanding to occupy substantially the total space between said sidewalls in the absence of said foamed plastic layer.

2. A wall construction according to claim **1**, wherein said layer of fibrous material comprises a compressed mat of fiber glass.

3. A wall construction according to claim **1**, wherein said layer of compressed fibrous material has a thickness in the compressed condition greater than one half of said predetermined distance.

4. A wall construction according to claim **1**, wherein said foamed plastic layer includes first and second foamed plastic sublayers disposed adjacent each of said sidewalls, said layer of fibrous material being sandwiched between said plastic sublayers.

5. A wall construction according to claim **1**, wherein said layer of fibrous material includes first and second sublayers of fibrous material disposed adjacent the sidewalls, said plastic layer being sandwiched between said two sublayers of fibrous material.

6. A wall construction according to claim **1**, wherein said sidewalls comprise thin plate-like metal members.

7. A wall construction according to claim **1**, wherein said wall construction comprises a prefabricated lightweight panel;

wherein said sidewalls comprise thin plate-like metal members; and

wherein said layer of fibrous material comprises a mat of fiber glass.

8. A wall construction according to claim **7**, wherein said panel includes elongated rigid support members disposed between said sidewalls for maintaining same said predetermined distance apart, said support members being fixedly secured to and extending along the adjacent corresponding edges of said sidewalls, said insulating means being disposed between said sidewalls in the space bounded by said support members.

9. A wall construction according to claim **8**, wherein said layer of foamed plastic is selected from the group consisting of polyurethane and polystyrene.

10. A method of forming an insulated wall construction, comprising the steps of:

positioning a pair of sidewall means in spaced parallel relationship;

placing a layer of compressed, fibrous and fireproof material adjacent to and parallel with the inside surface of one of said sidewall means and spaced from the other sidewall means;

securing edgewall means to and between the lateral edges of said sidewall means; and

causing a plastic material to form a solidified foam substantially filling the space between said fibrous material and said other sidewall means, whereby said fibrous material is held in a compressed condition.

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