

June 23, 1953

P. TALMEY
REFRIGERATOR CAR

2,642,818

Filed Nov. 5, 1947

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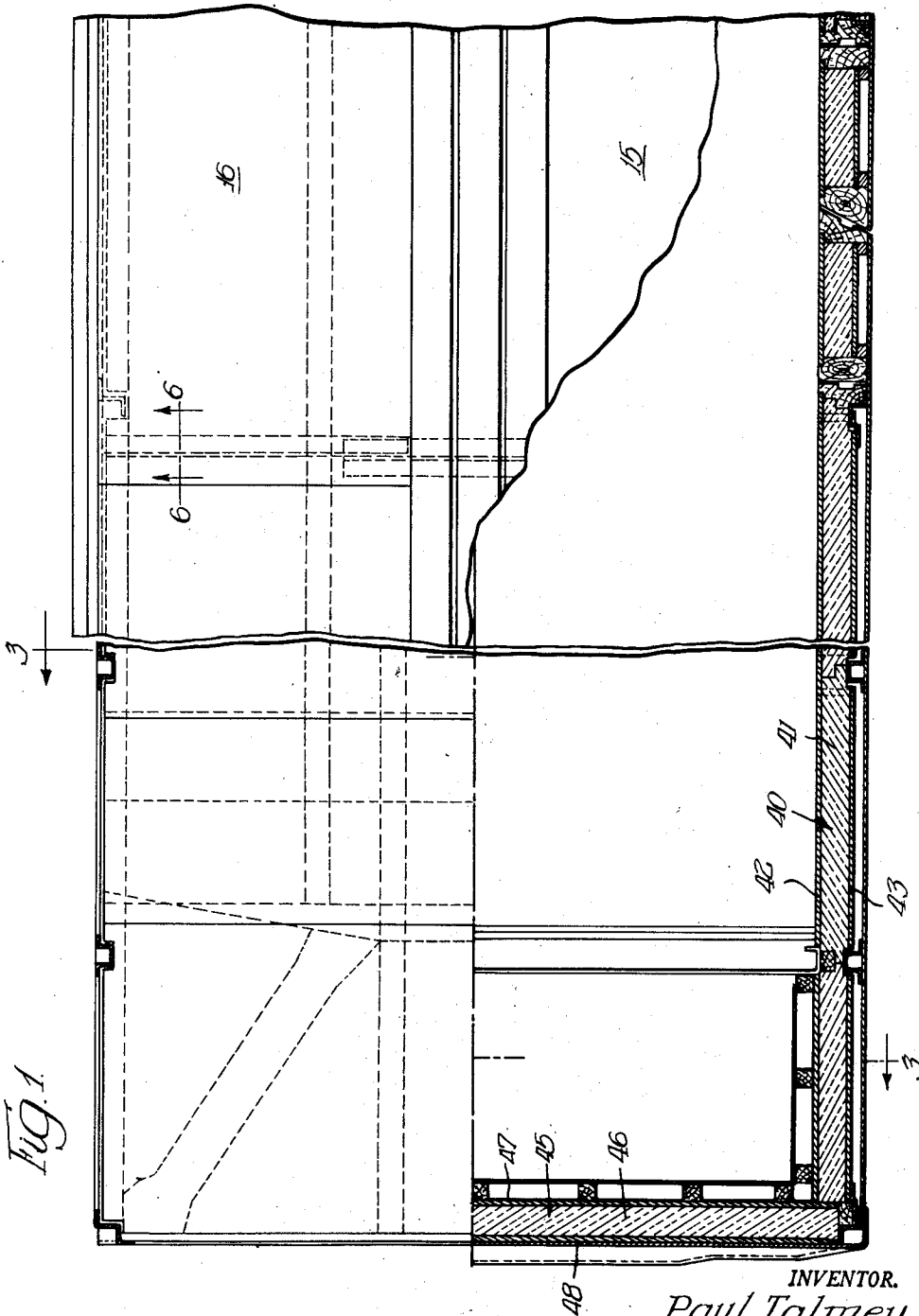


Fig. 1

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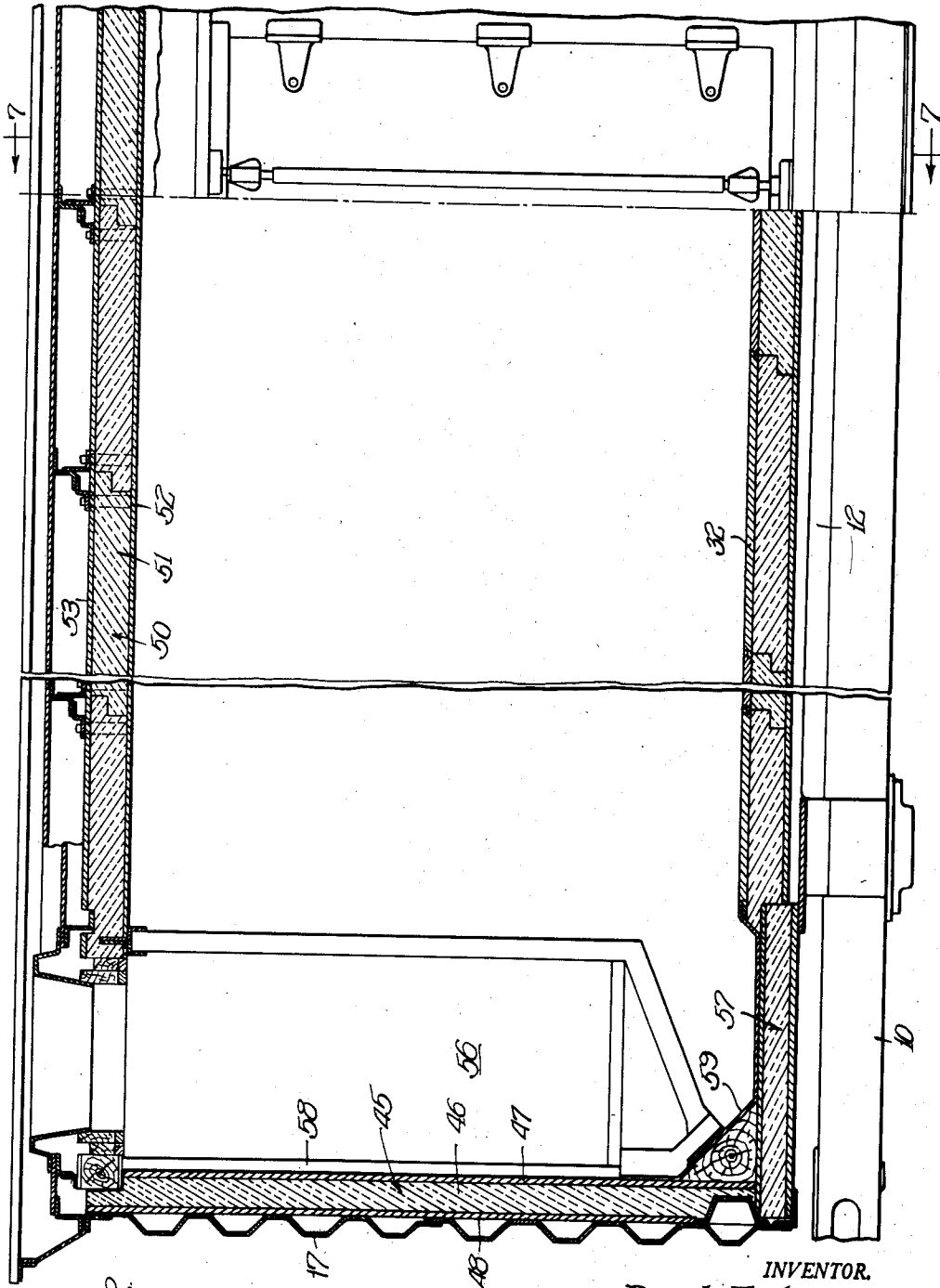


Fig. 2

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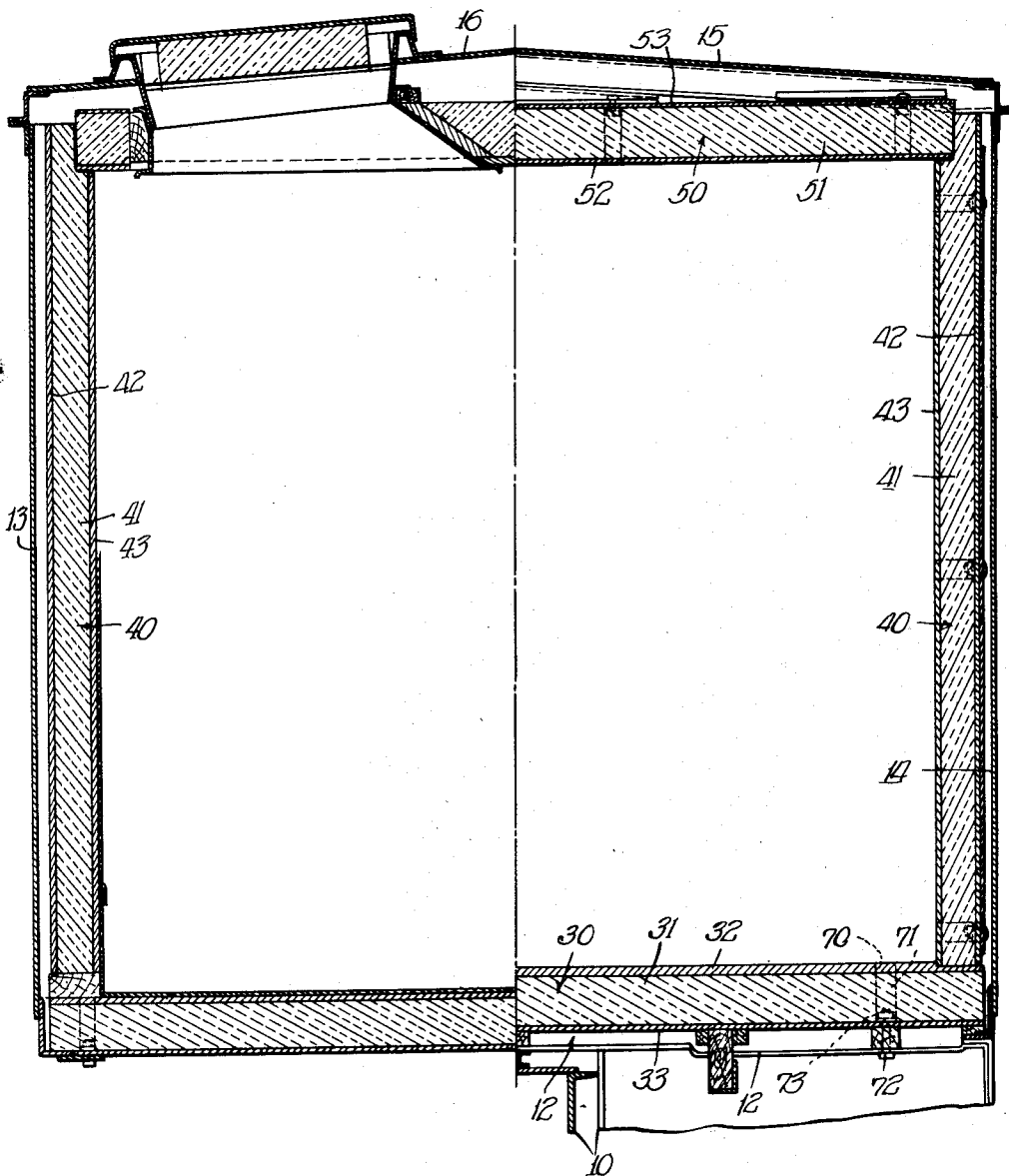
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Fig. 3



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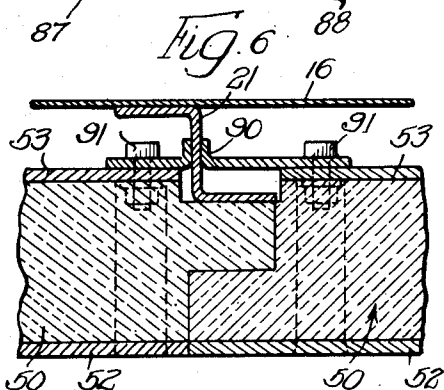
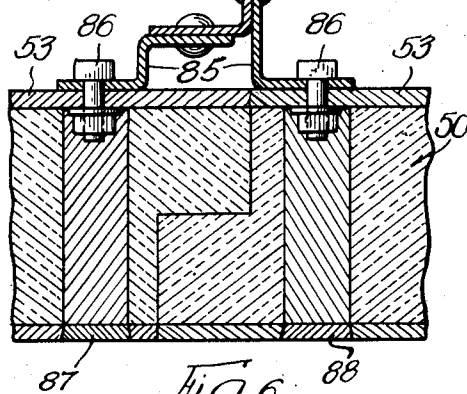
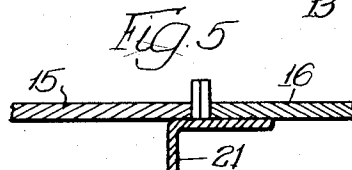
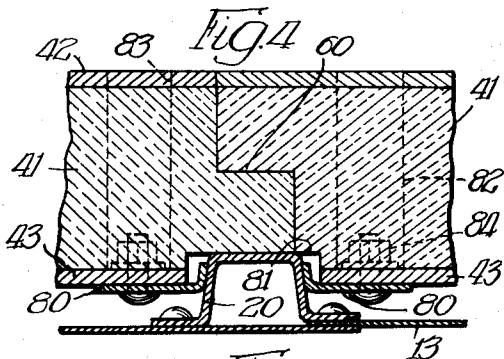
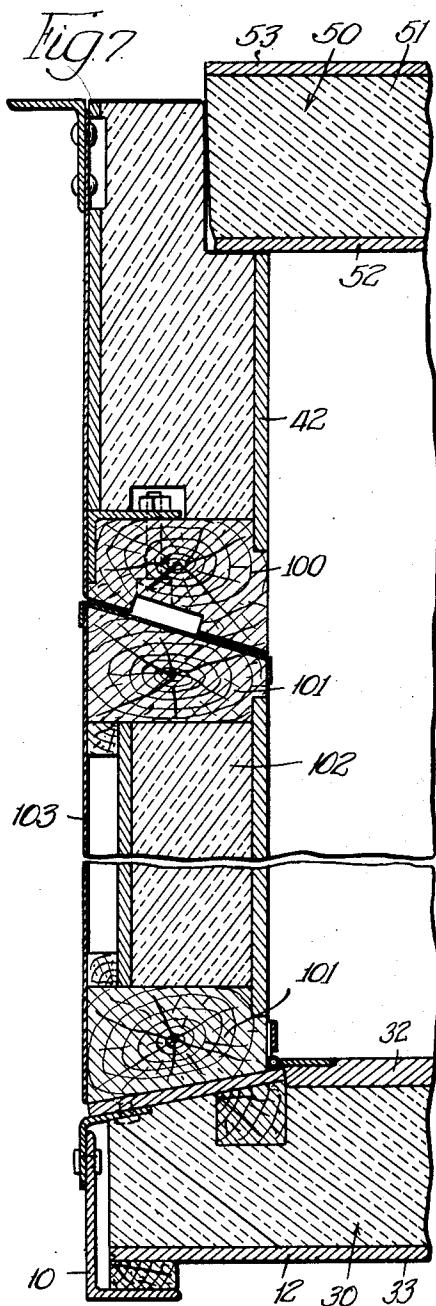
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4 Sheets-Sheet 4



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2,642,818

REFRIGERATOR CAR

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Application November 5, 1947, Serial No. 784,203

8 Claims. (Cl. 105—409)

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This invention relates to refrigerator cars and the like, and has for its principal object the provision of a new and improved device of this kind.

It is a main object of the invention to provide new and improved insulation for refrigerator cars and the like.

Another object of the invention is to provide within the car a continuous insulation of low thermal conductivity, uninterrupted by materials of higher thermal conductivity.

Another object of the invention is to provide an insulation sandwich of low thermal conductivity and having sufficient strength to enable it to support the load within the car.

Another object of the invention is to provide an insulation for a refrigerator car and the like that is both moisture- and vermin-proof.

Another object of the invention is to provide for insulating refrigerator cars and the like at low cost both as to initial cost and maintenance.

Another object of the invention is to eliminate the framing members formerly used to affix thermal insulation to the walls of a refrigerator car and the like.

Further objects of the invention not specifically mentioned here will be apparent from the detailed description and claims which follow, reference being had to accompanying drawings in which a preferred embodiment of the invention is shown by way of example, and in which:

Fig. 1 is a fragmentary view of a refrigerator car partly in section and with parts broken away to show the application of the invention thereto;

Fig. 2 is a fragmentary cross sectional view of the car taken substantially along the longitudinal median line thereof;

Fig. 3 is a transverse cross sectional view taken substantially along the line 3—3 of Fig. 1, looking in the direction of the arrows;

Fig. 4 is a fragmentary cross sectional view drawn to an enlarged scale and showing one method of attaching the insulation to the car shell;

Fig. 5 is a fragmentary cross sectional view taken along the longitudinal median line of the car and showing particularly the securing of the insulation ceiling to the roof of the car;

Fig. 6 is a view similar to Fig. 5, taken substantially along the line 6—6 of Fig. 1, looking in the direction of the arrows; and

Fig. 7 is a vertical cross sectional view through the door of the car taken substantially along the line 7—7 of Fig. 2 looking in the direction of the arrows.

Refrigerated freight cars, refrigerated trailer

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trucks and the like, usually consist of an outer shell frequently composed of metal and surrounding an inner shell that is spaced inwardly therefrom with the intervening space occupied by thermal insulation either in the form of a blanket, molded slabs or pellets. Generally the inner shell of the structure is composed of wood and is supported in spaced relation with respect to the outer shell by numerous brackets and/or framing members extending therebetween, which members invariably have a higher thermal conductivity than the insulation, with the result that heat losses are increased adjacent each of these members. When the blanket or other non-rigid type of insulation is used, it is necessary to fasten such insulation to the walls of the car with wooden framing members, which furnish additional conductive paths between the inner and outer shells.

In the prior art of which I am aware, numerous attempts have been made to remedy this condition, the most common being forming the insulation into separate layers and providing separate members; the one on the outer shell and the other on the inner shell, which members are staggered and connected together by material of relatively low thermal conductivity. While this arrangement materially increases the length of the path over which the heat must travel in entering or escaping from the car and thereby lessens the losses encountered when solid direct members are employed, the results are still far from ideal because the inner and outer shells are connected together at points having thermal conductivity that is higher than the main insulation. The present invention seeks to overcome this difficulty.

In the floors of prior art cars of which I am aware, it has been generally necessary to provide additional support since the insulating materials commonly used heretofore are so highly compressible as to make necessary the provision of load supporting brackets or joists for supporting the floor of the inner shell above the floor of the outer shell of the vehicle. In instances where supporting brackets have been omitted, the weight of the load has depressed the floor and thereby compressed the insulation to such an extent that its thermal conductivity has been materially increased.

The present invention provides for insulating the outer shell of structures such as refrigerator cars by means of a sandwich of insulating material, which sandwich consists of a central body of low thermal conductivity and of sufficient

strength in compression to enable it to support the load without the use of additional supporting means. Fixed to the inner and outer surfaces of this central body of insulation is a sheet of rigid material. These sandwiches cover the entire inner surface of the outer shell, that is the door, floor, roof, side walls and end walls thereof. The inner ones of the rigid sheets that are fixed onto the insulating central bodies provide a smooth inner shell for the vehicle, which inner shell is separated from the outer shell of the vehicle by a continuous band of insulation that is uninterrupted by paths of material of thermal conductivity higher than that of the insulation.

In one embodiment of the invention, the central body of insulating material consists of foamed plastic, such as polystyrene, expanded with a gasifying agent so that the resulting structure contains a myriad of tiny closed air cells. It is understood, of course, that any material having a comparatively rigid structure, high compressive strength, and a relatively high tensile strength combined with a low thermal conductivity constant, known as the "K" factor, could be employed in such a sandwich without departing from the spirit of the invention. Several other such materials are now available on the market such as foamed hard rubber and foamed urea formaldehyde for example.

The rigid sheets applied to the opposite faces of this central body of foamed polystyrene are, in the preferred embodiment, composed of plywood although one or both sheets could be of steel or plastic or any material that can be efficiently utilized for fastening members. These rigid sheets are fixed to the central body suitably by cement and the individual laminae of the sheets are fixed together by suitable cement, which cements are moistureproof so as to render the sandwich so formed relatively unaffected by moisture. The sandwiches used in the floor of the car contain on their upper surfaces a thicker rigid sheet also composed of plywoods which serves as an inner floor for the car. A particular advantage resulting from the use of these sandwiches, affixed to the external shell of the car in a manner to be subsequently described, is the elimination of the use of framing members needed to hold the insulation in place against the walls of the car. These members are the source of considerable heat loss no matter how low the thermal conductivity of the insulation. Cork and similar insulating materials might not require framing members but are impractical because of their high cost and excessive weight. Such materials can, however, utilize the teachings of this invention for assembly and installation.

Many refrigerator car designs call for a smooth exterior surface in the outer shell of the car, with the result that vertical posts extend from top to bottom of the car at frequent intervals on the inside surface of this outer shell. When such a car is insulated with sandwiches of the type employed in the present invention, the outer rigid sheets of the sandwiches are disposed in line with the inner surfaces of the posts, with the result that there is an air space or spaces between the insulation and shell of the car. Also the roofs of many cars are provided with rafter-like members, called "carlines," that depend downwardly into the interior of the car, in which case the insulation ceiling will be supported from these carlines with an air space above it and between it and the roof of the car. In other in-

stances where the inner surfaces of the outer shell are smooth, the insulation sandwiches will be placed directly thereagainst with no air spaces intervening.

Referring now to the drawings in more detail wherein a preferred embodiment of the invention is shown by way of example applied to a typical refrigerator car, it will be seen that the car comprises an underframe 10 supported on suitable trucks, not shown, and supporting a sub-floor 12 from the opposite edges of which side walls 13 and 14 extend upwardly, and are connected together by roof members 15 and 16. The ends of the car are closed in by end walls 17 all of which members in the example shown are assumed to be metal.

As will be seen in Fig. 4, the side walls 13 and 14 are composed of a plurality of individual sheets lapped together and riveted to posts 20 that extend from top to bottom of the car. As will be seen best in Figs. 2 and 5, the roof members 15 and 16 are supported by carlines 21 which depend therebelow. The particular details of the structure of the outer shell of the vehicle are not of the essence of the present invention.

The outer shell so formed is insulated in the preferred embodiment of the invention by sandwiches 30 laid on the floor 12 of the car and extending laterally thereacross into substantial abutment with the inside surfaces of the outer side walls 13 and 14. The sandwiches consist of a central body 31 composed of a rigid insulating material having a low K factor. Foamed polystyrene, as commercially available, for example, has a K factor in the order of .27; that is to say, the thermal conductivity of the material permits a layer of material one inch thick and one foot square to pass 27/100 B. t. u. per hour for each degree of temperature difference between the two surfaces of the material. The above given K factor is not substantially different from present available non-rigid insulation. Some of the advantages of this material which should preferably be possessed by the material used in the central body of such a sandwich, are high compressive strength, relatively high tensile strength, virtual resistance to insect infestation, almost complete impermeability to moisture and a low specific density. Fixed to the upper and lower surfaces of this material 31 are rigid sheets 32 and 33 which are of themselves preferably composed of material such as wood. As will be seen in Fig. 3, the upper rigid sheet 32 is substantially thicker than the lower sheet 33 and each is composed of several laminations of wood.

Similarly the inner faces of the side walls of the outer wall are insulated by sandwiches 40 which consist of a main central body 41 of rigid insulating material of low thermal conductivity to the opposite faces of which body rigid sheets 42 and 43 are attached. Sheets 42 and 43 may likewise be plywood. The end walls of the shell likewise are insulated by sandwiches 45 which consist of a central body 46 composed of similar insulating material, and to which facing members 47 and 48 are attached. The roof is insulated by sandwiches 50 each comprising a central body of similar insulation 51 with upper and lower facing 52 and 53 respectively, which facings may also be plywood.

As will be seen in Figs. 2 and 3 in the ends of the car, wherein is disposed the ice bunkers 56, the floor sandwich 57 is somewhat thinner than the main floor in the car. The interior surface of the bunker is lined by suitable material 58,

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such as metal, to protect it from damage that might result by dropping cakes of ice into the bunker. The floor of the bunker is equipped with a pan 59 through which water dripping from the melting ice is collected and drained out of the car through a suitable trap, not shown.

In order to facilitate handling, sandwiches are preferably made in a convenient width, say four feet, and these sandwiches are step-cut along opposite edges to form a so-called ship-lap joint, which permits breaking up the seams between adjacent members, thereby decreasing heat losses along those seams. As will be seen in Fig. 4, the central insulation 41 of the side wall panels is step-cut at 60 approximately along the transverse median line of the sandwich and the inner facing 42 is offset with respect to the outer facing 43 so as to form a typical ship-lap joint. The sandwiches used on the floor ends and roof of the car are similarly ship-lapped. If desired, a single sandwich extending from the center door to the end of the car may be substituted for the plurality of panels shown. As will be seen best in Fig. 2, the floor sandwiches wherein the upper rigid sheets 32 are of appreciable thickness may also be ship-lapped in this sheet 32 if desired.

The individual sandwiches disposed on the floor of the car are secured thereto in a manner best seen in Fig. 3. The upper facing 32 contains a perforation 70 that registers with a perforation 71 in the central body of insulation 31. A bolt 72 is extended up through the sill of the car and through the lower facing 33. A nut 73 is threaded onto this bolt to bind the sandwich to the floor 12 of the car. Several such bolts will be used in each of the sandwiches on the floor. After the nuts have been tightened down, the perforation 71 in the central insulating body 31 is filled with a plug which may be of the same material as the body and is cemented into place so as to remain fixed. If desired, in lieu of said plug, the perforation can be filled by pressure injection of the same or other insulating material in plastic form so as to create a tighter bond on hardening and also serve the purpose of cementing the nut on the bolt and prevent its working loose. In fact, any type of low K factor material can be utilized to plug and seal the perforation either as a formed plug forced and cemented into place, or otherwise forced into said opening. The perforation 70 in the upper facing 32 may be similarly plugged and sealed so as to render the floor smooth and free from perforations.

As will be seen in Fig. 4, in cases where the side walls of the vehicle contain vertically extending posts 20, brackets 80 are attached to these posts preferably by welding, and the edges of the central insulating material and outer facings of the sandwiches are cut away at 81 to fit over the post. The central body of insulating material is perforated as at 82 and the inner facing 42 contains a perforation 83 through which bolts 84 that extend through the brackets 80 and the outer facing 43 are accessible. After the nuts on the bolt have been tightened perforations 82 and 83 are blocked and sealed to render the side walls continuous and uninterrupted.

Roof members 15 and 16 of the outer wall are pitched to provide for drainage and the carlines 21 are appreciably thicker at the center of the car than at the edges. Preferably the ceiling panels 50 are disposed horizontally and equidistant from the floor and are attached to these carlines by brackets best seen in Figs. 5 and 6.

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At the center of the car, brackets 85 are attached to the carlines 21 by welding or riveting and are perforated to receive bolts 86 which extend through the upper facing 53 of the sandwiches. The nuts on the bolts are accessible through perforations 87 and 88 in the central insulation and lower facing respectively, which perforations are blocked and sealed after the bolts have been tightened.

Brackets 85 extend substantially below the lowermost section of the carlines 21. As will be seen in Fig. 6, the outer edges of the car brackets 90 are attached to the carlines 21 above the lowermost portions therefrom and extended laterally therefrom. Bolts 91 project through these brackets and the upper facings 53 of the ceiling sandwiches 50 to support the sandwiches thereagainst.

It will be noted that the side wall sandwiches rest upon the upper surfaces of the floor sandwiches 30 and are step-cut along their upper edges to permit the ceiling sandwiches to extend beyond the inner faces of the side wall sandwiches and that the end wall sandwiches are similarly located. As a result of this construction, the juncture line between floor and side wall and side wall and roof are in effect ship-lapped so that heat in passing through this joint must travel a path that is substantially longer than the straight line distance between the inner and outer facings of the sandwiches.

As will be seen in Fig. 7, the doors by which access to the car is obtained are framed with suitable members 100 with which the interior facings 42 are ship-lapped. The door itself consists of a suitable frame 101, generally rectangular and closed in by an insulation sandwich 102, which is of the same general construction as the other sandwiches. The outer surface of the door may contain a metal facing 103 if desired. The door frames and bunker hatch frames, if used, constitute the only places in the entire car where there is a direct path between the inner and outer shells that is filled with a material other than the main insulating material employed.

The car insulated in the foregoing manner has been found to have substantially lower heat losses than have prior art refrigerator cars. The main insulation combines a low thermal conductivity with great strength in compression, and when coupled in a sandwich with plywood the product is a very satisfactory insulation for structures of this kind. When composed of such materials cemented together by suitable moistureproof cement, the resulting structure is virtually impervious to moisture and vermin. The insulation is not fragile and not subject to packing by vibration or static loading of the car. Furthermore there is a considerable saving in weight, which is extremely important in this field.

While this type of insulation has been described as being used in sandwich form, additional savings in construction costs and weight are possible by omitting either one or both of the plywood sheets. That is to say, it is entirely feasible to apply the blocks of insulation directly to the shell of the car, having plywood facing only for the interior walls and ceiling of the car. With certain types of lading, even the interior of the car can be finished with the insulation itself. Foamed polystyrene, for instance, has sufficient structural strength to be bolted onto the shell of the car and have the perforations filled and sealed as above-described.

While I have illustrated a refrigerator car

with the invention applied thereto, I have done so by way of example only, as the invention may be applied to any structure wherein heat insulation is desired and wherein the temperatures encountered are within the range that materials employed are capable of withstanding. I have illustrated a specific embodiment of the invention for the purpose of illustration and there are many modifications and adaptations which can be made by one skilled in the art within the teachings of the invention.

Having thus complied with the statutes, and shown and described a preferred embodiment of the invention, what I consider new and desire to have protected by Letters Patent is pointed out in the appended claims.

What is claimed is:

1. The combination with a refrigerator car having an outer shell having internal posts and carlines, of a thermal insulation lining comprising: sandwiches composed of a sheet of multi-cellular material of high compressive strength, sheets of rigid fibrous material secured on the opposite faces of said multi-cellular material, brackets on the posts and carlines of the shell of the car against which the outer sheets of fibrous material are disposed, bolts extending through said outer sheets and brackets to secure the sandwiches to the brackets, said multi-cellular sheets and inner fibrous sheets being perforated to give access to the bolts, and plugs composed of the same materials as the sandwiches for plugging said perforations after the bolts have been tightened.

2. The combination with a refrigerator car having an outer shell having posts and carlines, of a thermal insulation lining comprising: insulation sandwiches each comprising a central body of multi-cellular heat insulation material of high compressive strength and rigid low thermal conductivity sheets secured to the opposite faces of said body; means securing said sandwiches to said posts and carlines, said means extending only through the outer ones of said rigid sheets, said central bodies and inner rigid sheets being perforated to render said securing means accessible from inside the car and lining, and low thermal conductivity plugs secured in the perforations to complete the insulating of said shell.

3. The combination with a refrigerator car having an outer shell having internal posts and carlines, of a thermal insulation lining comprising: sandwiches of insulation covering the sides, ends, ceiling and floor of the shell and disposed against the inside faces of said posts and carlines, said sandwiches each comprising a pair of rigid sheets of low thermal conductivity material with a body of lower thermal conductivity material of high compressive strength fixed therebetween, brackets fixed on said posts and carlines and abutted against the outer ones of said rigid sheets, bolts extending through said brackets and the outer ones of said rigid sheets to secure the sandwiches to the shell, said inner rigid sheets and said body of material containing perforations through which said bolts are accessible, and plugs composed of the same materials as said inner rigid sheets and body of material for plugging said perforations to render said body of material uninterrupted by material of higher thermal conductivity.

4. The combination with a refrigerator car which has a floor, roof and side and end walls comprising a shell for said car, of a thermal in-

sulation lining therefor comprising a hard surfaced sheet having bonded thereto a sheet of insulation material of low thermal conductivity, said material being sufficiently rigid to be self-supporting, and having sufficient strength in compression to withstand the pressure of the car-lading, means for securing said insulation to the inside shell of said car with the hard surfaced sheet forming the interior wall of the car, said means extending only partially through the insulation adjoining the shell of said car, the hard surfaced sheet and insulation material being counterbored to render said securing means accessible from inside the car and lining, and low thermal conductivity plugs for filling and sealing said perforations to provide a smooth and uninterrupted low thermal conductivity insulation lining for said car.

5. The combination with a refrigerator car which has a floor, roof and side and end walls comprising a shell therefor, and has internal posts and carlines, of a thermal insulation lining therefor consisting of a self-supporting substance of low thermal conductivity and high compressive strength, brackets on said posts and carlines, means for securing said insulation to said brackets, said means extending only partially through the said insulation, said insulation being counterbored to render said securing means accessible from the inner side thereof, and low conductivity seals for filling and closing the counterbores to complete the thermal insulation of said car.

6. The combination with a refrigerator car the like which has a floor, roof and side and end walls comprising a shell for said car, of a thermal insulation lining therefor composed of insulation sandwiches comprising two hard surfaced sheets having bonded therebetween a central sheet of insulation material of low thermal conductivity, said material being sufficiently rigid to be self-supporting and having sufficient strength in compression to withstand the pressure of the car-lading, means for securing said insulation sandwich to the inside face of the outer shell of said car, said means extending only through the outer sheet of said sandwich adjoining the said shell, the other of said outside sheets and the central sheet of insulation material being perforated to render said securing means accessible from inside the car and lining, and low thermal conductivity plugs for filling and sealing said perforations to provide a smooth and uninterrupted low thermal conductivity insulation lining for said car.

7. The combination with a refrigerator car having an outer shell supported by internal posts and carlines; of a laden supporting insulation lining therefor that is entirely free from members having thermal conductivity higher than that of the insulation, comprising: outer rigid wooden members disposed against said posts and carlines; bolts securing said members to said posts and carlines; slabs of rigid foamed polystyrene butted together and cemented to said outer members; and inner wooden members butted together and cemented to said styrene and forming the laden engaging inner facing of the car.

8. The combination with a refrigerator car having a floor and an outer shell supported by internal posts and carlines; of a laden supporting insulation lining therefor that is entirely free from members having thermal conductivity higher than that of the insulation, comprising: outer members of moisture resistant plywood

butted together and disposed against said posts, carlines and floor; bolts securing said members to said posts, carlines and floor; slabs of foamed polystyrene, which is non-fragile and has high compressive strength, butted together and cemented to said outer members with moisture-proof cement; and inner members composed of moisture resistant plywood butted together and cemented to said polystyrene with moistureproof cement.

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