March 2, 1943. D. D. GRASSICK 2,312,987

HEAT INSULATING PANEL

Filed Nov. 15, 1939 2 Sheets-Sheet 1

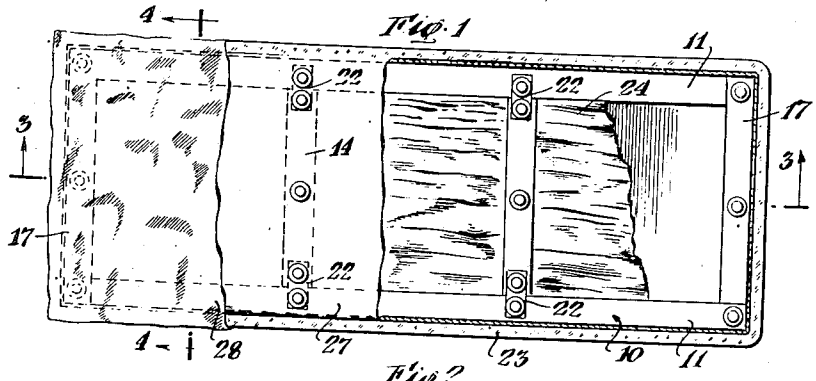


Fig. 1

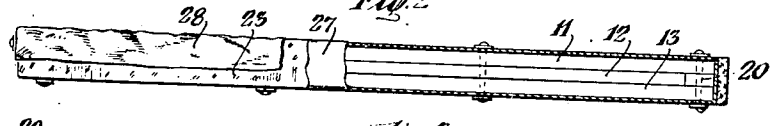


Fig. 2

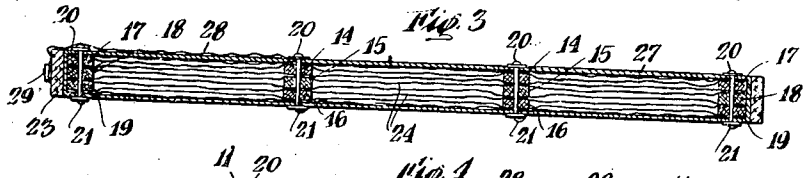


Fig. 3

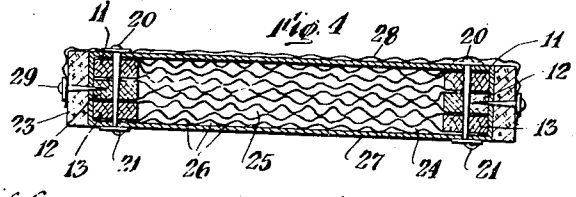


Fig. 4

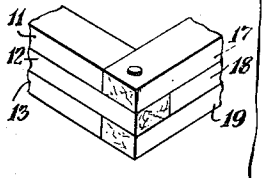


Fig. 6

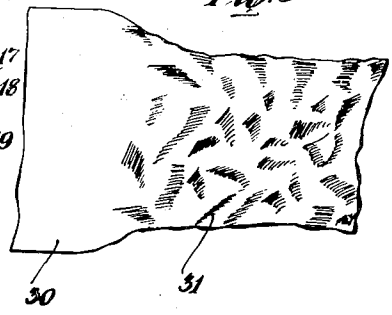


Fig. 5

INVENTOR.
BY Donald D. Grassick
Alan N. Mann
ATTORNEY.

Published by AsbestosClaims.Law
asbestosclaims.law/library/22596/1

March 2, 1943. D. D. GRASSICK 2,312,987

HEAT INSULATING PANEL

Filed Nov. 15, 1939 2 Sheets-Sheet 2

Fig. 7

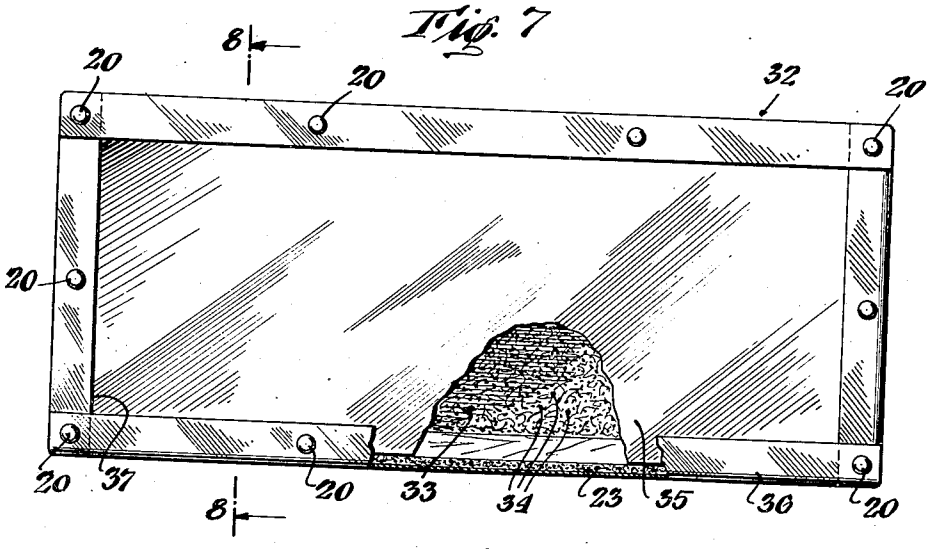


Fig. 8

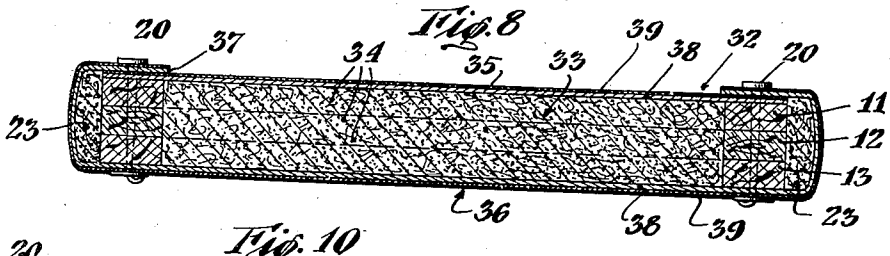


Fig. 10

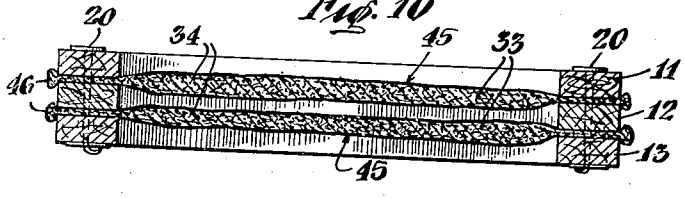


Fig. 9

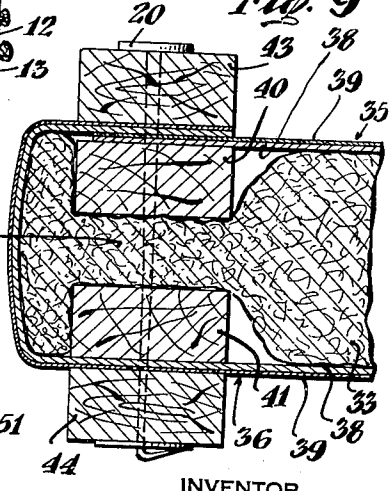
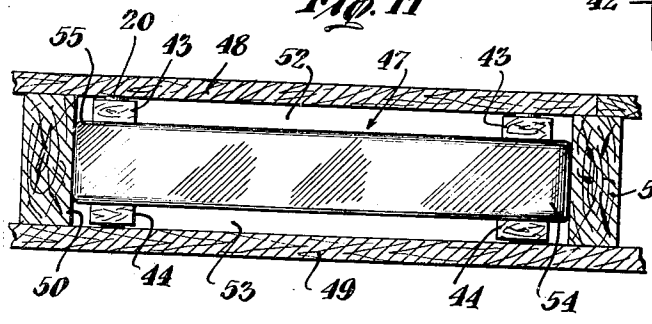


Fig. 11



INVENTOR

Donald D. Grassick

BY

Alan M. Mann

his ATTORNEY

Published by AsbestosClaims.Law

asbestosclaims.law/library/22596/2

Patented Mar. 2, 1943

2,312,987

UNITED STATES PATENT OFFICE

2,312,987

HEAT INSULATING PANEL

Donald D. Grassick, Chicago, Ill., assignor to Alfol Insulation Company, Inc., a corporation of Delaware

Application November 15, 1939, Serial No. 304,483

7 Claims. (Cl. 154—45)

This invention relates to heat insulating panels and more particularly to a prefabricated heat insulating wall panel for railroad cars, refrigerators, cold storage rooms and other similar constructions where it is desired to maintain certain temperature conditions. The panel is characterized by having an entire outer covering of metallic moisture-resistant heat reflective insulating material and by a distortable frame which houses the insulating material. These features make the panel especially suitable for use under conditions of excessive moisture and under conditions of wall deformation such as occur in railroad cars, which tend to distort the panel.

This application is a continuation in part of my copending application Serial Number 157,844 filed August 7, 1937.

The panel of this invention will be described with particular reference to its use in railroad cars but without limiting the invention thereto. The heat insulating constructions used heretofore in railroad cars comprise principally mass type of insulation filling the space between the inner and outer sheathings. This arrangement is subject to the disadvantages of absorbing and retaining the heat throughout the mass of insulation instead of reflecting the heat back upon its source, and to absorbing and retaining leakage water and atmospheric moisture which in sufficient amount will decrease the insulating efficiency of the material as much as 50% or more. The mass insulation filling the wall space also prevents circulation of air so that large quantities of the absorbed water are retained in the mass. Consequently damp rot of the insulating material and car framing will result.

Rigid board forms of insulation have also been tried but they are subject to being split or fractured under stresses caused by movements of the car.

Another prior form of installation for insulating the walls of a railroad car comprises sheets of metallic foil arranged vertically within the walls of the car. These sheets are normally attached to the studding and are spaced apart to provide dead air spaces between adjacent sheets. This arrangement is quite effective from the heat insulating standpoint but has the disadvantage of high cost of installation, which has seriously limited commercial use. Each of the sheets has to be installed separately and very carefully in view of the fragile character of the foil. An installation of this type in vertical walls requires about 15 hours for a crew of 4 men for each car. That is, a total of 60 man hours per car.

In accordance with my invention I have overcome the practical and commercial disadvantages and limitations of the above described prior arrangements and have produced a unitary prefabricated panel that is economical in construction and installation. This panel has an entire heat reflective surface and can be installed easily and quickly. For example, vertical walls of a railroad car may be completely insulated with these panels, which fit between the studding, in about one-half hour with a crew of 3 men. In other words, a total of 1½ man hours as compared with the above mentioned 60 man hours for the prior metal foil installations, or an effective reduction in labor of 97½%.

The panels of my invention are so shaped and made of such size that they may be quickly and easily installed between the studding or other confining members simply by pushing the panel between these members and without the necessity of nailing or otherwise fastening the panel to the enclosing members.

The heat insulating panel of my invention comprises a polygonal, skeleton type frame made of relatively light weight and a low heat conductivity framing strips which are joined together at their interconnections by pivoting means that give flexibility to the joints and permit some distortion of the frame. This type of construction relieves stresses such as might be caused by movements of a railroad car and thereby avoids splitting or fracturing of the frame. Enclosing within the skeleton frame and substantially coextensive with the width and length of the frame is a relatively flexible body of heat insulating material having an outer heat reflective metallic cover. This insulating body is held by the marginal frame and the metallic facing sheet and is sufficiently flexible and compressible to permit appreciable distortion and thereby relieve stresses which normally would be caused by the weave or torque or a railroad car and would normally tear or disrupt the insulating material. The metallic heat reflective facing sheet has sufficient excess material to permit flexing without tearing.

The insulating material which is housed by the marginal frame may be of any suitable type so long as it possesses the necessary flexibility to prevent damaging stresses. This insulating material may be composed entirely of metallic foil or similar sheet material having a heat reflective metallic surface; or the insulating mate-

rial may be composed of mass insulation covered by heat reflective metallic sheet material such as metallic foil. The mass insulation may be either in one body or may be divided up into several layers or blankets of the material and where desired each layer or blanket enclosed in a metallic foil envelope or cover. The mass insulating material may be one or a combination of the various known forms of this material such as hair-felt, glass wool, mineral wool, rock wool, cotton, etc.

In accordance with one commercially advantageous embodiment the heat insulating panel of this invention comprises generally a light weight frame made of laminated wood or fiber board and divided into sections by several cross spacer strips, and a plurality of spaced sheets of crumpled thin metal foil, or other suitable thin sheet material, located within the frame and extending the approximate length and width thereof. The air spaces between the adjacent metal foil sheets serve as barriers to the transfer of heat by convection and conduction, and the sheets themselves reflect back most of the incident radiant heat waves. The entire assembly of frames and foil sheets is advantageously completely enveloped with a sheet of strong paper and an outer jacket made of metal foil, the principal purpose of which is to reflect back towards its source the main portion of the radiant heat incident thereon, emanating from the car structure or from the air inside or outside the car. It also serves to prevent water vapor from entering the panel. The foil jacket is preferably fastened to the paper by adhesive to provide a combination foil and paper covering sheet.

Where installation and operation conditions permit the panel need not be covered with the protective paper mentioned above, and in some instances the outer metal foil cover may be eliminated where the insulating material within the panel has a heat reflective facing sheet. If an outer heat reflective cover is desired this may be used in the form of the above mentioned combined paper and foil or a heavy metal foil substantially thicker and more durable than the metal foil used within the frame. Whatever type of insulation is used in my panel I prefer to have both front and back faces of the panel provided with a metallic heat reflective sheet which will resist moisture penetration and will reflect heat rays incident thereto. Also, I prefer in installing the panels in the wall or floor or ceiling structure of the car to be insulated, to so arrange the panel between the inner and outer sheathings that dead air spaces will be provided between each face of the panel and the adjacent sheathing.

These dead air spaces in combination with the entire heat reflective cover or faces of the panel produce marked improvements in the heat insulating efficiency of the panel. By this arrangement equivalent insulative effect may be obtained in a given space with 1½ inches less thickness of insulation mass than with arrangements in which the mass insulating material fills the entire space between the sheathings.

The novel features of this invention are set forth with particularity in the appended claims. The invention itself, however, both as to construction of the panel and its use will be clearly understood from the following detailed description taken in conjunction with the accompanying drawings in which:

Fig. 1 is a top plan view of one form of the completed panel, partly broken away to show the sheets of covering materials and the inner metal foil sheets;

Fig. 2 is a side view of this panel partly broken away to show the several laminations and covering sheets;

Fig. 3 is a longitudinal sectional view taken along line 3—3 of Fig. 1;

Fig. 4 is a cross sectional view taken along line 4—4 of Fig. 1;

Fig. 5 is a plan view of a fragment of the thin metal foil sheets used in this panel;

Fig. 6 is a fragmentary perspective view showing the connection between side and end members of the panel;

Fig. 7 is a plan view of a modified form of panel employing a single body of mass insulation covered with a metallic facing sheet;

Fig. 8 is a sectional view taken along lines 8—8 of Fig. 7;

Fig. 9 is another modified form of panel in which the insulation material extends between the wood laminations at the edges of the frame to provide a self gasketing or cushioning effect, and furring strips are provided along the sides of the frame to act as spacers for the panel when installed in a wall structure;

Fig. 10 is another modified form of panel in which the insulation material comprises blankets of mass insulation each enclosed in a metallic covering sheet; and

Fig. 11 is a sectional view showing the adaptation of my panel to a wall structure with air spaces between each face of the panel and the opposing wall.

Referring now to the several figures in the drawing and at first to the form of panel shown in Figs. 1 to 6 inclusive, it will be seen that this panel comprises a laminated frame 10 having several laminations 11, 12 and 13 of wood or fiber board. Any number of these laminations may be used, or a single board frame may be employed. The frame 10 is divided into sections of the desired size by spacer strips 14 located transversely of the frame. These spacer strips may likewise consist of any desired number of laminations such as for example the three laminations 14, 15 and 16, shown in Fig. 3. The frame 10 has end portions made up of laminations 17, 18 and 19. Side frame laminations 11, 12 and 13 are attached to end frame laminations 17, 18 and 19 by interlapping as shown in Fig. 6. The several laminations used in the ends and in the spacer strips of this panel are held together by nail fasteners 20 which extend through holes in the laminations and have their ends bent back as shown at 21 to form a resilient, yet firm type of connection. The small metal or vulcanized fiber strips 22 are provided as connecting means for the spacer strips and frame members and as washers for the nail fasteners 20. This type of flexible connection between the frame members permits the frame to distort and thereby relieve stresses caused by movements of the railroad car.

The side and end surfaces of the entire frame 10 are preferably covered with a punched felt gasket 23 which enables the panel to be firmly installed in the car frame. This gasket is compressible and expansible within certain limits such that if the panel is constructed of a width and length slightly less than the space in which

Published by AsbestosClaims.Law
asbestosclaims.law/library/22596/4

it is to be installed, the gaskets will expand to fill this space. Also, they will compensate for any normal variation or unevenness in the dimensions of the car frame surrounding the panel, whereby a completely tight insulated joint between the edges of the panel and the framing of the car is obtained. The compressible feature of the gasket permits normal movement, sway or torque in the framing members of the car without any harmful compression of the fiber board panel frame. This frame itself is also flexible and compressible to a certain extent so that it may be forced into spaces in which rivet heads or other projections may protrude, without the necessity of cutting or fitting of the panel as would normally be required with the usual rigid type of insulation device.

Located within the panel frame 10 and extending the approximate length and width of the frame, are a number of heat reflective thin sheets shown at 24 in Figs. 1, 3 and 4. These sheets may advantageously be made of thin metal foil, such as aluminum foil. They may have a smooth flat surface but it is preferred that they be crumpled so that any contact between the several sheets is only point contact. This is illustrated at 25 in Fig. 4. This arrangement effects negligible conduction of heat by metal contact between the several sheets. An important feature of this arrangement of crumpled sheets is that they are properly spaced to provide heat insulating air spaces between adjacent sheets as shown at 26 in Fig. 4. These air spaces will provide resistance to the flow of heat from one metal sheet 24 to the adjacent sheet. The bright reflective surfaces of the metal sheets 24 serve to reflect back toward its source practically all of the radiant heat waves incident upon these surfaces.

The several metal foil sheets 24 are held in place in the panel by means of the laminated end portions 17, 18 and 19, laminated spacer strips 14, 15 and 16, and the laminated side frame 11, 12 and 13. As shown in Figs. 3 and 4 the metal foil strips 24 extend between the separate laminations of these end members, side frames and spacer strips. By using two metal sheets between adjacent laminations the necessary number of laminations is reduced accordingly. The intermediate laminated spacer or frame strips 14, 15, 16 may be made of wood or fiber board and may be located in the panel in such positions as to divide the panel into halves, thirds, quarters or any desired number of sub-divisions usually depending upon the length of the panel. In the usual case a sufficient number of these intermediate strips are used to restrict each of the sub-divisions to an area of about 3 or 4 feet square. For this size surface area the number of crumpled metal foil sheets 24 that may be used without sagging, tearing or settling, is given below; the number of sheets of metal foil varying with the depth or thickness of the panel:

Thickness	Number of sheets
1 inch	3
2 inches	5
3 inches	8
4 inches	10, etc.

The above described wood or fiber board frame with a suitable number of intermediate spacer strips and spaced metal foil sheets or other heat reflective sheets, is covered over its entire surface with a reinforced paper or fiber 27. The principal purpose of this covering is to envelop the entire panel assembly and to bind it into a semi-rigid unit; also to provide a base for the reflective metal foil jacket covering. This protective covering is preferably waterproof to retard seepage of water vapor. The structure of the panel is such that it permits air circulation within the panel which will tend to quickly evaporate any moisture condensation or water that may occur within the panel.

Covering the outside of this protective paper or fiber board sheet 27, is a non-porous jacket of metal foil 28. The metal foil jacket and the waterproof paper envelope or fiber board sheet may be applied separately and individually or in any pre-combined form. The purpose of the metal foil jacket 28 is threefold—namely, to reflect the major portion of the radiant heat incident upon the outer surface of the panel; to prevent passage of water in fluid or vapor form into the body of the insulation, and to create temperature conditions within the air space which will minimize condensation of moisture on the boundaries thereof.

In Fig. 5 a typical type of the metal foil sheet for use in the panel is shown in uncrumpled form at 30 and in crumpled form at 31. This crumpling may be effected by slightly wrinkling the flat metal foil sheet by hand and then pulling out the sheet to its new effective length. This crumpling establishes a large variety of formations and surfaces of different elevations in the sheet. The principal purpose of this crumpling is to provide the air space and point contact between sheets as described above in connection with Fig. 4. It also provides ample material to permit flexing with weave or torque of the car without strains or shearing of the material.

The fragmentary showing in Fig. 6 illustrates the single pin type of connection at the corner of the frame which lends itself to flexibility and permits distortion of the frame for the purposes described above.

In the modification shown in Figs. 7 and 8, the panel generally shown at 32 is similar to the panel shown in the preceding figures except for the insulating material in the panel and the cover for the panel. In this modification, the insulating material is a preformed bat or body of mass insulation shown at 33 and contains a resinous or other suitable binding material 34. The bat 33 is sufficiently preformed and held together by the binder 34 to be substantially self-sustaining. While it has a definite form it is nevertheless sufficiently compressible and flexible to give with the torque and weave of a railroad car and thereby prevent fracture or other harmful results normally caused by such stresses.

The panel 32 having the framing strips 11, 12 and 13 and the enclosed bat of mass insulation 33 is completely covered with the heat reflective cover or facing sheet indicated at 35 and 36. As shown, the facing sheet is made preferably in two parts, one of which is the heat reflective sheet 35 that covers the insulation material along one face of the panel; and the other is a similar heat reflective sheet 36 which covers the opposite face of the panel as well as the sides and end of the panel, and is folded around the marginal edges of the other face and overlaps the facing sheet 35 as indicated at 37 in Fig. 8. The two cover sheets 35 and 36 are held in place by the pins 20 at each corner of the panel and also along the sides and ends of the panel. None of these pins 20, however, prevents flexing of the panel.

The facing sheets 35 and 36 are preferably-

Published by AsbestosClaims.Law
asbestosclaims.law/library/22596/5

made of a paper base sheet 38, shown in Fig. 8, and an outer liner of heat reflective foil or the like 39 which is uniformly combined with the base paper sheet 38. This combined material has sufficient strength to protect the insulating material inside of the panel and to assist in holding the panel together as a unit. The heat reflective cover sheet 39 provides the desired heat reflective properties for the faces of the panel and provides a moisture barrier. These properties in combination with the insulating effect of the bat of mass insulation 33 produce a very efficient insulation unit or panel.

A convenient method for assembling the panel shown in Figs. 7 and 8, is to provide a jig or box of substantially the desired dimensions of the panel and line this box with the combined foil and paper sheet which is to form the cover sheet 36 of the panel. Next, the framing strips 11, 12 and 13 are placed within the liner and the bat of insulation 33 is placed inside of these framing strips. Next, the top cover sheet 35 is placed over the bat of insulation 33 and the top edges of the sheet 36 are then folded down so as to overlap the margin of the sheet 35. Finally the pin connectors 20 are driven down through the several laminations of cover sheet and framing strips. The end of the nail 20 is then turned down against a washer as shown, to form a substantial yet flexible connection.

Another modified form of panel is shown in Fig. 9 and is similar to the panel of Figs. 7 and 8 except that in this case the mass insulation 33 extends between the framing strips and provides on the outside thereof a mass of insulation which functions as a gasket or cushioning means when the panel is installed. By this arrangement the panel is self-gasketing and no separate gaskets such as shown at 23 in Fig. 7 need be used. As shown, the insulation 33 extends between the laminations 40 and 41 to form a relatively small mass of material 42. All of these elements are enclosed within the cover sheets 35 and 36 described above. Because of the reinforcements provided by the framing strips 40 and 41 which positively engage the insulating material 33 and help hold it in place, the material 33 may be of a substantially lighter density than that described above for Fig. 7 and need not have any adhesive binder. Also, if desired, the reflective cover sheets may be arranged directly around and in contact with the body of insulation 33 as indicated in Fig. 10.

Another characteristic feature of the form of panel shown in Fig. 9 is the provision of spacer or furring strips 43 and 44. These strips are provided to take the place of furring strips which would otherwise be used in the walls of the car to be insulated. These strips simplify the installation problems since they can be made of the proper dimensions to space the panel automatically in the desired location. They may be of the same general type and order of material used for the frame of the panel and as shown in Fig. 9 the strips 43 and 44 may be attached to the framing members by the pins 20. These furring strips also assist in holding the frame together and in supporting the body of insulation which may be relatively light weight and not self-sustaining.

In Fig. 10 there is illustrated a panel having a still different form of insulation. In this case the insulation comprises relatively thin preformed blankets of the mass material 33 which are enclosed in heat reflective envelopes 45 or have heat reflective surface sheets covering one or both sides of the blankets of insulation 33. These cover sheets 45 may be of the same type of cover sheet described above or may consist of only metal foil. As shown, the blankets extend between the laminations 11, 12 and 13 and provide cushioning bodies 46 which serve to self-gasket the panel. A slight excess amount of cover sheet 45 is used as indicated by the generally wavy lines representing this material so that these cover sheets may give with the movements of the car without tearing. One or any desired greater number of blankets may be used in this form of panel.

In Fig. 11 is illustrated an application of my panel to a wall structure which comprises two sheathings 48 and 49 separated by studding members 50 and 51. The panel 47 is located between the two sheathings or walls 48 and 49 in spaced relationship. The proper location of the panel 47 in this space is provided by the spacing members 43 and 44 described above in connection with Fig. 9. These members, as shown, space the panel 47 so as to provide dead air insulating spaces 52 and 53 on opposite sides of the panel between the panel face and the opposing wall. This dead air space adds materially to the insulating effect of the insulating material contained in the panel 47. The extensions of the panel shown at 54 and 55 illustrate the self-gasketing construction described above in connection with Fig. 9 and insure a tight but resilient fit of the panel in the wall space.

It will be understood that other forms of materials than those described above by way of example may be used in the construction of the panel of this invention so long as these materials conform to the principles of the invention set forth hereinabove. For example, the thin foil crumpled metal sheets 24 might be substituted by other suitable metal or non-metal sheets having heat reflective surfaces. Likewise the wood or fiber board materials used for the panel frame may be substituted by any other suitable light weight material for meeting the requirements of this invention. Where the frame members are not used as separators for the insulating material such as shown in Figs. 7 and 8, they may be made of a single thickness of material instead of laminations.

The term "polygonal" as used in the claims herein is used in the generic sense to cover a frame having three or more sides which may be straight or curved. In the usual practice the frame will be in the form of a quadrilateral, although variations in the form of cut-off corners, additional short sides, or other deformations of the strickly collateral structure may sometimes be required for fitting odd shaped spaces which are to be insulated.

Various other modifications occurring to those skilled in the art may also be made without departing from the scope of this invention. Some of the novel features of this invention are defined in the appended claim.

What I claim is:

1. A preformed, unitary, relatively flexible heat insulating panel adapted for insulating the walls of refrigerated railroad cars comprising a laminated frame of polygonal form made of several superimposed elongated pieces of relatively light weight and low heat conductivity material, the sides of said frame being joined together only at their interconnecting corners by pivoting means that give flexibility to the joints and per-

Published by AsbestosClaims.Law
asbestosclaims.law/library/22596/6

mit some distortion of the frame to relieve any stresses such as may be caused by movements of a railroad car, a plurality of crumpled sheets of heat reflective foil located within the frame and substantially coextensive with the length and width of said frame and held together only at their edges and at spaced intervals between contiguous laminations of said frame, at least two of said sheets of foil being held between contiguous laminations and the number of said laminations being no more than half the number of said foil sheets, said frame laminations supporting said sheets only along small areas but preventing sagging of the large unsupported areas of said sheets, said crumpled sheets having sufficient excess material to permit flexing and thereby relieve any stresses such as may be caused by weave or torque of a railroad car, without straining or shearing of said sheets and the crumpled formation of the sheets permitting touching each other only at pointlike contacts and providing between adjacent sheets insulating air spaces.

2. A heat insulating panel as defined in claim 1 in which the heat reflective foil sheets are made of crumpled aluminum foil.

3. A heat insulating panel as defined in claim 1 in which the panel is enclosed within a heat reflective sheet covering that restricts moisture condensation and tends to prevent transfer of heat into the panel and a compressible gasket is enclosed within said covering sheet adjacent the edges of the panel frame to insure a tight fit of the panel between framing members of a refrigerator car and to conform to normal weaving of a railroad car frame.

4. A preformed, unitary, relatively flexible heat insulating panel adapted for insulating the walls of refrigerated railroad cars, comprising a preformed bat of mass insulation covered with a heat reflective foil and a framework engaging the edge of said bat made up of relatively lightweight framing strips arranged to engage opposite faces of said bat and flexibly connected together by pivoting means to hold said bat in place but permitting distortion of the panel sufficient to conform with the weave and torque of a railroad car.

5. A heat insulating panel as defined in claim 4 in which the heat insulating material extends between laminations of the framing strips to provide on the outer surface of the panel a compressible means of insulating material adapted to act as a gasket for the panel.

6. A preformed, unitary, relatively flexible heat insulating panel adapted for insulating the walls of refrigerator railrod cars comprising a laminated frame of polygonal form made of several superimposed elongated pieces of relatively light weight and low heat conductivity material, the sides of said frame being poined together only at their interconnecting corners by pivoting means that give flexibility to the joints and permit some distortion of the frame to relieve any stresses such as may be caused by movements of a railroad car, a plurality of sheets of heat-reflective foil located within the frame and substantially co-extensive with the length and width of said frame but having a surface area greater than the internal dimensions of said frame so that excess foil is present to permit the frame to move without tearing the foil, such foil layers being held only at their edges and at spaced intervals between contiguous laminations of said frame and at least two of said sheets of foil being held between contiguous laminations, said frame laminations supporting said sheets only along small areas but preventing sagging of the intermediate areas of said sheets.

7. A structure as specified in claim 6 in which mass insulation is enclosed between adjacent layers of the heat-reflective foil.

DONALD D. GRASSICK.

Published by AsbestosClaims.Law
asbestosclaims.law/library/22596/7

CERTIFICATE OF CORRECTION.

Patent No. 2,312,987. March 2, 1943.

DONALD D. GRASSICK.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 5, second column, line 11, for the word "means" read --mass--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 6th day of April, A. D. 1943.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.