

June 11, 1963

J. LAMONT
REFRIGERATOR CAR

3,092,979

Filed Oct. 27, 1960

4 Sheets-Sheet 1

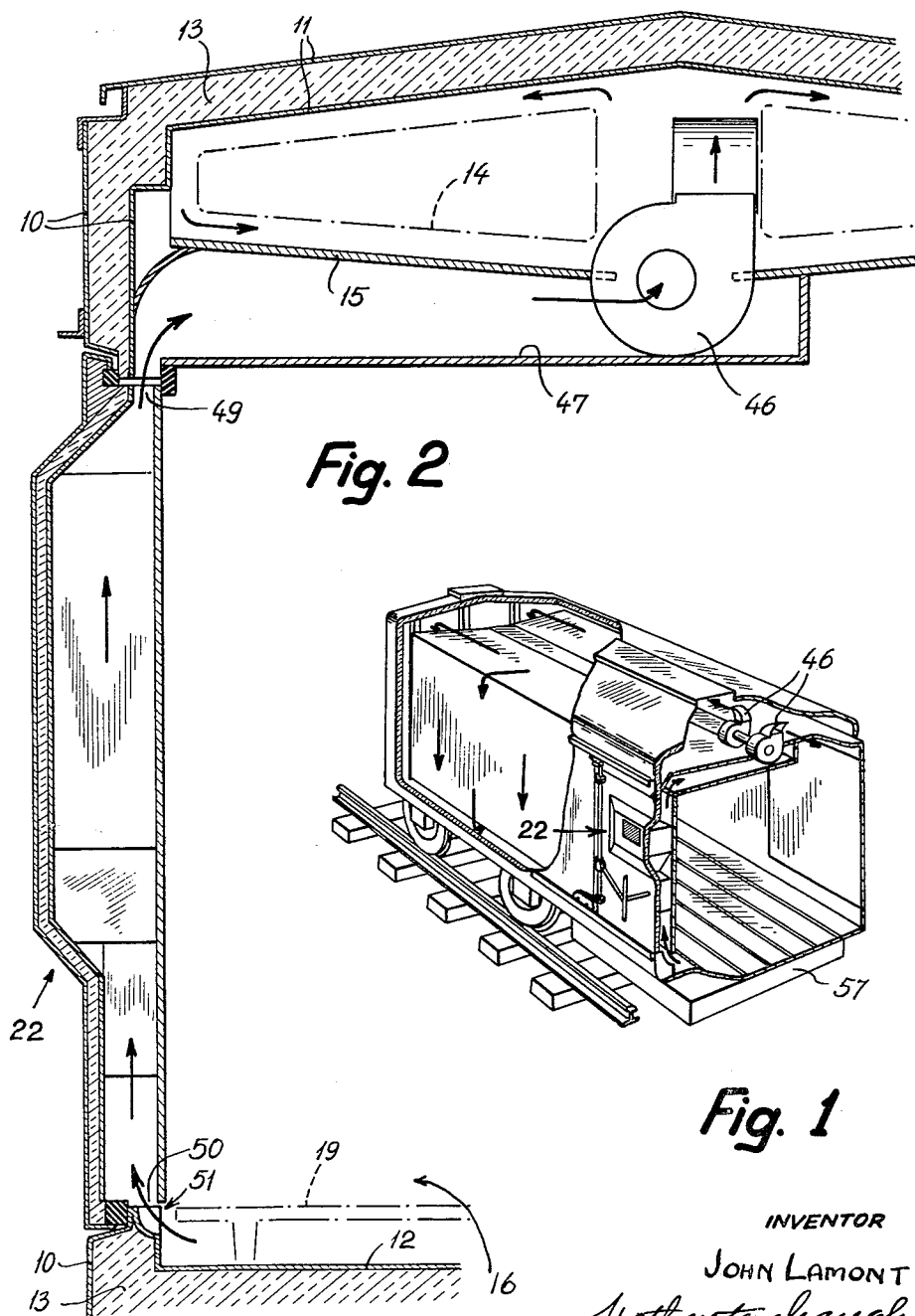


Fig. 1

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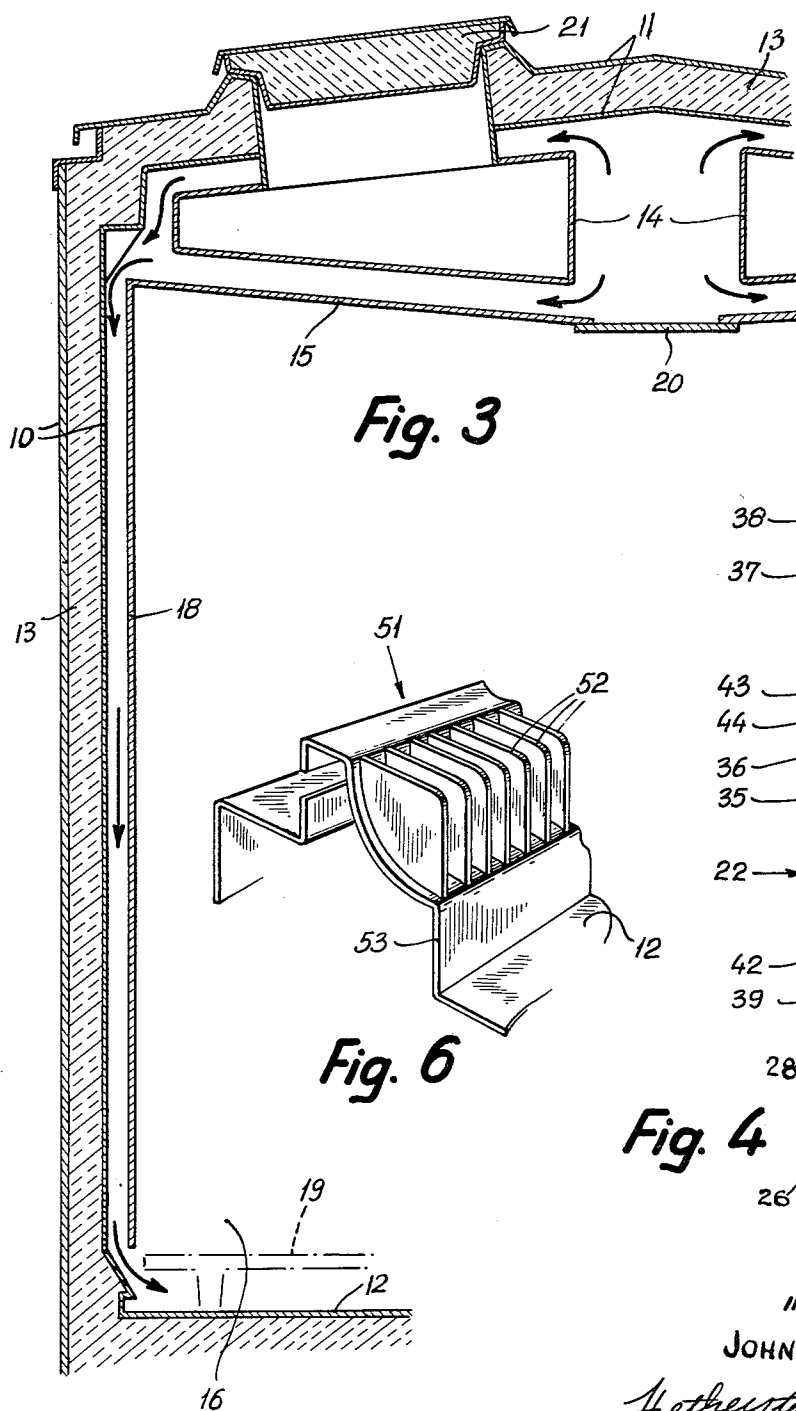


Fig. 3

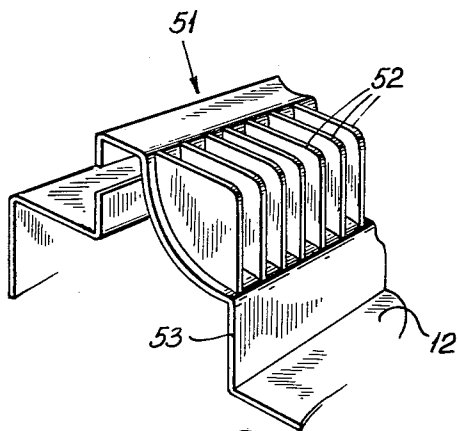


Fig. 6

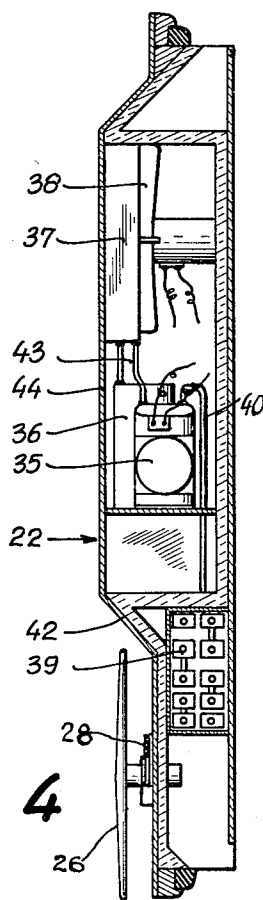


Fig. 4

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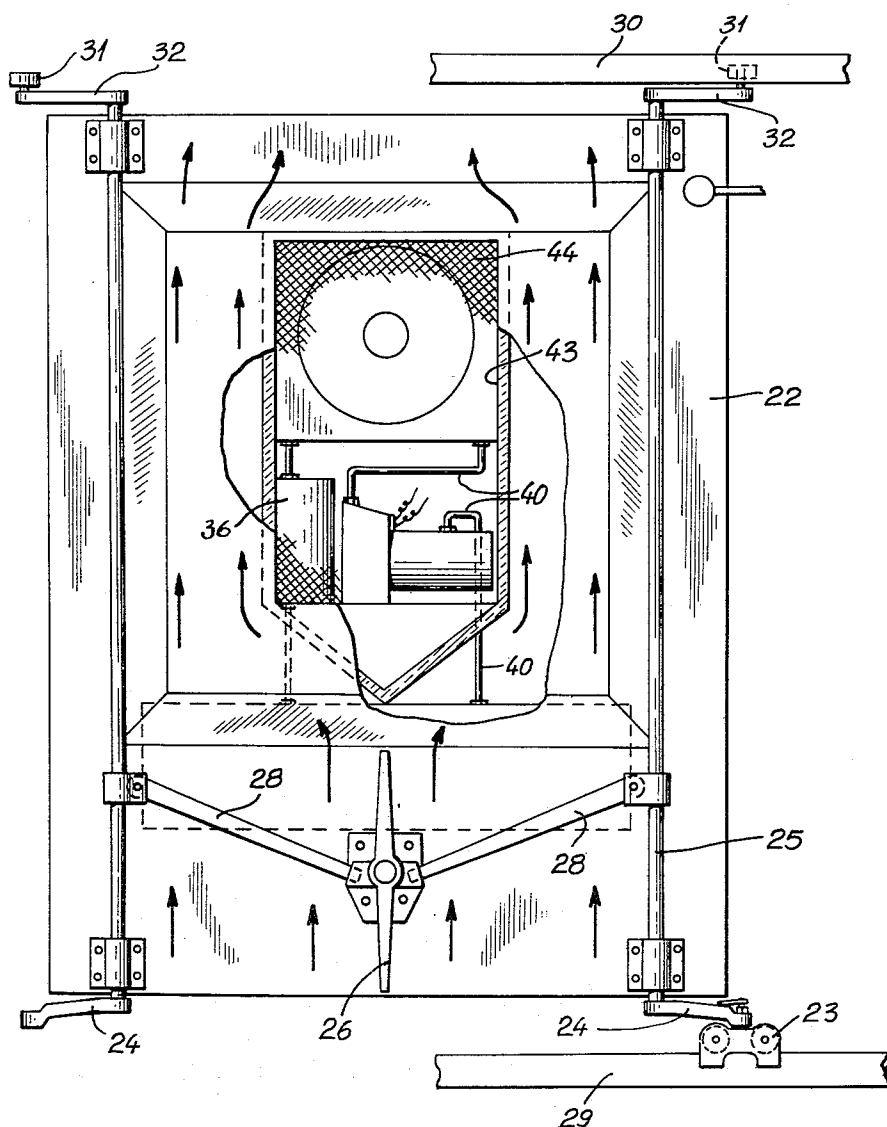


Fig. 5

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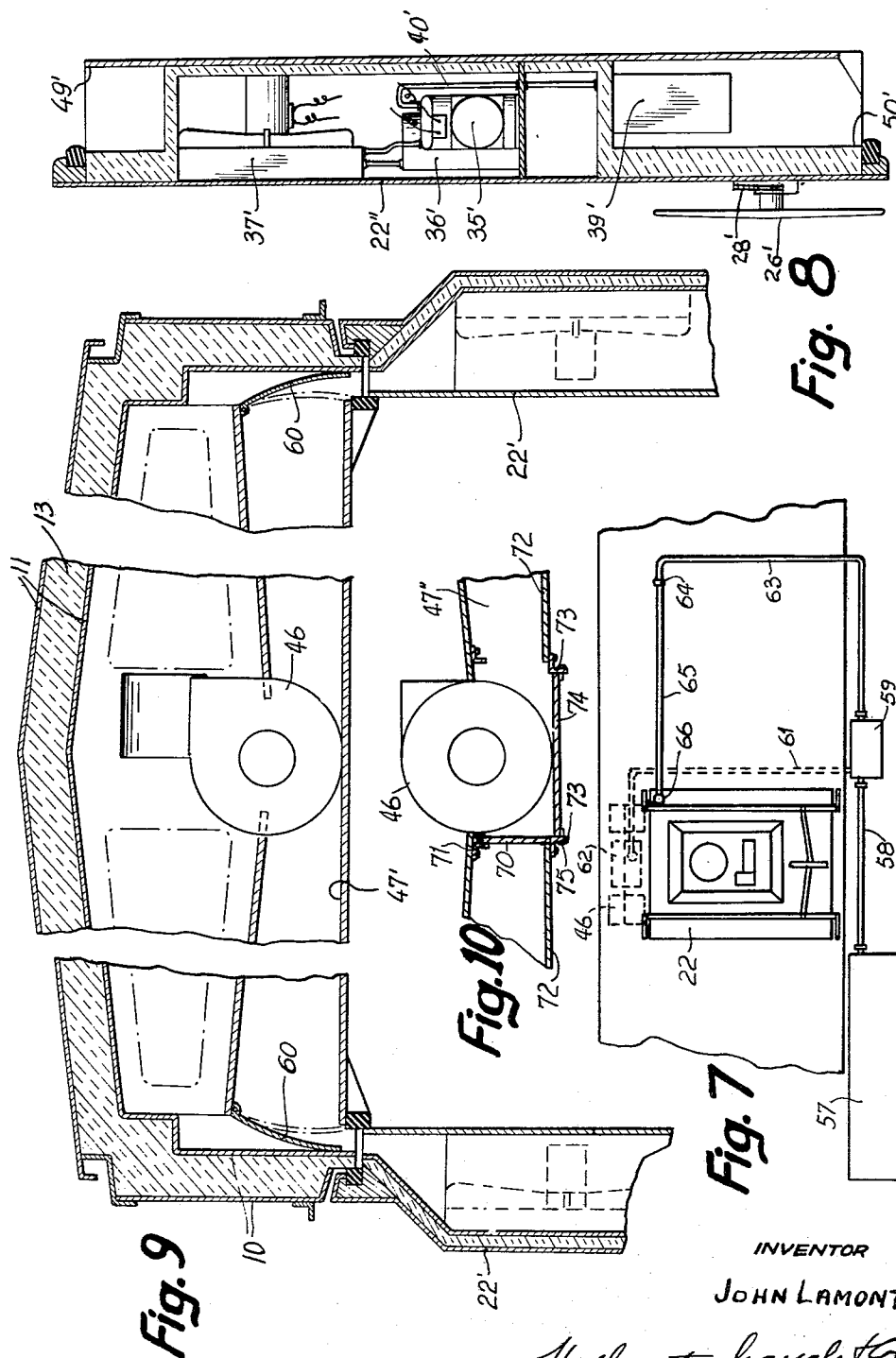
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4 Sheets-Sheet 4



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REFRIGERATOR CAR

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3 Claims. (Cl. 62-239)

This invention relates to refrigerator cars used in railway service to carry perishable goods.

Refrigerator cars at present most commonly in use are of either the overhead ice tank or end bunker type heated in winter by either charcoal or alcohol burning heaters. A mixture of ice and salt is used in the tank to produce refrigeration. The use of such a mixture has some rather serious disadvantages. Thus, for example, it is necessary to switch out the refrigerator cars from the trains at the main terminals for icing; this requires extra switching, and manhandling and also results in delays. Furthermore the corrosion caused by the ice and said mixtures results in repairs of the order of 35-50% of the initial cost of the car approximately every seven years. In addition, the servicing costs for both ice and charcoal, although difficult to assess precisely, are undoubtedly high.

In order to overcome the above disadvantages of ice tank type cars, manufacturers have resorted to the use of mechanical refrigeration systems. One such system, for instance, would have the ice tanks of the car replaced by a mechanical refrigeration unit located in one end of the car. For new cars, the refrigeration unit would similarly be placed at one end of the car. Such systems have the serious drawback that the first costs are very high, both in the conversion of existing cars and in the case of new cars. Particularly where conversion takes place the cost is excessive since substantial structural changes are required and the installation procedure is laborious.

Another disadvantage is that quick repair by unit substitution is not practical as some of the system components are integral with the car structure and not easily removed.

In addition, most systems of the above type take about 5 feet off the ends of the car with a consequent reduction in volume and floor area.

Furthermore the various components, being located at the ends of the car, are in a zone of maximum shock, and since they are secured to different structural members of the car, such as the end walls, floor and roof, they are subject to vibrations of varying frequency and amplitude which impose severe strains on the connection piping resulting in failures due to leakage.

It is the object of this invention to provide a refrigeration system which fully overcomes the disadvantages of the above conventional mechanical refrigeration systems for railway cars.

The system in accordance with the invention is essentially characterized in that the refrigeration unit is mounted in the door of the car, provision being made for circulation of air through the door and through the car, preferably through a plenum which surrounds the loading space inside the car. This arrangement is made possible by improvements in the design of refrigeration units, which can be made small enough to fit inside a modified railway refrigeration car door.

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The invention is, of course, applicable to the construction of new refrigerator cars, but one of its major advantages resides in the fact that when used for the conversion of existing tank type refrigerator cars, it makes it possible to avoid any major structural changes, so that the installation costs are reduced to a minimum. As a matter of fact, it is not even necessary to remove the ice tanks since these do not in any way interfere either with the installation or with the operation of the refrigeration unit. The total conversion cost is about $\frac{1}{3}$ to $\frac{1}{2}$ of the cost of mounting mechanical refrigeration units at the ends of the car.

In accordance with the invention the power unit to supply energy to the refrigeration unit is mounted under the car, and the fans for circulating the air are mounted in a plenum above the loading space. No provision need therefore, be made for a separate machinery compartment, and thus, there is no reduction of floor area or of cubic capacity.

All the components are readily accessible for on the spot servicing or unit replacement, whichever is more convenient in each case. In particular the refrigeration unit may be removed by disconnecting the power supply and removing the whole door, which can readily be replaced by a spare door with a refrigeration unit mounted therein. The power unit and the fan are also easily accessible or replaceable.

In addition the novel system is far more reliable than end mounted units because the refrigeration components are located in the centre of the car, that is in a zone of minimum shock, and in addition they are all contained in a unit frame, namely the door, and therefore, they are not subject to varying vibrations.

A further advantage is the improved distribution of the cold air which results from placing the refrigeration unit and the fan at the centre of the car instead of at the ends.

Preferred embodiments of the invention are illustrated by way of example in the accompanying drawings, in which:

FIG. 1 is a fragmentary perspective view, partly broken away, of a railway car fitted with a door mounted refrigeration unit in accordance with the invention.

FIG. 2 is a fragmentary transverse vertical section of the car shown in FIG. 1 with the sectional plane passing through, but not in the centre of the door.

FIG. 3 is a fragmentary transverse vertical section in which the sectional plane does not pass through the door.

FIG. 4 is a transverse vertical section through the door.

FIG. 5 is a front view of the door partly broken away.

FIG. 6 is a perspective view of one embodiment of the sill.

FIG. 7 is a fragmentary side elevation of a car showing diagrammatically the electrical connections between the power unit and the refrigeration unit and fans.

FIG. 8 is a transverse vertical section through a door in accordance with a modified embodiment of the invention.

FIG. 9 is a fragmentary transverse vertical section of a car having doors on opposite sides with refrigeration units mounted in both doors.

FIG. 10 is a view showing a modification of the baffle system of FIG. 9.

Referring to FIGS. 1 to 6, the invention is illustrated

as applied to a refrigerator car having double outer walls 10, roof 11 and floor 12, with a layer 13 of insulation contained therein. FIGS. 2 and 3 show the location of the ice tanks 14 of certain conventional cars, which, for the purposes of the present invention, may be left in place. The tanks are disposed in a plenum formed by a ceiling 15, above the loading space 16 and at one or both ends of the car. The plenum is continued at the sides by inner walls 18 spaced from the double outer walls 10, and at the floor of the car by a loading platform 19. As shown in FIG. 3 the ceiling 15 which formerly had an elongated slot at the centre, is suitably blocked off by means of a panel 20. The hatch 21 for icing is no longer needed with the present arrangement and may be sealed on permanently.

The door 22 (FIG. 5) is mounted for sliding movement by means of rollers 23 at the bottom, pivotally secured to links 24 in turn rigidly secured to hinge rods 25 which may be turned by a screw 26 through the intermediary of arms 28. The rollers 23 ride on a bottom rail 29, while at the top, the door is guided in a top rail 30 by means of horizontal guide rollers 31 journaled on links 32 connected to the upper ends of rods 25. This arrangement, which is well known, being used on existing refrigerator car doors, operates in such a way that the door may be fitted tightly in place by turning rods 25 so that links 24 and 32 are turned towards the car. If the rods are turned the opposite way by acting on screw 26, the door will move outwardly enough to clear the outer wall of the car, and it may then be slid along the rails 29 and 30.

The refrigeration system according to the invention comprises three separate units, namely; a refrigeration unit, an air circulating system, and a power unit.

The refrigeration unit (FIGS. 4 and 5) is mounted entirely inside the door 22; it comprises a compressor 35, a liquid receiver 36, a condenser coil 37, a fan 38 and an evaporator coil 39. These elements are connected by appropriate piping 40 and operate in a conventional manner. In order to receive the elements of the refrigeration unit the door 22 which is flush on the inside with inner wall 18, projects slightly outwardly at 42 to an extent which yet allows the car to clear other cars on an adjacent track. All the elements except the evaporator coil are contained in a central compartment 43 which is insulated towards the inside of the car and from the rest of the door, and which communicates with the outside through a screen 44.

Circulation of the air through the plenum (FIGS. 1 and 2) is effected by a pair of fans 46 which are disposed at the centre of the car, as is the door 22. The fans 46 are arranged to direct the air towards opposite ends of the car; they communicate with the door through a duct 47, which forms part of the plenum.

To allow passage of the air from the inside of the door to the duct 47 the door (FIG. 2) has at its top edge an opening 49 communicating with the duct 47. A similar opening 50 communicating with the plenum under the loading platform 19 is provided at the bottom edge of the door to circulate the air. The opening 50 registers with a sill 51 which may be formed by a plurality of up-right transverse plates 52 (FIG. 6) secured to an extension 53 of the floor 12, the remaining portion of the sill being formed by an extension 51 of the outer wall 10. The plates 52 form passages which open at the top and on the inside, to place the door opening 50 in communication with the plenum, and at the same time they bridge the gap between the extension 51 and the loading platform 19.

The power unit is diagrammatically shown at 57 in FIGS. 1 and 7, and is mounted under the car. The unit 57 may include a diesel driven alternator and auxiliaries such as a fuel tank, battery and rectifier for battery charging; these elements are conventional and no details thereof are deemed necessary in the drawing. The unit

57 is connected by piped wiring 58 to a terminal box 59. Piped wiring 61, extending inside the car, connects the terminal box 59 to motor 62 which drives the fans 46. Piped wiring 63 extends on the outside of the car from the terminal box 59 to an outlet box 64, and from this outlet box a flexible wire 65 is plugged at 66 to the door 22. The plug 66 has connections (not shown) to the compressor and condenser motors. When the door is opened by sliding it towards the right (FIG. 7) the flexible wire 65 permits the same without disconnecting the power supply to the door. If the door has to be removed, the power unit 57 is disconnected from the refrigeration unit in the door at plug 66.

Certain modifications of the basic arrangement are shown in FIGS. 8, 9 and 10.

FIG. 8 shows a door 22' which is constructed so that it is flush on the outside with the outside wall of the car, while it projects on the inside into the loading space. Otherwise, the door 22', and the refrigeration unit mounted therein, are identical to the door 22; the corresponding elements being indicated by the same numerals with prime notation.

In FIG. 9 there are provided two doors 22', one on opposite sides of the car, each being fitted with a refrigeration unit. Duct 47' extends across the car so as to communicate with both doors. With this arrangement a pair of flaps 60 are provided at the two ends of the duct. The flaps may be locked in the closed and preferably also in the open position by any suitable means (not shown), so as to close off the ducts of either door, for servicing or replacement of same, while the refrigeration unit of the other door continues to operate. This also permits conversion either to a one or two-door unit.

FIG. 10 shows an arrangement similar to FIG. 9, but in which the flaps 60 are replaced by vertical cut-off panels 70 attached to angles 71 on either side of the fans 46. In this embodiment the duct 47'' is formed by two lateral panels 72 secured to angles 73, and by a central panel 74 bridging the angles 73 and supported thereon by pins 75. The figure shows one of the cut-off panels 70 in place; the panel 70 may be removed after removing the central panel 74.

What I claim is:

1. A rail car having a pair of centrally located opposite side doors; a ceiling, side walls and a platform defining a loading space and defining a plenum surrounding said loading space; a pair of fans mounted in said plenum above said loading space at the centre of said car and having their exhausts opening into said plenum portion above said ceiling and directed towards the opposite ends of the car; a duct extending across said car at the centre above said doors and communicating with the intakes of said fans; each door having a passageway therethrough with an opening at its top edge communicating with said duct and an opening at its bottom edge communicating with the portion of the said plenum below said platform; and a mechanical refrigeration unit mounted in said door to cool air in said passageway.

2. A rail car having a side door; a ceiling, side walls and platform defining a loading space and defining a plenum surrounding said loading space; a fan mounted in said plenum above said loading space and having an exhaust opening into said plenum portion above said ceiling; a duct communicating with the intake of said fan and extending to the side of said car above said door, said door having an opening at its top edge communicating with said duct and an opening at its bottom edge communicating with the portions of said plenum below said platform, a sill registering with said bottom door edge opening, said sill being formed with a plurality of up-right transverse plates which form passages opening at the top and inner side to place said bottom door edge opening in communication with said plenum below said loading space, and a mechanical refrigeration unit mounted in said door.

3. A rail car having a pair of opposite side doors; a ceiling, side walls and a platform defining a loading space and defining a plenum surrounding said loading space; a fan mounted in said plenum above said loading space; a duct extending to both sides of said car above said doors 5 and communicating with the intake of said fan; each door having an opening at its top edge communicating with said duct and an opening at its bottom edge communicating with the portion of said plenum below said platform, said fan having its exhaust opening into said plenum 10 portion above said ceiling; openable closure means in said

duct on both sides of said fan, and a mechanical refrigeration unit mounted in said door.

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