June 4, 1935. V. WILLOUGHBY 2,003,916

RAILWAY CAR

Filed Oct. 15, 1932 3 Sheets-Sheet 1

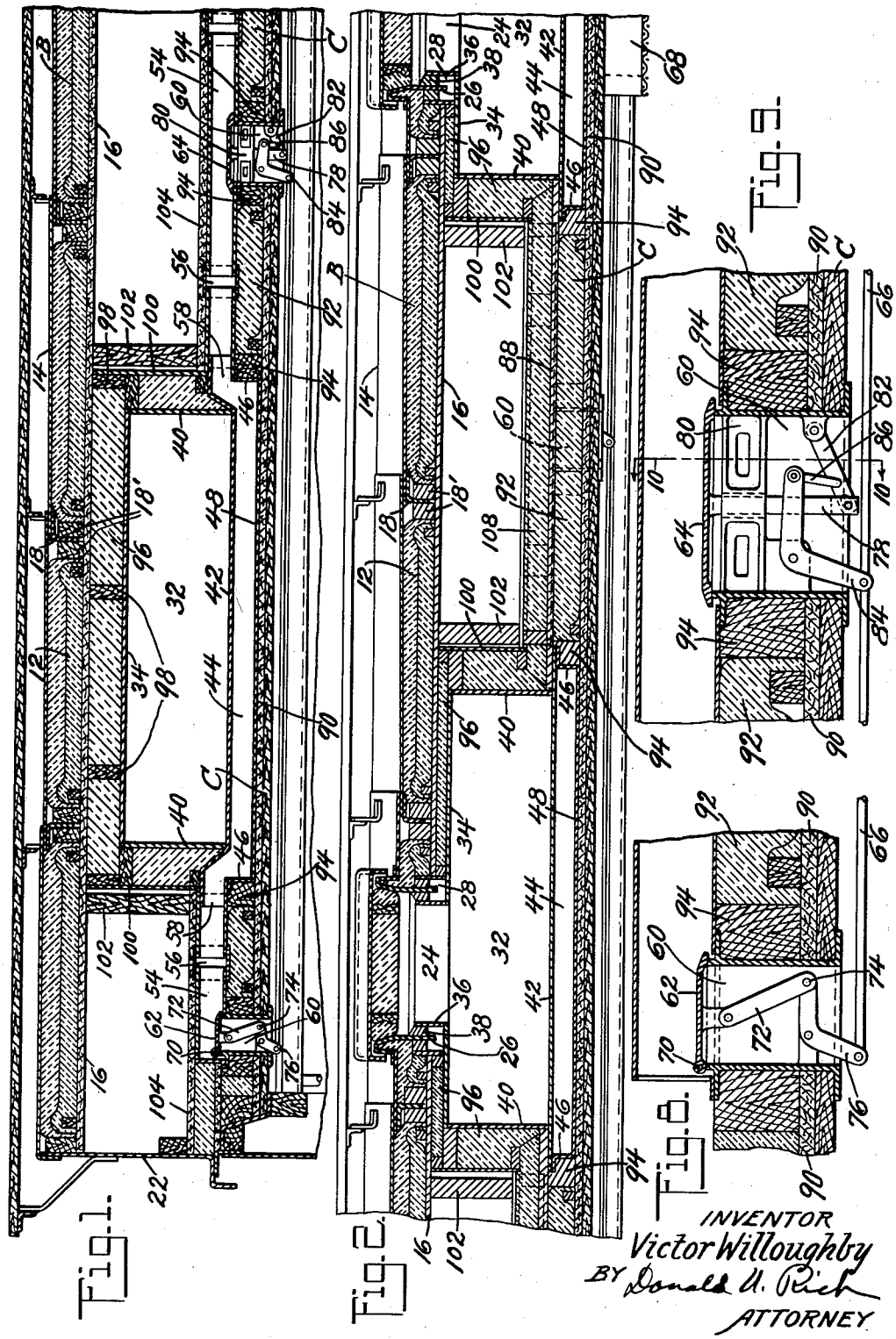

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

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RAILWAY CAR

Filed Oct. 15, 1932 3 Sheets-Sheet 2

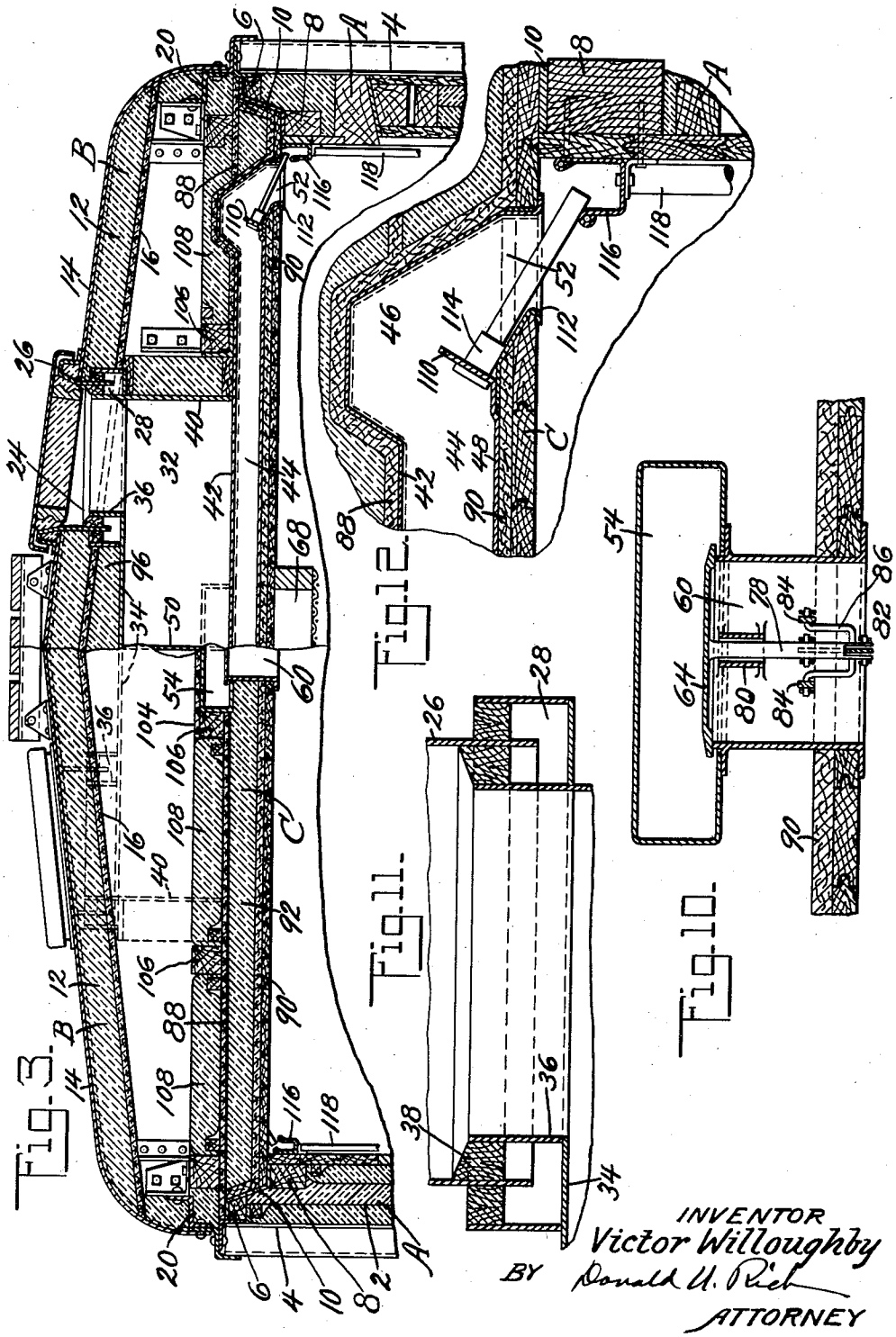

Fig. 3.

Fig. 12.

Fig. 11.

Fig. 10.

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RAILWAY CAR

Filed Oct. 15, 1932 3 Sheets-Sheet 3

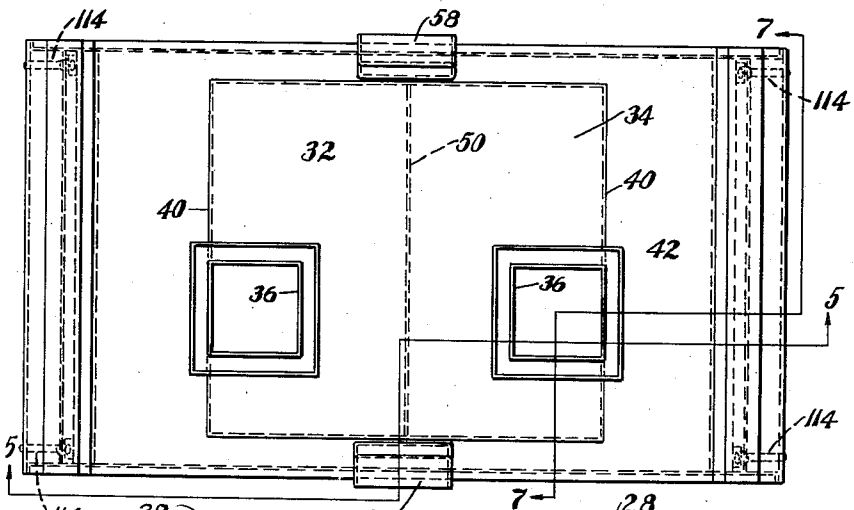

Fig. 4.

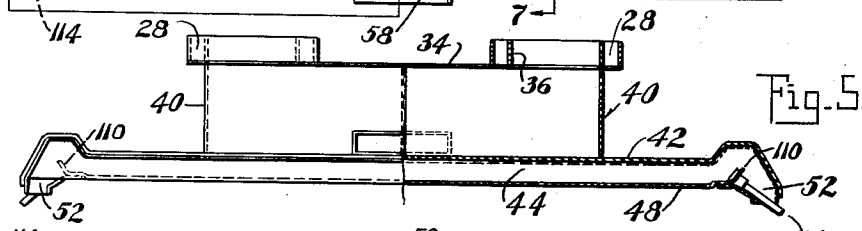

Fig. 5.

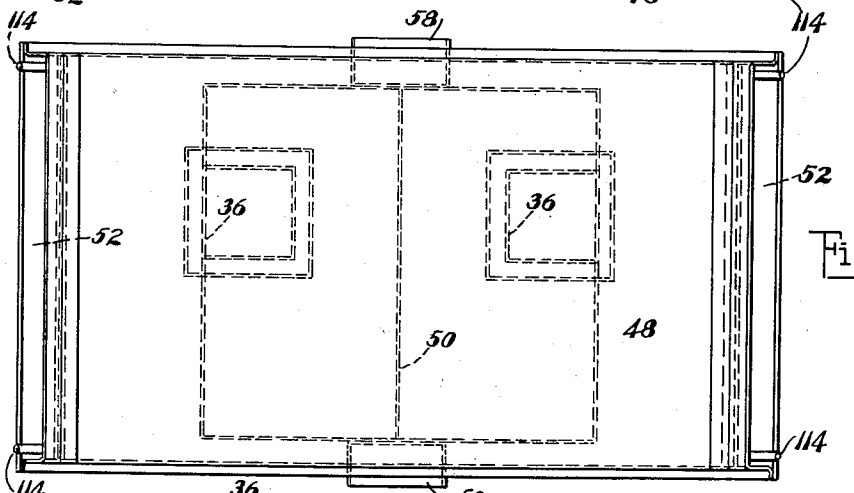

Fig. 6.

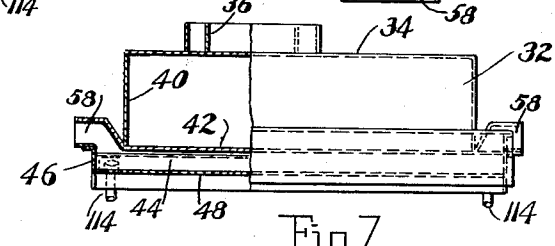

Fig. 7.

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UNITED STATES PATENT OFFICE

2,003,916

RAILWAY CAR

Victor Willoughby, Ridgewood, N. J., assignor to American Car and Foundry Company, New York, N. Y., a corporation of New Jersey

Application October 15, 1932, Serial No. 637,862

16 Claims. (Cl. 62—91.5)

This invention relates to railway refrigerator cars and has particular reference to a car refrigerated by air cooled by solid carbon dioxide.

One object of this invention is the provision of a railway refrigerator car in which end bunkers are eliminated, thus providing increased lading space, and the refrigerating or cooling system is built into and forms a part of the car roof.

Another object of this invention is the provision of a railway refrigerator car having a refrigeration system maintained in and supported by the roof, which system includes closed containers for holding solid carbon dioxide and means for setting up and maintaining circulation of air from the car body into and out of contact with the containers whereby the interior of the car body is maintained at a low temperature.

A further object of this invention is the provision of a new and improved car roof having a system of and apparatus for refrigeration formed as a part thereof, the roof comprising a structure which may be applied to and removed from a car body as a unit.

A still further object of this invention is the provision for a new and improved container for holding solid carbon dioxide.

Other objects and advantages of this invention will be apparent from the following description taken in conjunction with the accompanying drawings, in which:

Figure 1 is a sectional view through the upper portion of one end portion of a car in which the present invention is embodied.

Fig. 2 is a sectional view through the upper portion of the car of Fig. 1, the view being taken on a different sectional line from that of Fig. 1 and being taken intermediate the end portions of the car.

Fig. 3 is a cross sectional view through the upper portion of the car, the right hand portion of the view being taken through a hatch and the left hand portion being taken in advance of an oppositely arranged hatch.

Fig. 4 is a top plan view of one of the combined refrigerant holding containers and air chilling chamber units.

Fig. 5 is a sectional view on the line 5—5, Fig. 4.

Fig. 6 is an inverted view of the construction shown in Fig. 4.

Fig. 7 is a sectional view on the line 7—7, Fig. 4.

Figs. 8 and 9 are detail sectional views of air inlets showing valves for controlling the same, together with the linkage for operating said valves.

Fig. 10 is a sectional view on the line 10—10, Fig. 9.

Fig. 11 is an enlarged sectional view of the hatchway at its connection with the refrigerant holding container, and

Fig. 12 is an enlarged detail view, in section, showing the discharge end of one of the air chilling chambers.

In the drawings similar characters of reference designate similar parts in the several views, the latter disclosing among other features certain parts only of a car as the remaining parts may be of conventional construction.

As shown in Fig. 3, the car includes side walls A and a roof indicated generally at B. The walls may be formed of any suitable or desired material but in the instance shown are formed of insulating material 2 externally sheathed with metal 4. The upper edge portions of the side walls A are so formed as to provide seating surfaces for the roof B and include reinforcing elements comprising upper and lower stringers 6 and 8 respectively; the upper edge portion of the side being covered by a flashing 10 which may be of insulating material, if desired, or of metal, the flashing obviously forming a seat for the roof which is substantially leak-proof, as will be apparent.

The roof B is formed in the main of insulating material 12 covered by a roof sheet 14 and lined with wood or other suitable fibrous material 16. The roof includes carlins 18, angles as shown clearly in Fig. 1, and side plates 20 and end plates 22. On either side of the carlins 18 are stringers 18' which serve as attaching means for the insulating material 12 and also as means for supporting the lining 16 of the roof.

The roof is provided with a plurality of spaced pairs of hatchways 24 lined with metal 26, the lower edge portions of which hatchways project into wells 28 formed with the top portions of refrigerating units indicated generally at 32 and supported by the roof, as presently to be more specifically described, the wells 28 being adapted to hold oil or some other non-freezing solution to form a liquid seal for preventing the escape of gas, as will be apparent hereinafter.

As will be clear from the drawings, a plurality of these refrigerating units 32 are provided, arranged in spaced relation longitudinally of the car and they each comprise closed containers for holding solid carbon dioxide, the top wall 34 of each of which units is provided with hatchways 36 attached to frame members

38 fitted within the roof hatchways and secured to the flashings 26 (see Fig. 11). The units 32 also are each provided with end walls 40 and a bottom plate 42 which extends beyond the containers and constitutes a conduction plate forming the top wall of an air chilling chamber comprising a conduit 44, the latter having side and bottom walls 46 and 48, respectively. The units 32 are each divided into independent compartments by means of a partition plate 50, and the air chilling chambers 44 extend transversely to the longer axis of the car. In the instance shown, the chambers 44 are of such dimensions as to extend from side wall to side wall of the car, as shown clearly in Fig. 3, the opposite ends of said chilling chambers being provided with air discharge outlets 52 whereby chilled or cooled air passes into the body of the car adjacent the side walls thereof. The air cooling chambers 44 of the several units 32 are connected in a series by means of warm air ducts 54 arranged at substantially the longitudinal center line of the car and connected by means of couplings 56 with warm air intakes 58 which communicate with the chilling chambers 44, as shown clearly in Fig. 1. The warm air ducts 54 receive air from the interior of the car through air inlets 60 positioned in a ceiling indicated generally at C, said air inlets being provided with valves, one of which is shown in Fig. 8 at 62 and another being indicated in Fig. 9 at 64, the valves being adapted to be operated by suitable linkage actuated by an operator 66 connected to a thermostat in thermostat housing 68. In Fig. 8, the valve 62 is pivoted at 70 and has a link 72 connected therewith and the lower end of this link is pivoted at 74 to a bell crank 76 actuated by the operator 66. In the form shown in Fig. 9 the valve 64 is provided with a stem 78 which is slidable through a spider 80 arranged in the inlet 60 and the lower end of said stem is connected to a link 82 which is adapted to be elevated and depressed by means of a bell crank lever 84 connected to operator 66, the bell crank lever 84 being connected by a link 86 with the link 82. Figs. 9 and 10 disclose certain forms of operating mechanism for the valves 62 and 64 but obviously any preferred or desired means for operating the valves may be provided within the scope of the present invention.

As will be apparent from the drawings, the ceiling member C forms a part of the roof and extends from side to side and from end to end of the car and comprises an insulated construction having spaced members 88 and 90 with the interior insulation 92 therebetween, said ceiling member C serving to support the several refrigerating units 32 and being reinforced by transversely arranged stringers or braces 94. The ceiling member C is in its entirety spaced from the upper portion of the roof, as clearly shown in Figs. 1 and 3, and serves to support the several containers 32 and the warm air ducts 54; the chilling chambers and warm air ducts extending from end to end of the car. As clearly shown in Figs. 1 and 7, the air intakes 58 are arranged somewhat above the horizontal elevation of the chilling chambers 44 and the warm air intakes are hence offset from the chilling chambers for the reason that as the warm air enters the chilling chamber it is cooled and drops. By offsetting the air intakes 58 the air is permitted to drop naturally with no obstruction to its travel.

The refrigerating units 32, as clearly shown in Figs. 1, 2 and 3 are insulated, as shown at 96, and are retained against any possibility of shifting relative to the roof by means of braces 98 interposed between the roof liner 16 and the top walls 34 thereof and by metal plates 100 extending between the roof liner 16 and the bottom wall or conduction plates 42 of said containers. Arranged adjacent these plates 100 are roof braces 102 which extend between the roof liner 16 and insulating material 104 positioned over the warm air ducts 54.

The ceiling member C is reinforced by longitudinally arranged stringers 106 (see Fig. 3) which serve also as attaching means for upper insulation 108.

In effect, from the above description it will be obvious that the construction comprises a plurality of independent solid carbon dioxide containers built into a car roof and each having an air chilling chamber, a portion of which chamber comprises the bottom of the container, the several air chilling chambers being connected through air ducts which receive warm air from the body of the car and each of said chambers having discharge outlets for cold air arranged adjacent the side walls of the car, the containers, chilling chambers and air ducts all being thoroughly and efficiently insulated.

The refrigerating units themselves are indicated more clearly in Figs. 4–7 inclusive and, as clearly shown in Figs. 5 and 12, the bottom walls of said chilling chambers have their end portions upwardly flanged as at 110 to provide baffles for directing the air upwardly so that it may be discharged through the outlets 52 vertically into the car body. The outlets 52 of the air chilling chambers project through suitable openings formed in the ceiling C, and flashings 112 are provided at the apertures for an obvious purpose. The baffles 110 also serve to support discharge pipes 114 for delivering water of condensation into gutters 116 secured to the side walls A from where the water may pass into drain pipe 118 for discharge out of the car. It has been found desirable to provide four of these discharge pipes 114, one adjacent each corner of each of the refrigerating units but this is merely by way of example.

In use, air from the interior of the car will pass through the intakes 60 and be conducted through the ducts 54 into the air chilling chambers 44 where it contacts with the conduction plates 42 of the refrigerating units 32. This cooled air will then pass through the air chilling chambers and be discharged through the outlets 52 into the body of the car. Due to the thermostat in the housing 68 the quantity of air admitted to the air ducts 54 will be regulated by the positions of the valves 62 and 64. The roof B includes the ceiling member C and is preferably fabricated as a unit and then applied in position on the upper edges of the side walls A of the car.

The drawings illustrate one embodiment of the invention and it is to be understood that they are for illustrative purposes only and various changes in the form and proportions of the construction may be made within the scope of the appended claims without departing from the spirit of the invention.

What is claimed is:

1. In a railway car, a body, a roof, a plurality of longitudinally spaced refrigerating units secured to the roof each including closed containers adapted to hold a refrigerant and an air chilling

chamber extending from said to side of the car, and air entrance ducts connecting successive air chilling chambers.

2. In a railway car, a body, a roof, a plurality of spaced refrigerating units arranged in longitudinally spaced relation within the body and secured to the roof, each of said units including a closed container holding a refrigerant and an air chilling chamber extending substantially from side to side of the car, air discharge means from the air chilling chambers arranged adjacent the side walls of the car, and air entrance ducts extending longitudinally of the body between and connecting successive air chilling chambers.

3. In a railway car, a body, a roof, a plurality of longitudinally spaced refrigerating units adjacent the roof, each including closed containers holding solid carbon dioxide so formed as to prevent escape of gas into the car body and having charging openings extended through the car roof, said units each also including an air chilling chamber extending substantially from side to side of the car and formed in part of the bottom wall of the container, and air entrance ducts extending between successive refrigerating units and connected to the air chilling chambers thereof at points adjacent the containers.

4. In a railway car, a body, a roof, a plurality of spaced refrigerating units adjacent the roof, each including closed containers holding solid carbon dioxide so formed as to prevent escape of gas into the car body and having charging openings extended through the car roof, said units each also including an air chilling chamber extending substantially from side to side of the car and formed in part of the bottom wall of the container, air entrance ducts extending between successive refrigerating units and connected to the air chilling chamber thereof at points adjacent the containers, and valve controlled inlets for admitting air to said air entrance ducts.

5. In a railway car, a car body, a car roof removable as a unit from the body and having a ceiling member formed as a part thereof, refrigerating units suspended from the roof and supported by the ceiling member, and air chilling chambers forming parts of said units having air entrance portions positioned intermediate the sides of the car and air discharge portions adjacent the side walls of the car.

6. A car roof formed as a unit and adapted to be detachably secured to a car body, said roof having formed therein refrigerating units each including a closed container for holding a refrigerating medium and an air chilling chamber formed beneath said container and having parts in the form of conduits extending from side to side of said roof.

7. A refrigerating unit for railway cars or the like comprising an air chilling chamber comprising a conduit having air discharge means formed along opposite edge portions thereof, a container for holding a refrigerant, the bottom wall of said container constituting the upper wall of said air chilling chamber, and means for admitting air directly into the chilling chamber into immediate contact with the bottom wall of the container.

8. In a railway car, a body, a roof detachable as a unit from the body and provided with a ceiling member, a plurality of refrigerating units built into the roof and spaced longitudinally therein and each comprising a closed container having a hatchway extending into the upper portion of the roof and an air chilling chamber formed in part of one of the walls of the container, said chamber being arranged above the ceiling member and extending transversely of the roof and being provided with air discharge outlet portions adjacent the sides of the roof, and air entrance ducts connecting successive units arranged at substantially the longitudinal center line of the roof and discharging into the air chilling chambers adjacent the containers.

9. In a railway car, a body, a roof detachable as a unit from the body and provided with a ceiling member, a plurality of refrigerating units built into the roof and spaced longitudinally therein and each comprising a closed container having a hatchway extending into the upper portion of the roof and an air chilling chamber formed in part of one of the walls of the container, said chamber being arranged above the ceiling member and extending transversely of the roof and being provided with air discharge outlet portions adjacent the sides of the roof, air entrance ducts in the ceiling member connecting successive units arranged at substantially the longitudinal center line of the roof and discharging into the air chilling chambers adjacent the containers, and valve controlled air inlets extending through the ceiling member into the air entrance ducts.

10. In a refrigerating system for railway cars, a plurality of refrigerating units built into the car roof and each including closed containers holding solid carbon dioxide and an air chilling chamber in direct heat exchange relation with said containers and provided with discharge portions adjacent the side walls of the car, an air entrance duct in the roof at substantially the longitudinal center line thereof connecting the refrigerating units and having means for admitting air into the chilling chamber, air intakes for admitting air to said duct, and valve means in said intakes for regulating the admission of air to said duct.

11. In a railway car, a body, a roof, and a refrigerating unit adjacent the roof comprising a closed container holding solid carbon dioxide arranged at substantially the longitudinal center of the car and an air chilling chamber formed beneath said container and having parts in the form of conduits formed in part of a portion of the container, said chamber being arranged transverse to the longer axis of the car and having air discharge means adjacent the sides of the car body.

12. An insulated car roof formed as a unit and adapted to be detachably secured to a car, said roof having embedded in the insulation a plurality of closed containers for holding solid carbon dioxide, said containers being arranged in longitudinally spaced relation relative to the car body and intermediate the side walls at substantially the center of the body, air chilling chambers in direct heat exchange relation with said containers, and an air entrance duct in the roof connecting said air chilling chambers.

13. In a railway car, a body, a roof, refrigerating units formed with the roof, said units each comprising a combined air chilling chamber and closed containers for holding solid carbon dioxide, said air chilling chamber being horizontally arranged and extending substantially from side to side of the roof, means for charging said containers with solid carbon dioxide, a liquid seal for preventing escape of gas from the containers into the body of the car, and an air

entrance duct connecting successive air chilling chambers.

14. In a railway car, a body, a roof, refrigerating units formed with the roof, said units each comprising a combined air chilling chamber and closed containers for holding solid carbon dioxide, means for charging said containers with solid carbon dioxide, a liquid seal for preventing escape of gas from the containers into the body of the car, an air entrance duct connecting successive air chilling chambers, and drain means in the air chilling chambers for discharging condensate therefrom.

15. In a railway car, a body, an insulated roof, and a plurality of spaced refrigerating units embedded in the roof insulation and supported wholly by said roof, each of said units comprising a closed container holding a refrigerant and an air chilling chamber with its longer axis transverse to the longer axis of the car and formed in part of a portion of said container, air discharge means formed with opposite end portions of said air chilling chamber, and air inlets leading into said chamber at points adjacent the container.

16. In a refrigerator car, a body, an insulated roof removable as a unit from the body, and means for effecting refrigerating of the body comprising refrigerating units wholly supported by the roof and each including a closed container holding solid carbon dioxide and an air chilling chamber formed in part of a portion of said container, said chamber extending between the side walls of the car and having air discharge means at its opposite end portions, the containers and air chilling chambers of said units being embedded in the roof insulation.

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