Oct. 10, 1961 P. TALMEY 3,003,199

REFRIGERATOR CAR, OR THE LIKE

Filed May 16, 1957

FIG. 1

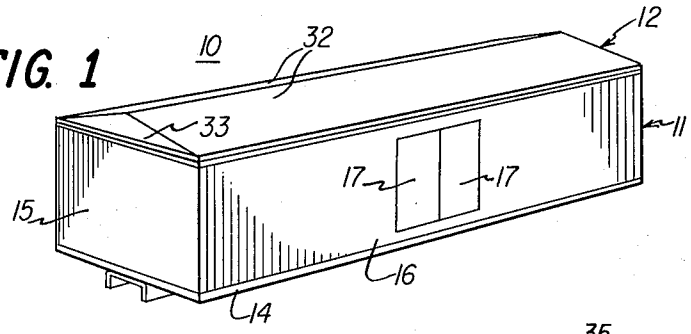


FIG. 2

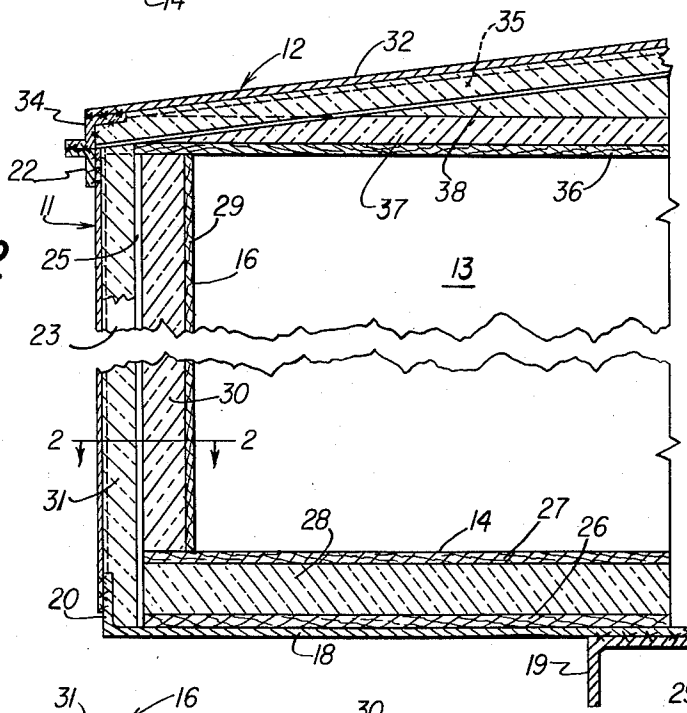
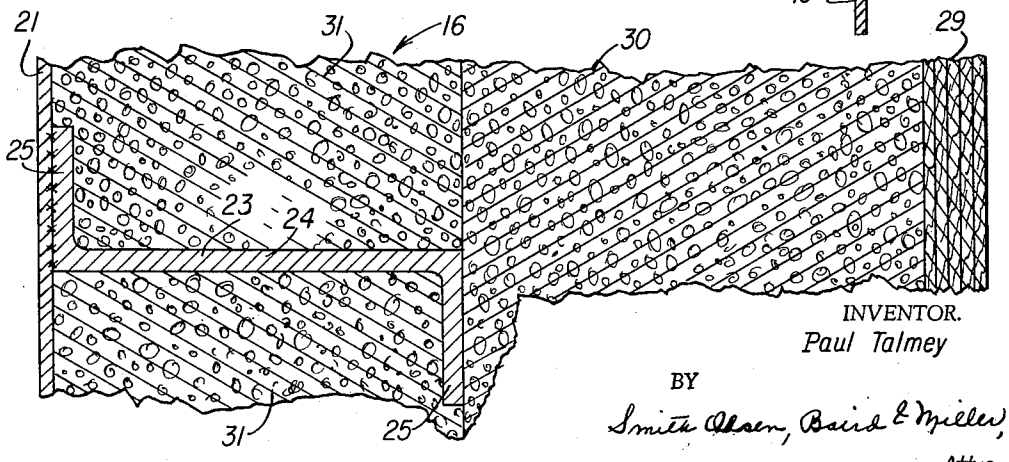


FIG. 3



INVENTOR.
Paul Talmey

BY
Smith Olsen, Baird & Miller,
Attys.

United States Patent Office 3,003,199 Patented Oct. 10, 1961

3,003,199

REFRIGERATOR CAR OR THE LIKE

Paul Talmey, Barrington, Ill., assignor to General American Transportation Corporation, Chicago, Ill., a corporation of New York

Filed May 16, 1957, Ser. No. 659,620
3 Claims. (Cl. 20—4)

The present invention relates to refrigerator cars, or the like and it is a general object of the invention to provide a refregerator compartment wall of improved construction that has an exceedingly low coefficient of heat transfer and that is of strong and integral structure.

Another object of the invention is to provide a composite structural wall of improved construction that serves the structure into which it is incorporated as a supporting wall, as an outside or weather wall, and as a heat-insulating wall.

Another object of the invention is to provide an improved composite structural wall of the character noted, wherein the wall may be erected or fabricated upon the site of the structure in which it is incorporated.

A further object of the invention is to provide an improved refrigerator compartment wall that involves a layer of synthetic organic resin that is molded in situ with respect to the other elements of the wall and that bonds together the other elements mentioned to produce an integral unified construction.

A further object of the invention is to provide an improved refrigerator compartment wall that involves a foamed layer of polyurethane, bonding together the other elements of the wall, and that is produced in situ upon curing of a corresponding mass of molding material that is injected into the spaces defined between the assembled other elements of the wall.

A still further object of the invention is to provide a railway refrigerator car body of improved construction and arrangement, wherein the car body comprises the assembly of only two principal subassemblies, each of integral and unitary structure, whereby the car body is of strong and rugged structure and is economical to manufacture.

Further features of the invention pertain to the arrangement of the elements of the refrigerator compartment wall, whereby the above-outlined and additional operating features thereof are attained.

The invention, both as to its organization and method of operation, together with further objects and advantages thereof, will best be understood by reference to the following specification taken in connection with the accompanying drawing, in which:

FIGURE 1 is a perspective view of a railway refrigerator car embodying the present invention;

FIG. 2 is an enlarged fragmentary lateral sectional view taken through the car of FIG. 1; and

FIG. 3 is a greatly enlarged fragmentary sectional view of the detail of construction of the side wall of the car body, taken in the direction of the arrows along the line 2—2 in FIG. 2.

Referring now to the drawing, the refrigerator car 10 there illustrated and embodying the features of the present invention comprises a body including assembled complementary lower and upper sections or subassemblies 11 and 12 defining a lading compartment 13 therein. The lower body section 11 comprises a floor panel 14, two end wall panels 15 and two side wall panels 16, each of the side wall panels 16 having a substantially centrally disposed doorway formed therein that is provided with a pair of cooperating doors 17. The floor panel 14 comprises a lower supporting plate 18, formed of steel or the like, and carried by a center sill 19, also formed of steel or the like, which center sill 19 carries trucks, not shown, that are provided with track-engaging wheels.

The marginal edges of the supporting plate 18 are provided with upwardly directed flanges 20; and the end wall panels 15 and the side wall panels 16 are provided with outside sheaths 21, formed of steel or the like, that are welded or otherwise secured at the lower edges thereof to the flanges 20. Also, the abutting edges of the sheaths 21 are welded or otherwise secured together at the corners of the lower body section 11 to provide a water-tight box-like structure. Further elongated steel angle bars 22 are welded or otherwise secured to the upper edges of the sheaths 21; and also the abutting ends of the angle bars 22 are welded or otherwise secured together at the corners of the lower body section 11 to provide a fully reinforced structure. Each of the end panels 15 and each of the side panels 16 is reinforced by a plurality of upstanding spaced-apart structural members or side posts 23, the side posts 23 preferably being in the form of steel Z-bars; the Z-bars 23 reinforcing each of the end panels 15 being arranged in laterally spaced-apart relation and interiorly of the associated sheath 21, and the Z-bars 23 reinforcing each of the side panels 16 being arranged in longitudinally spaced-apart relation and interiorly of the associated sheath 21. Of course, the Z-bars 23 are welded or otherwise rigidly secured to the associated sheath 21 for the reinforcing purpose. For example, as illustrated in FIG. 3, the Z-bar 23 is disposed inwardly of the sheath 21 and provided with a web 24 having oppositely directed arms 25 at the opposite ends thereof, one of the arms 25 being welded or otherwise secured to the adjacent sheath 21. Also the lower ends of the Z-bars 23 project down into the inside of the adjacent flange 20 and are welded or otherwise secured thereto so as to provide a reinforced structure extending from the supporting plate 18.

Also the floor panel 14 comprises lower and upper sheets 26 and 27 formed of a hard-surfaced material, such for example, as hardwood plywood, and an intervening layer 28 formed of material of rigid cellular structure, such for example, as a suitable foamed synthetic organic resin. Specifically, the layer 28 may be formed of foamed polystyrene. Accordingly, the floor panel 14 is of sandwich construction, the sheets 26 and 27 being intimately bonded to the opposite surfaces of the layer 28. Moreover, the sheet 26 is arranged in direct engagement with the supporting plate 18; while the sheet 27 defines the floor of the lading compartment 13. This construction is very advantageous as the sheet 27 provides a hard-wearing resilient floor for for the lading compartment 13; the layer 28 is of exceedingly high compressive strength; and the composite sandwich construction has an exceedingly low heat transfer factor.

The end wall panels 15 and the side wall panels 16 are of substantially identical construction; and as illustrated in FIGS. 2 and 3, the side wall panel 16 also comprises an inner sheet 29 formed of hard-surfaced material, such for example, as hardwood plywood, an inner layer 30 formed of material of rigid cellular structure, and an outer layer 31 formed of synthetic organic resin of cellular structure. The layer 30 is intimately bonded to the adjacent surface of the sheet 29 and engages the adjacent arms 25 of the side posts 23; while the layer 31 is intimately bonded to the adjacent surface of the sheath 21 and embeds the side posts 23. Also, the layer 31 is intimately bonded to the layer 30 at the meeting surfaces thereof. The layer 30 is formed of a suitable foamed synthetic organic resin, such, for example, as polystyrene; while the layer 31 is formed of a suitable foamed polyurethane resin, such, for example, as a polyester cross-linked with urethane groups. Accordingly, the side panel 16 is of sandwich construction, the sheath 21 and the

sheet 29 being intimately bonded to each other through the intermediary of the layers 30 and 31 that are intimately bonded to each other. Moreover, the sheet 29 defines one of the side walls of the lading compartment 13. This construction is very advantageous as the sheet 29 provides a hard-wearing resilient side wall for the lading compartment; the layers 30 and 31 are of exceedingly high compressive strength; and the composite sandwich construction has an exceedingly low heat transfer factor.

The upper body section 12 comprises two pitched roof sheaths 32 formed of steel, or the like, and welded or otherwise secured together at the longitudinally extending crest of the roof, and two structural triangular end sheaths 33 formed of steel, or the like, and welded or otherwise suitably secured to the roof sheaths 32 at the opposite ends thereof so as to provide a watertight inverted dish-like structure. Also, the upper body section 12 comprises a marginal flange surrounding the roof sheaths 32 and the end sheaths 33 and formed of steel structural members 34 that are substantially Z-shaped in cross-section, the eave edges of the roof sheaths 32 being supported upon the Z-bars 34 and welded or otherwise secured thereto, and the lower edges of the end sheaths 33 being welded or otherwise secured to the adjacent Z-bars 34; whereby a reinforced structure is provided. The roof sheaths 32 are reinforced by a plurality of laterally extending and longitudinally spaced-apart structural members or carlines 35, the carlines 35 preferably being in the form of steel Z-bars. The carlines 35 are disposed interiorly with respect to the roof sheaths 32 and one arm of each of the Z-bars 35 is welded or otherwise rigidly secured to the adjacent roof sheath 32 for the reinforcing purpose. Each of the carlines 35 comprises two sections, the upper ends of which are suitably welded or otherwise secured together, and the lower ends of which engage the associated Z-bars 34 and are welded or otherwise rigidly secured thereto, so as to provide a rigid reinforced structure.

Also the upper body section 12 comprises a ceiling sheet 36 formed of hard-surfaced material, such, for example, as hardwood plywood, an inner layer 37 formed of material of rigid cellular structure, and an outer layer 38 formed of synthetic organic resin of cellular structure. The layer 37 is intimately bonded to the adjacent surface of the sheet 36 and engages the lower portions of the adjacent arms of the carlines 35, the outer portions of the layer 37 being notched to receive the adjacent portions of the carlines 35; while the layer 38 is intimately bonded to the adjacent surface of the roof sheaths 32 and embeds the carlines 35. Also the layer 38 is intimately bonded to the layer 37 at the meeting surfaces thereof. The layer 37 is formed of a suitable foamed synthetic organic resin, such, for example, as polystyrene; while the layer 38 is formed of a suitable foamed polyurethane resin, such, for example, as a polyester cross-linked with urethane groups. Accordingly, the upper body section 12 is of sandwich construction, the sheet 36 and the roof sheaths 32 being intimately bonded to each other through the intermediary of the layers 37 and 38 that are intimately bonded to each other. Moreover, the sheet 36 defines the ceiling of the lading compartment 13. This construction is very advantageous as the sheet 36 provides a hard-wearing resilient ceiling for the lading compartment 13; the layers 37 and 38 are of exceedingly high compressive strength; and the composite sandwich construction has an exceedingly low heat transfer factor.

In manufacturing the railway car 10, the lower and upper body sections 11 and 12 are separately fabricated and are then assembled to produce the finished car. In making the lower body section 11: the supporting plate 18 is welded to the center sill 19; the side posts 23 are erected about the perimeter of the supporting plate 18 and welded thereto and to the flanges 20; the sheaths 21 are erected about the perimeter of the supporting plate 18 and welded to the side posts 23 and to the flanges 20; thereby producing the reinforced outer steel shell of the lower body section 11. The floor panel 14 may be built in sections that are subsequently placed upon the supporting plate 18 and secured together using ship-lap joints therebetween; and more particularly, each section of the floor panel 14 is fabricated by intimately bonding the sheets 26 and 27 to the opposite surfaces of the preformed layer or slab 28 of foamed polystyrene, utilizing a suitable cement. The sections of the floor panel 14 are then placed in the lower car body 11 and secured together to provide the unified floor panel 14. In this arrangement, the opposite ends of the sections of the floor panel 14 engage the adjacent arms 25 of the side posts 23; whereby the opposite ends of the section of the floor panel 14 are spaced from the adjacent sheaths 21 by the webs 24 of the side posts 23, as illustrated in FIG. 3. In the arrangement, the joints between the different sections of the floor panel 14 extend laterally across the car 10 from side to side thereof.

The end wall panels 15 and the side wall panels 16 are fabricated in a substantially identical manner in a plurality of sections that are subsequently placed within the car 11 upon the floor panel 14. More specifically, each of the side wall panels 16 comprises a pluralityy of sections that are separately fabricated; and more particularly, the sheet 29 is intimately bonded to the adjacent surface of the preformed layer or slab 30 of foamed polystyrene utilizing a suitable cement.

The sections of the side wall panel 16 are then placed in the lower car body 11 upon the floor panel 14 and adjacent to the side posts 23 so that the sheet 29 faces the interior of the lading compartment 13 and so that the exposed surface of the slab 30 engages the flanges 25 provided upon the car post 23. The plurality of sections of the side wall panel 16 are thus assembled and secured together utilizing ship-lap joints therebetween so as to produce the composite side wall panel 16. Of course, at this stage of the assembly the sections of the side wall panel 16 must be suitably blocked in place from the interior of the compartment 13, as they are not otherwise secured to the side posts 23. The assembly of the end wall panels 15 proceeds in the manner of the side wall panels 16, as described above; whereby the floor and the two end walls and the two side walls of the lading compartment 13 are thus defined.

At this time, the foamed molding material that is productive of the polyurethane resin upon curing is injected under pressure into the spaces disposed about the perimeter of the end wall panels 15 and the side wall panels 16 so as substantially completely to fill these spaces embedding the side posts 23. For example, with respect to the side wall panel 16, the foamed molding material produces upon curing the layer 31 of polyurethane resin that is intimately bonded to the side posts 23, to the adjacent sheath 21 and to the adjacent surface of the slab 30, the layer 31 extending down between the flange 20 and the adjacent end of the floor panel 14 and bonded to the adjacent ends of the elements 26, 27 and 28. After curing of the polyurethane resin, the blocking structure may be removed from the interior of the lading compartment 13, as the end wall panels 15 and the side wall panels 16 are now intimately bonded to each other and to the floor panel 14; whereby the lower body section 11 is finished and ready for assembly with respect to the upper body section 12.

In making the upper body section 12, the roof sheaths 32, the end sheaths 33 and the Z-bars 34, together with the car lines 35 are suitably welded together to provide the substantially pan-like steel shell thereof. The ceiling panel is also fabricated into a number of sections that are ultimately introduced into the upper body section 12 and secured together employing ship-lap joints therebetween. More particularly, each section of the ceiling panel is produced by securing the sheet 36 to the adjacent surface of the preformed foamed layer or slab 37 of polystyrene employing a suitable cement. Laterally

spaced-apart notches are formed in the opposite ends of the slab 37 to receive the carlines 35; and then the sections of the ceiling panel are introduced into the shell of the upper body section 12 and secured together. At this time, the foamed molding material that is productive of the polyurethane resin upon curing is injected under pressure into the space disposed between the slab 37 and the shell of the upper body section 12 and between the carlines 35 so as substantially completely to fill the space and to embed the carlines; whereby upon curing of the polyurethane resin the layer 38 is produced that is intimately bonded to the roof sheaths 32, to the end sheaths 33, to the carlines 35 and to the adjacent surfaces of the slab 37, including the surfaces of the notches formed therein. The ends of the layer 38 extend into contact with the Z-bars 34 and are bonded thereto producing an integral construction of the upper body section 12.

Thereafter the upper body section 12 is inverted and placed upon the lower body section 11 so that the flanges of the Z-bars 34 rest upon the flanges of the angle bars 22, and are suitably welded in place. Before welding of the adjacent flanges provided on the members 34 and 33, a suitable cement may be placed upon the elements 36 and 38 disposed about the perimeter of the Z-bars 34 so that these parts are cemented to the ends of the engaged elements of the end wall panels 13 and the side wall panels 16. For example, with reference to the side wall panels 16, the ends of the elements 38 and 30 may be cemented to the adjacent surface of the element 36 and the end of the element 31 may be cemented to the adjacent surface of the element 38. Accordingly, at this time, a unitary car body is produced of the separately fabricated body sections 11 and 12; and in the construction of the railway car 10, the engaging insulating panels are intimately bonded to each other so as to produce in effect a single unified insulating lining for the composite steel shell of the railway car 10 and bounding the lading compartment 13.

The fabrication of the doors 17 that are provided in the doorways formed in the side wall panels 16 is substantially the same as that of the sections of the side wall panels 16, as described above; whereby the description of these steps is omitted in the interest of brevity. Of course, these separately fabricated doors 17 are hung and arranged when closed properly to seal the doorways formed in the side wall panels 16, in the usual manner.

Reconsidering the molding of the polyurethane resin layers 31, 38, etc., it is pointed out that a large variety of molding materials may be employed, as the system is predicated upon the reaction of polyisocyanate and water to liberate carbon dioxide, while simultaneously the polymerization and cross-linking reactions between the polyisocyanate and the polyester entrap the liberated carbon dioxide; whereby no external blowing or foaming agent is required. Moreover, the resin is self-curing, since the reactions are exothermic and take place at room temperature. When the ingredients are mixed employing some water, the reactions are initiated producing the carbon dioxide gas and the resulting foam; however, suitable catalysts (amines) are ordinarily added to the ingredients to accelerate the reactions and to reduce the curing time. For example, the curing time of a typical molding material can be reduced from about ten hours to about one to two hours by the addition of an appropriate amount of urea. Also the polyesters (alkyd resins) and the polyisocyanates should be selected so as to control the density of the resulting polyurethane resins, as a rigid (or at least a semi-rigid) foamed structure is desired in the present case. Fortunately, the density of the polyurethane resin may be controlled over a wide range from about 1.5 to about 40 lbs./cu. ft. by controlling the amount of water employed, the amount of catalyst added, and particularly by selecting the polyisocyanate used for cross-linking; and in general, it is noted that the diisocyanates produce linear polymers of relatively low density and rigidity, while the triisocyanates and higher polyisocyanates produce more highly cross-linked polymers of relatively high density and rigidity. In the present case, a suitable polyurethane resin (condensation product) may be produced that is formed essentially of copolymers of a polybasic carboxylic acid and as adipic acid and a polyhydric alcohol such as glycerol cross-linked with naphthyldiisocyanate and some diphenoltriisocyanate.

These polyurethane resins are highly desirable in the present case because of the great compressive strength, the high tensile strength, the high impact resistant characteristic, and the exceedingly low heat transfer factor thereof, together with the circumstance that they are self-curing at room temperature and may be readily molded in situ, so as substantially completely to fill all of the space into which the foamed molding material is injected. The complete elimination of air pockets or spaces in the heat-insulating wall is very advantageous as it prevents the circulation of convection air currents therein, with the result that the coefficient of heat transfer of the heat-insulating wall is greatly reduced. Moreover, these resins being of the thermosetting type can withstand temperatures up to 350° F., without damage thereto, which gives ample margin for any high-temperature conditions that may exist immediately adjacent to the sheaths of the wall panels, when the refrigerator car is in daytime use in certain desert areas of this country in the summer months. Furthermore, these resins possess the peculiar characteristic of forming tenacious bonds with almost any kind of material in contact therewith during the curing reactions, and including steel, wood, other resins, etc., whereby the structural strength of the car is increased by the distribution or spreading of the bulge stress on the sheaths thereof.

In view of the foregoing, it is apparent that there has been provided a refrigerator compartment wall of improved construction and arrangement, that is of unitary sandwich construction, exceedingly strong, and characterized by an exceedingly low heat transfer factor, as well as a railway refrigerator car provided with such walls.

In the appended claims, it is intended that the expression "refrigerator compartment wall" shall embrace any wall thereof, including a floor wall and a ceiling wall and a door wall thereof, as the end wall and the side wall thereof.

While there has been described what is at present considered to be the preferred embodiment of the invention, it will be understood that various modifications may be made therein, and it is intended to cover in the appended claims all such modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. A refrigerator compartment wall of composite sandwich construction comprising a rigid outer metal sheet and a rigid inner plywood sheet arranged in spaced-apart relation, and self-supporting heat-insulating inner and outer layers arranged in the space between said sheets and substantially filling the same, said two layers being disposed in contact with each other and intimately bonded together, said outer layer being disposed in contact with said outer sheet and intimately bonded thereto, said inner layer being disposed in contact with said inner sheet and intimately bonded thereto, said outer layer being formed essentially of polyurethane and having a cellular structure and a high compressive strength and being separated from said inner sheet by the thickness of said inner layer, said inner layer being formed essentially of polystyrene and having a cellular structure and a high compressive strength and being separated from said outer sheet by the thickness of said outer layer.

2. The refrigerator compartment wall of composite sandwich construction set forth in claim 1, wherein said outer layer comprises an in situ formed mass of foamed

polyurethane and said inner layer comprises a preformed slab of foamed polystyrene.

3. In a refrigerator, heat-insulating walls defining a refrigerated compartment; at least one of said walls being of sandwich construction and comprising a rigid outer metal sheet and a rigid inner plywood sheet arranged in spaced-apart relation, a number of metallic structural reinforcing members arranged in the space between said sheets and disposed in spaced-apart relation with respect to each other, said members engaging said outer sheet and secured thereto and spaced outwardly from said inner sheet, a self-supporting heat-insulating slab arranged in the space between said sheets and engaging said inner sheet and intimately bonded thereto and spaced inwardly from said outer sheet and engaging said members, said slab being formed essentially of polystyrene and having a cellular structure and a high compressive strength, and a self-supporting heat-insulating layer arranged in the space between said sheets and engaging said outer sheet and intimately bonded thereto and spaced outwardly from said inner sheet and embedding said members and intimately bonded thereto, said layer being formed essentially of polyurethane and having a cellular structure and a high compressive strength, said slab and said layer engaging each other and intimately bonded together and cooperating with said members to fill the space between said sheets, said slab being separated from said outer sheet by the thickness of said layer and said layer being separated from said inner sheet by the thickness of said slab.

References Cited in the file of this patent

UNITED STATES PATENTS

2,047,133	Christianson	July 7, 1937
2,577,279	Simon	Dec. 4, 1951
2,730,772	Jones	Jan. 17, 1956
2,869,336	Smidl et al.	Jan. 20, 1959

FOREIGN PATENTS

C9891	Germany	Feb. 9, 1956