April 21, 1959 C. B. NELSON ET AL 2,882,701

REFRIGERATING APPARATUS HAVING COLD AIR JACKET

Filed Dec. 7, 1954 4 Sheets-Sheet 1

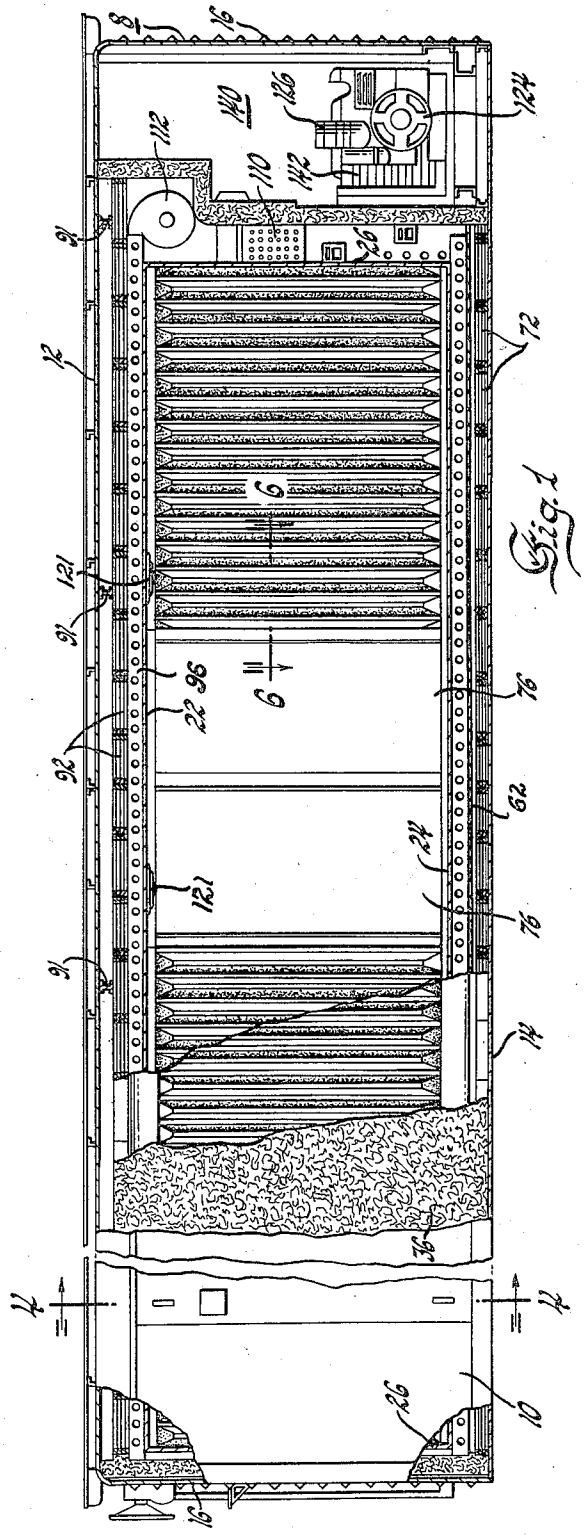


Fig. 1

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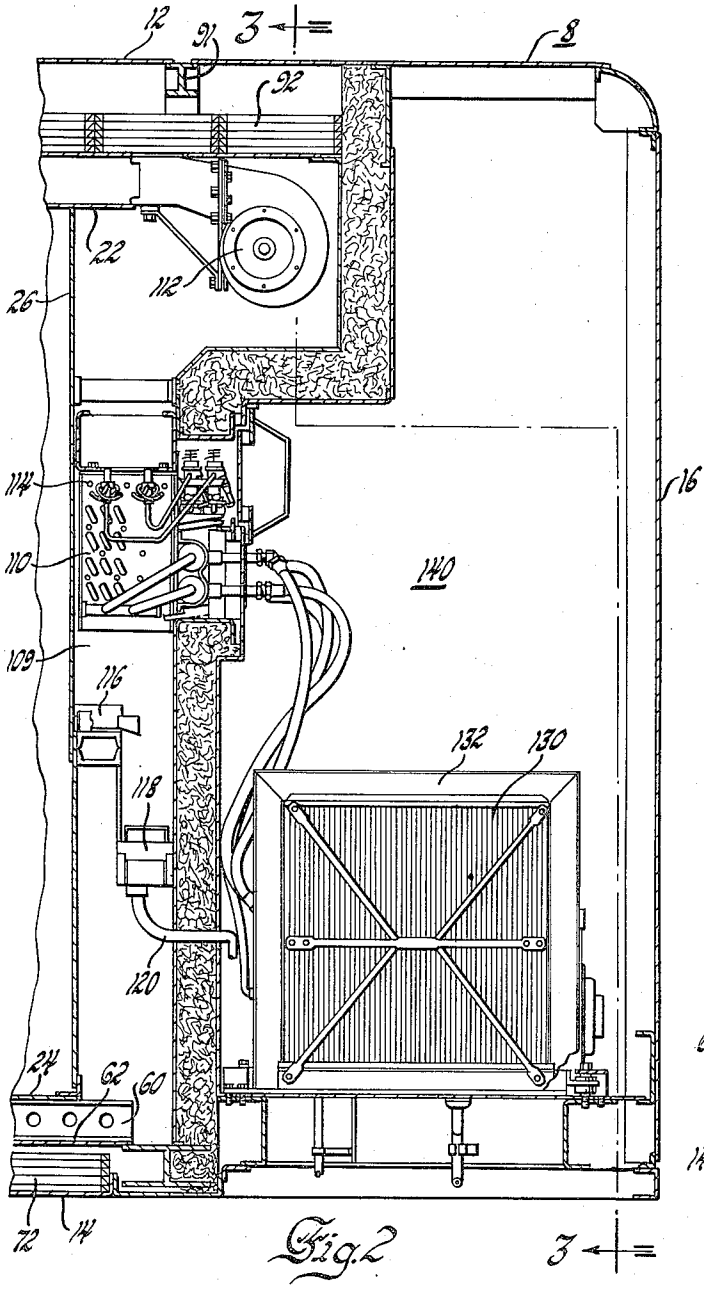


Fig. 2

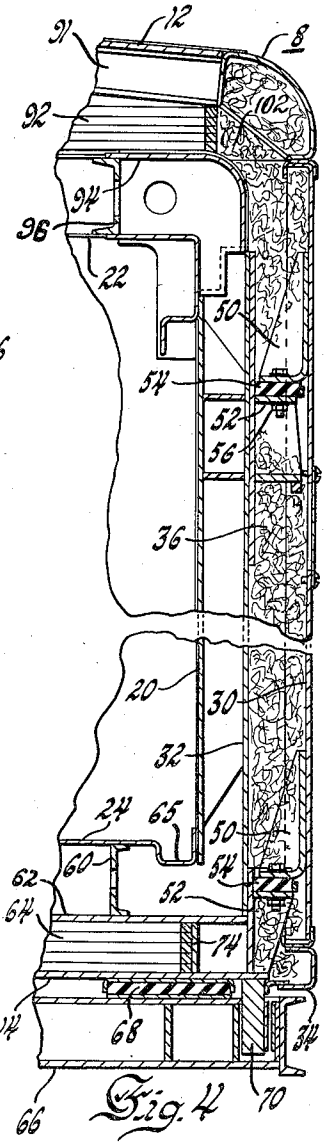


Fig. 4

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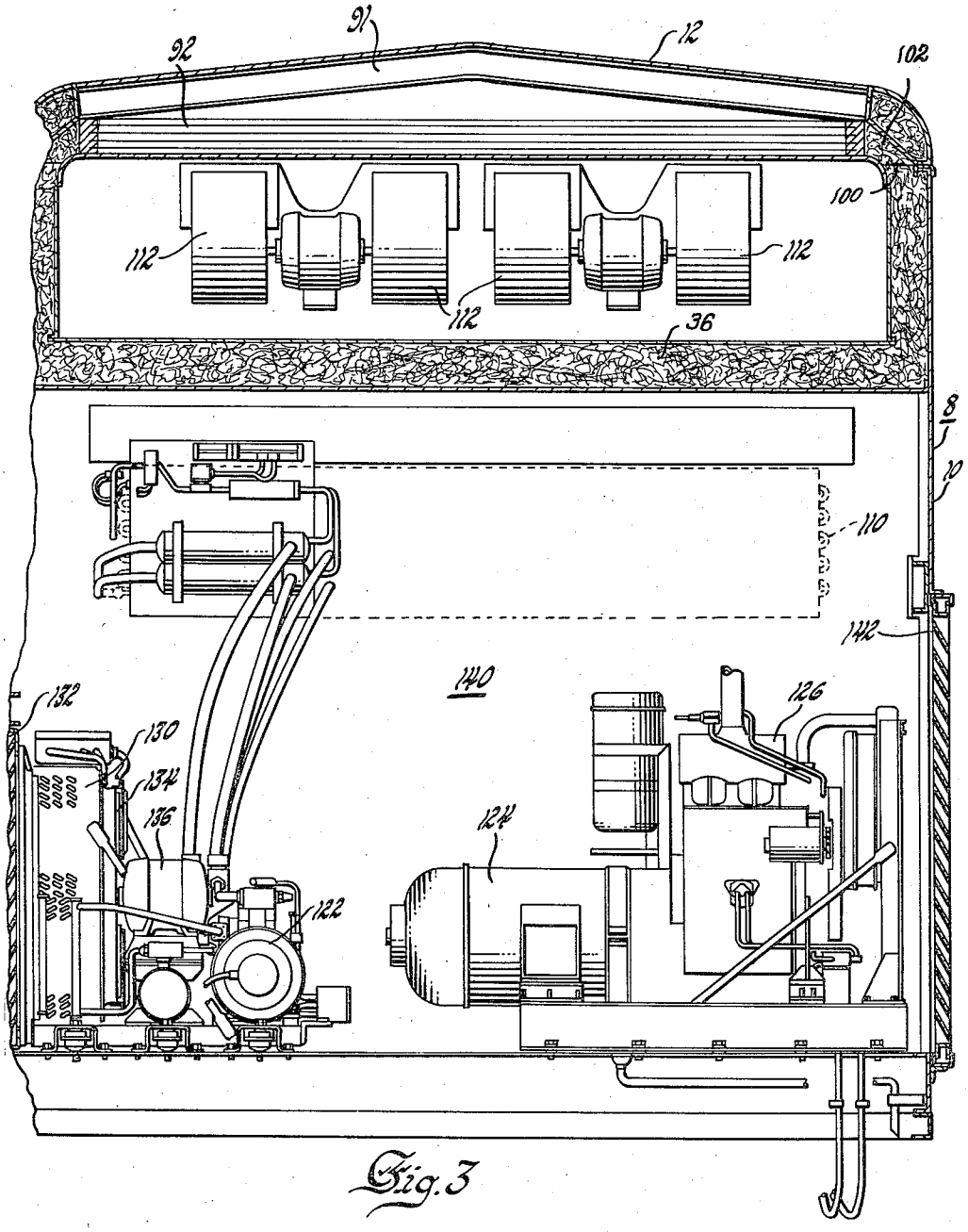


Fig. 3

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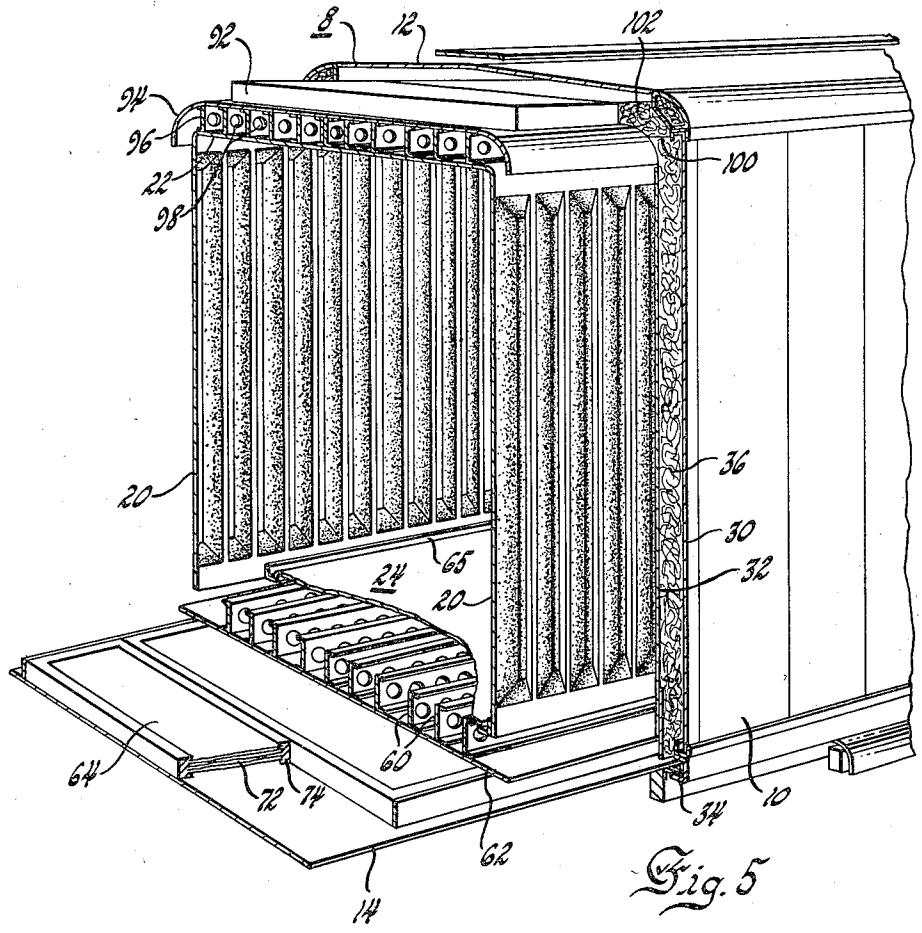


Fig. 5

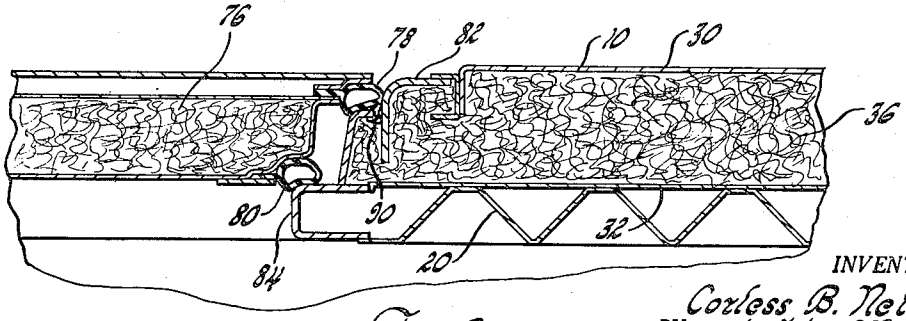


Fig. 6

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2,882,701

REFRIGERATING APPARATUS HAVING COLD AIR JACKET

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Application December 7, 1954, Serial No. 473,516

5 Claims. (Cl. 62—405)

This invention relates to refrigerating apparatus and more particularly to a refrigerated railway car and the method of manufacturing the same.

It is an object of this invention to provide an improved refrigerated railway car wherein the heat leakage through the walls of the car is maintained at a minimum and wherein the contents of the commodity compartment of the car are uniformly refrigerated throughout the entire compartment.

Another object of this invention is to provide an improved insulating arrangement wherein the insulation between the inner shell and the outer shell adds enough structural strength to the car so as to eliminate the need for direct metallic connections between the outer shell and the inner shell of the car.

Still another object of this invention is to provide a refrigerated car construction wherein the bottom, end and side walls may be fabricated as one unit and the top fabricated as a second unit which may be lowered onto the first unit.

More particularly it is an object of this invention to provide a refrigerated car construction wherein the insulation for the roof of the car may be laid in place while the roof is held in the inverted position.

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

In the drawings:

Figure 1 is a side elevational view with parts broken away showing the construction of a car embodying the invention;

Figure 2 is a fragmentary vertical sectional view showing the general arrangement of the refrigerating apparatus in the car;

Figure 3 is a vertical sectional view taken substantially on line 3—3 of Figure 2;

Figure 4 is a fragmentary sectional view taken substantially on line 4—4 of Figure 1 and shownig the construction of one of the side walls;

Figure 5 is a perspective view with parts broken away showing somewhat schematically the construction and arrangement of the insulation and the air distributing ducts; and,

Figure 6 is a fragmentary sectional view taken substantially on line 6—6 of Figure 1 showing the door jamb and side wall construction.

Referring now to the drawing wherein a preferred embodiment of the invention has been shown, reference numeral 8 generally designates the outer shell of a car having side walls 10, a roof 12, a bottom wall 14, and end walls 16. Reference numerals 20, 22, 24 and 26 designate the corresponding side walls, top, bottom, and end walls of an inner liner. As best shown in Figures 4, 5 and 6, the main side walls of the outer shell 10 comprise separated sheet metal plates 30 and 32 which are joined together adjacent their bottom edges as indicated at 34 in Figure 5 of the drawing so as to form a recess for receiving insulation 36.

The insulation 36 is preferably in the form of a foamed plastic involving the reaction product of an organic polyisocyanate and a polyester, such as meta toluene diisocyanate and an alkyd resin which has been poured into the space between the plates 30 and 32 so as to not only insulate the wall of the car, but also add strength to the car. The isocyanate insulation forms a strong bond with the metallic plates 30 and 32 and is structurally strong in comparison to the usual fibre type insulation. It will not shake down, rot or mold and is not affected by moisture. The plates 32 are secured to the corrugated side walls 20 of the inner liner so as to be intermediate the inner liner and the insulation 36. These side walls 20 are corrugated as best shown in Figures 1 and 5 so as to provide vertically extending air passages for refrigerated air between the side walls 20 of the inner liner and the sheet metal plate 32 which forms the inner surface of the outer shell.

The plate 32 is secured to the outer plate 30 adjacent the four corners of the sides of the car by means of suitable brackets which minimize the transfer of heat from the inner wall to the outer wall but assist in holding the inner shell properly spaced from the outer shell before and while the insulation 36 is poured in place. Thus, as shown in Figure 4 of the drawing, each of these brackets consists of a first bracket element 50 which is welded or otherwise secured to the outer wall plate 30 and a complementary bracket element 52 welded or otherwise secured to the inner plate 32. A block of insulation 54 is placed between the bracket elements 50 and 52 so as to prevent the direct transfer of heat from the one bracket to the other. The bracket elements 50 and 52 are bolted to one another by means of one or more bolts 56 which assist in holding the inner wall plate 32 in proper assembled relationship relative to the outer wall plate 30. Suitable insulating washers are used with the bolts 56 and prevent the direct transfer of heat from the brackets to the bolts. As explained hereinabove, the insulation 36 is of the type which adds structural strength to the wall with the result that only four of these bracket assemblies are used for each side wall. By virtue of the fact that these brackets do not touch one another and are insulated from one another by means of the insulation blocks 54, there is no direct metallic contact between the outer wall plate 30 and the inner wall plate 32 at any place.

The bottom wall of the refrigerator car comprises a floor panel 24 which is preferably in the form of a solid sheet metal plate which extends the full length and breadth of the commodity compartment of the car. A condensate collecting trough-like formation 65 is provided at the outer edges of the floor panel 24. The floor panel 24 is supported on a plurality of perforated longitudinally extending web members 60 which in turn are supported on a subpanel 62 which overlies panel type insulation 64 supported on the bottom 14 of the outer shell. The insulation 64 preferably comprises a plurality of panels each formed of thin sheets of metal foil 72 which are held together at their edges by means of vapor tight spacing means 74. The foil 72 preferably consists of .004 aluminum provided with polished or bright reflective surfaces on one or both sides.

Reference numeral 66 designates generally the underframe of a railway car. Since the construction of the underframe is to form the subject matter of a separate patent application, the construction of the underframe will not be described in greater detail in this application. Blocks of insulation 68 are provided between the bottom plate 14 of the car body and the upper surface of the

underframe 66 and these blocks aid in insulating the main car body from the underframe. As shown in Figure 4 of the drawing, the bottom plate 14 of the refrigerated car is provided with a projecting member 70 which assists in positioning the car body on the underframe. Insulation may also be provided between member 70 and the bolster 66 if desired.

A pair of access doors 76 are provided in each side wall of the car for use in loading and unloading the car. As best shown in Figure 6 of the drawing, each door is provided with a pair of sealing gaskets 78 and 80 which cooperate with an outer door jamb member 82 and an inner door jamb member 84 respectively so as to form an air-tight seal for the door opening. The outer door jamb member 82 is carried by the outer wall panel 30 whereas the inner door jamb member 84 is carried by the inner panel members 20 and 32. It will be noted that the inner and outer door jamb members are insulated from one another so as to prevent the direct transfer of heat by conduction through the door jamb. An insulating sealing strip 90 is provided as shown along the line where the inner door jamb member 84 seals against the outer door jamb member 82.

The roof of the car consists of a metallic panel 12 (supported on transverse I-beams 91) as best shown in Figures 3 and 4. Foil type of insulating panels 92 similar in construction to the panels 64 are provided directly beneath the roof panel 12. Beneath the insulating panels 92 there is provided an intermediate panel 94 (see Figures 2, 4, and 5) which rests on top of a plurality of longitudinally extending perforated web members 96 which in turn rest on the ceiling 22 of the inner liner of the lading compartment. The perforations 98 in the web members 96 allow uniform distribution of air throughout the entire space above the inner liner. The intermediate panel 94 is provided with downturned edges as best shown in Figure 5 which are arranged substantially in alignment with the upper edge of the side panels 32 and end panels 26 so as to form a complete envelope spaced from the outer walls of the car by means of the insulation 36 and spaced from the inner liner so as to form an air circulating chamber.

In constructing the car, the inner liner and the bottom, side and end walls are first assembled as one unit the roof portion of the car is assembled as another unit. Before the roof unit is installed, the foam type insulation 36 is poured into the space between side wall panels 30 and 32 and the corresponding end wall panels to a height indicated by the line 100 in Figure 5. In assembling the roof unit, the roof panel 12 is supported in an inverted position and the foil insulating panels 92 are then laid in place after which some of the polyisocyanate foam type insulation 102 is then poured in place adjacent the edges of the roof panel so as to assist in holding the insulating panels 92 in place as well as helping to insulate the irregularly shaped corner portion of the car roof. The roof may then be turned rightside up and lowered down onto the main car body. The foam type insulation 102 then rests on top of the upper edge of the corresponding foam insulation 36 in the side and end walls of the lading compartment so as to provide the necessary seal along the line of juncture which has been designated by reference numeral 100 of Figures 3, 4 and 5. The edges of the outer roof panel are then welded in place onto the upper edges of the outer side and end walls of the car and lading compartment whereby an air-tight envelope is formed surrounding the lading compartment.

As shown in Figures 1, 2, and 3, refrigerant evaporator means 110 is mounted in the air space adjacent the one end wall of the commodity compartment for refrigerating what may be termed a captive body of air which is sealed between the inner liner and the insulated outer walls of the lading compartment. Fan means 112 are provided as shown for pulling air up through the evaporator and for discharging the air into the plenum chamber like space, located directly above the inner liner. This refrigerated air is then circulated from this overhead space downwardly around the entire outer surface of the inner liner so as to cause refrigeration of the inner liner which then refrigerates the contents of the lading compartment. As explained hereinabove some of the air circulated by the fans 112 will travel down through the corrugated portions of the side wall and some of it will travel the full length of the car and flow downwardly along the far end wall of the inner liner, and all of the air will return through the air space provided beneath the floor of the inner liner. By virtue of the above described arrangement in which a captive body of air is used to cool the compartment walls, it is obvious that very little moisture is ever allowed to enter the refrigerated air chamber which surrounds the inner liner with the result that defrosting of the evaporator will be required only at very infrequent intervals. Radiant tube type electric heaters 114 are provided in thermal exchange relationship with the fins of the evaporator means 110 for use when defrosting is required. The defrost water will drip down onto defrost water collecting receptacles 116 and 118 located in staggered relationship within the end air duct 109. Suitable drain pipe means 120 serves to convey the condensate water to the outside of the car.

Lading compartment air is circulated by means of ceiling mounted fans 121. The corrugated side walls prevent boxes or the like placed in the commodity compartment from blocking the flow of commodity compartment air downwardly along the side walls. Suitable rub rails, meat supporting hooks, floor racks, etc., can be used in the commodity compartment but has not been shown in order to simplify this disclosure.

The refrigerating apparatus and controls are of the type described more fully in copending application Ser. No. 459,896 filed October 4, 1954, now Patent No. 2,793,834 to which reference is hereby made for a more complete description of the refrigerating apparatus and controls. As pointed out in said copending application, the refrigerating apparatus preferably consists of a dual refrigerating system generally designated by the reference numeral 122. Power for operating the refrigerating apparatus is supplied by means of an alternating current generator 124 driven by a diesel engine 126. The refrigerating apparatus includes a duel condenser means 130 located directly opposite the air inlet grille 132 provided in the side wall of the car. A condenser fan 134 driven by a fan motor 136 serves to forcefully circulate outside air over the condenser and thence through the machinery compartment 140 which is located adjacent the one end of the car outside of the insulated portion of the commodity compartment as shown. The air leaves the machinery compartment through air outlet grille 142 on the opposite side wall.

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

What is claimed is as follows:

1. In a refrigerated car; means forming a lading storage space having a wall structure comprising an outer metallic sheet, a layer of polyester polyisocyanate foam type insulation bonded to said outer sheet, and an intermediate metallic sheet bonded to said insulation; an inner shell having portions spaced from said wall structure to form with said wall structure a closed air space surrounding said inner shell; means including an evaporator for refrigerating air; means including a fan for circulating said air in thermal exchange relationship with said evaporator and thereafter through said air space in a closed circuit; means for positioning said intermediate metallic sheet in spaced relationship to said outer metallic sheet; said last named means comprising first bracket means carried by said outer metallic sheet and second

bracket means carried by said intermediate metallic sheet and having a portion arranged adjacent said first named bracket means; rigid insulation between said bracket means; and means for holding said bracket means and said rigid insulation in fixed relationship to one another.

2. In a refrigerated vehicle, an outer shell, an inner shell forming a commodity enclosure. insulating means between said inner shell and said outer shell, the top, bottom, and at least one end wall of said inner shell being spaced inwardly from said insulating means so as to form an air space surrounding said inner shell, a refrigerant evaporator disposed in a vertical portion of said air space adjacent one end of said inner shell, blower means for pulling air upwardly in thermal exchange relationship with said evaporator and for discharging the air over the top of said inner shell, means for thereafter directing air downwardly adjacent the side walls of said inner shell, fan means within said inner shell for circulating an independent air stream from within said inner shell in thermal exchange relationship with the inner wall of said inner shell, the insulating means adjacent said one end of said inner shell being spaced from the adjacent end of said outer shell so as to form a machinery compartment, refrigerant liquefying means including a motor-compressor unit within said machinery compartment for supplying liquefied refrigerant to said evaporator, an internal combustion engine within said machinery compartment, and means including an alternating current generator drivingly connected to said engine for supplying power for operating said refrigerant liquefying means, said fan means and said blower means.

3. In a refrigerated car; an outer shell; an inner shell spaced inwardly from said outer shell and forming a commodity enclosure; insulating means between said inner shell and said outer shell; the top, bottom, and at least one end wall of said inner shell being spaced inwardly from said insulating means so as to form air passage means; a refrigerant evaporator disposed in a vertical portion of said air passage means adjacent one end of said inner shell, blower means for pulling a primary stream of air upwardly in thermal exchange relationship with said evaporator and for discharging said primary air in the space above the top of said inner shell, means for directing primary air from said last named space downwardly adjacent the side walls of said inner shell, fan means within said inner shell for circulating a secondary air stream from within said inner shell in thermal exchange relationship with the inner wall of said inner shell, said inner shell having vertically extending corrugations formed therein arranged to have one side thereof subjected to said primary air and having its other side arranged to be subjected to said secondary air, said one end of said inner shell being spaced from the adjacent end of said outer shell so as to form a machinery compartment, refrigerant liquefying means including a motor-compressor unit within said machinery compartment for supplying liquefied refrigerant to said evaporator, an internal combustion engine within said machinery compartment, means including an alternating current generator drivingly connected to said engine for supplying power for operating said refrigerant liquefying means.

4. In a body for a vehicle adapted to transport perishable products which must be preserved under substantially constant temperature conditions, means forming a storage compartment having top, bottom, side and end walls, each of said walls being formed of a layer of insulation overlying a free space, said walls including means for sealing said free space on all sides to form a substantially fluid-tight chamber substantially surrounding said storage compartment and filled with a body of captive air sealed from the outside air and the air within said compartment, means dividing said free space into a plurality of communicating air flow channels, means for circulating said captive air through said channels, and means for establishing forceful circulation of compartment air within said compartment.

5. In combination; means forming a storage space having a wall structure comprising an outer sheet, a layer of polyisocyanate foam type insulation bonded to said outer sheet, and an inner shell assembly having portions bonded to said insulation; said inner shell assembly having a portion spaced from said wall structure to form with said wall structure an air conduit having one side abutting said polyisocyanate foam insulation and having its other side arranged in thermal exchange relationship with the air in said storage space; means including an evaporator for refrigerating air to temperatures below freezing; and means including a fan for circulating said air in thermal exchange relationship with said evaporator and through said air space.

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