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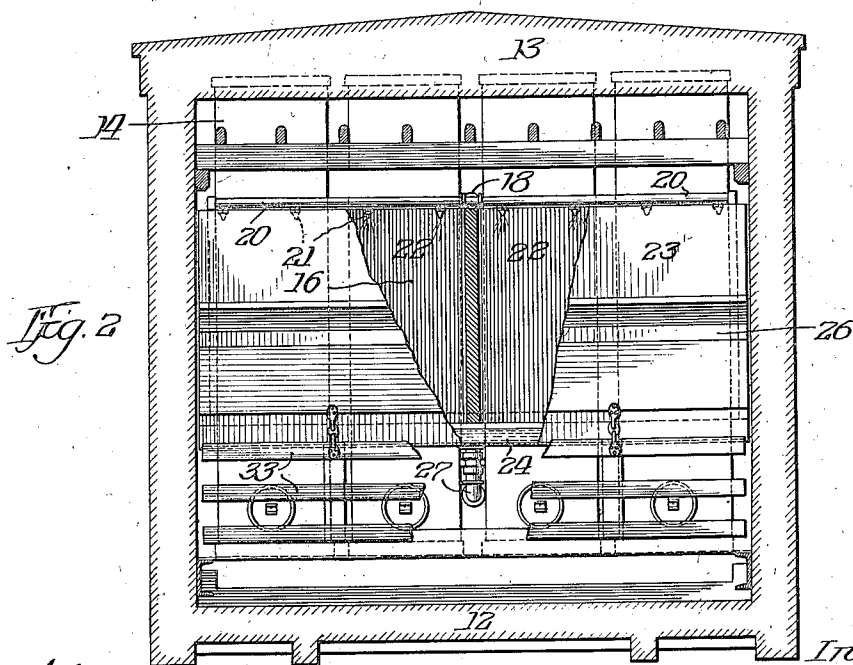
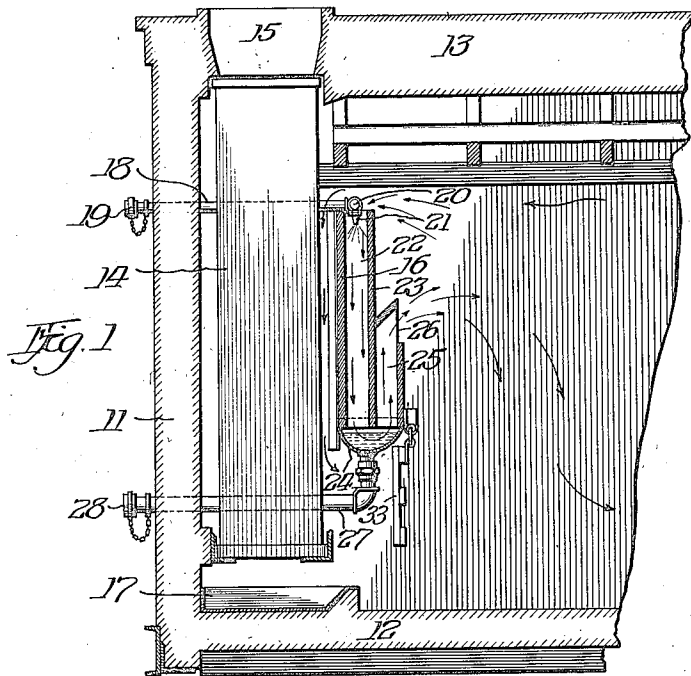
1,478,471

J. P. DOWDING

CAR REFRIGERATION

Filed Sept. 30, 1921

3 Sheets-Sheet 1



Witness:

J. C. Brown

By

Inventor
John P. Dowding

Cromwell, Greist & Warden
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Dec. 25, 1923.

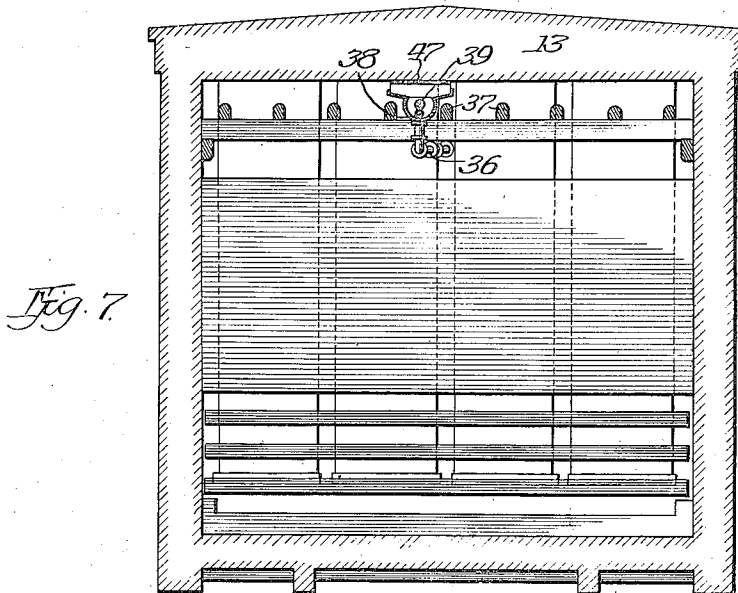
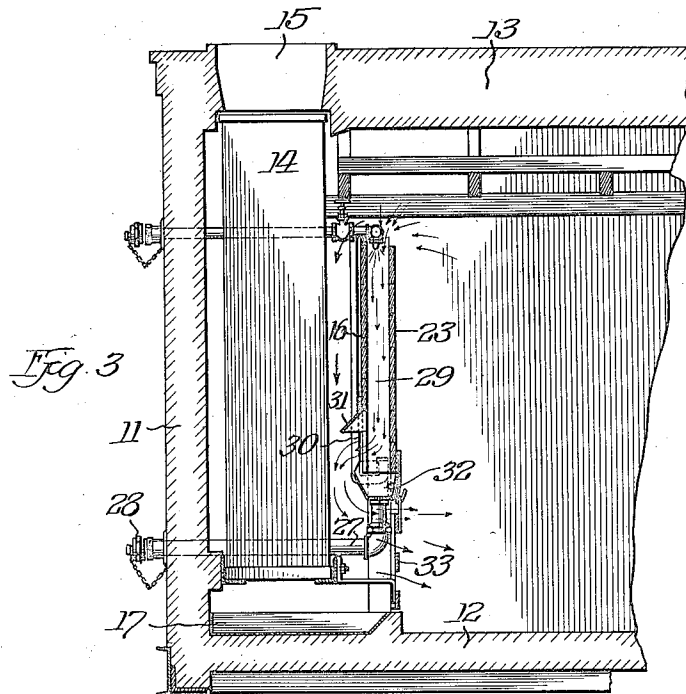
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J. P. DOWDING

CAR REFRIGERATION

Filed Sept. 30, 1921

3 Sheets-Sheet 2



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Dec. 25, 1923.

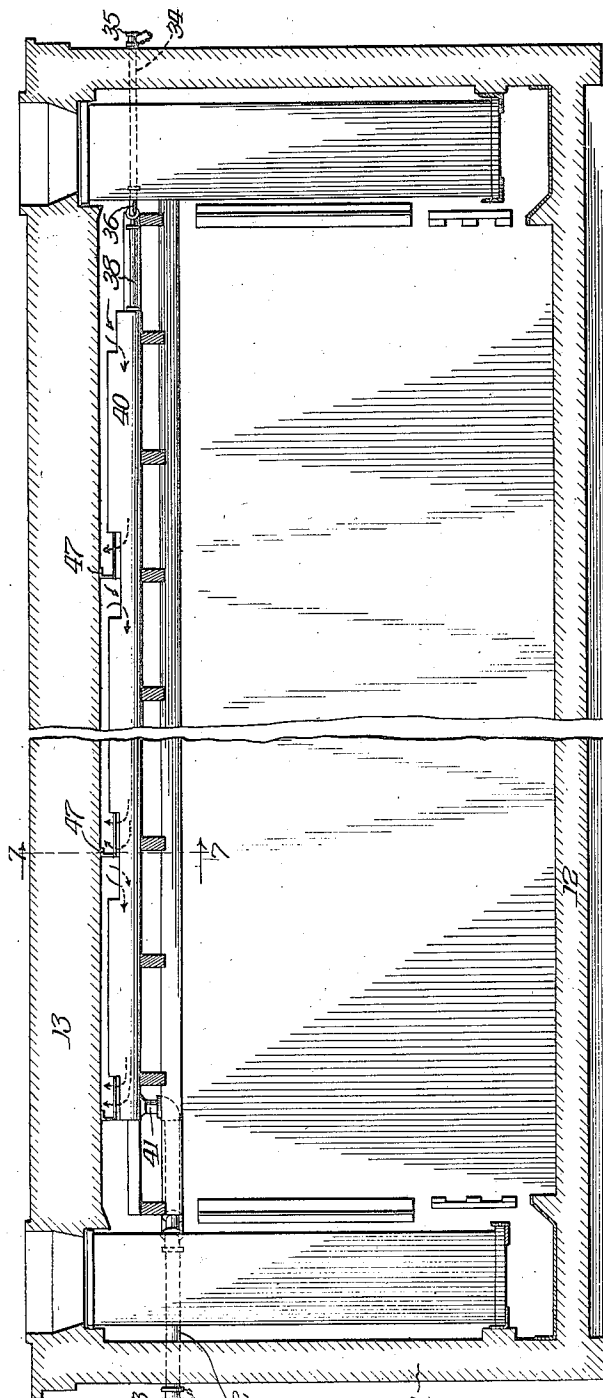
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J. P. DOWDING

CAR REFRIGERATION

Filed Sept. 30, 1921

3 Sheets-Sheet 3



Witness:

Ed. Larson

Fig. 4

By

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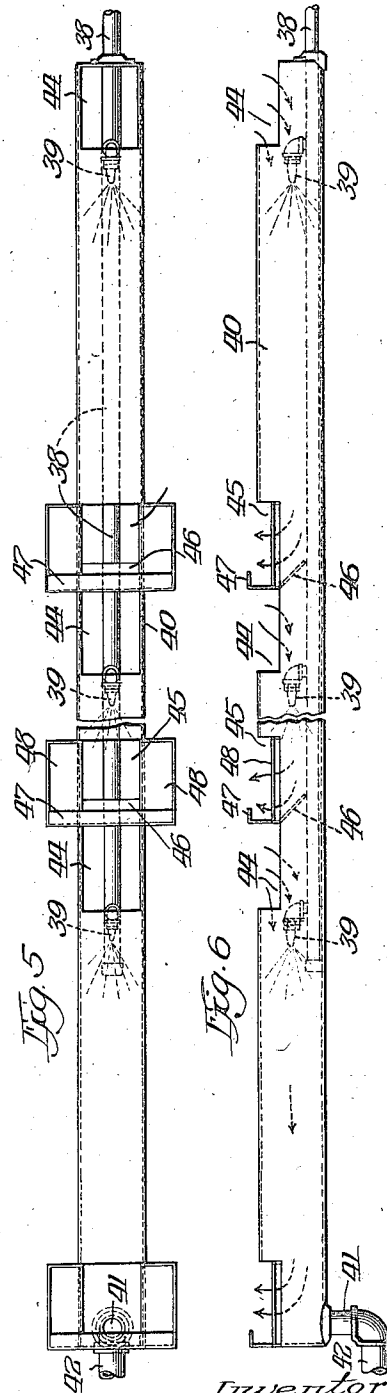


Fig. 5

Fig. 6

Inventor

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UNITED STATES PATENT OFFICE.

JOHN PERCIVAL DOWDING, OF CHICAGO, ILLINOIS.

CAR REFRIGERATION.

Application filed September 30, 1921. Serial No. 504,510.

To all whom it may concern:

Be it known that I, JOHN P. DOWDING, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Car Refrigeration, of which the following is a specification.

The present invention has for its object the provision of improved means for prechilling, rechilling and maintaining a low temperature in refrigerator compartments, having its particular application to refrigerator cars and the like.

Refrigerator cars of approved design are usually provided with ice bunkers at each end, to be charged periodically with ice and sufficient salt to produce a brine of low temperature in the bunkers, the air of the car, chilled by contact with the bunkers, circulating under conditions of gravity throughout the car interior.

Other types of refrigerator cars are cooled by means of low-temperature brine circulating through pipes disposed around the car interior; while in others refrigerating machines are employed driven from the car axle or other source of power.

In all such refrigerator cars it is necessary to precool thoroughly before the car is in condition to be loaded. Utilizing the refrigerating means of the car itself, whether ice bunkers or brine circulation or ice machine, a period of approximately thirty-six hours is required to lower the temperature of the car sufficiently to receive its load, and this represents a great loss to the railroads and shippers by reason of a car being withdrawn from service during this period of precooling.

It is also necessary in the case of long hauls to re-ice at intervals, stations being provided with facilities for the purpose. Ordinarily the ice bunkers are not entirely empty and the replenishing of the same at such stations will suffice, but in cases where by reason of delay in transit or otherwise the bunkers have become empty and the temperature within the car has risen beyond that required for efficient preservation of the lading, it is important to recool or re chill more quickly than could be done by ice alone.

My invention contemplates, not the substitution of other refrigerating means for the ice usually employed, but the provision of quickly acting brine circulation in association with the refrigerating bunkers for the prechilling of the car and for the speedy rechilling of the same at icing stations along the route, resulting in a great saving of time at the starting point and at the icing stations and also a great saving in the amount of ice required, and a decided improvement in the conditions under which the lading is maintained from the time it is placed in the car until it reaches its destination.

The objects of the invention are attained by equipping a refrigerator car with the usual ice bunkers provided for the chilling and gravity circulation of air within the car, and in association therewith, a pipe system for a fluid refrigerant including injector devices to produce circulatory air currents in contact with the fluid, together with means for connecting the pipe system of the car with an extraneous source of fluid refrigerant under pressure at the loading and icing stations.

By this arrangement, in combination, the car can be quickly prechilled while being iced and while being loaded, and later along the road can be rechilled by fluid refrigerant at the same time it is being re-iced and without opening the car.

In order that the invention may be readily understood in its constructional features as well as in the manner of employment, I have in the accompanying drawings illustrated different exemplifications of the same as a basis for a description thereof. It will be readily apparent that the invention is capable of modified application, wherefore the drawings and description are to be taken in an illustrative and not in an unnecessarily limiting sense.

In the drawings,
Fig. 1 is a fragmentary longitudinal vertical section illustrating the invention embodied in a railway car;
Fig. 2 is a transverse section through Fig. 1 with a portion broken away;
Fig. 3 is a view similar to Fig. 1 showing a modified form of the injector well;
Fig. 4 is a longitudinal section through

the car, foreshortened, illustrating the different arrangement of pipe and injector system;

Fig. 5 is a top plan view of the pipe system with its housing;

Fig. 6 is a side elevation of Fig. 5; and

Fig. 7 is a transverse section on the line 7-7 of Fig. 4.

Referring to Figs. 1 and 2 of the drawings, the car end wall is designated at 11, the floor at 12, and the roof at 13. Within the end of the car is arranged the usual ice bunker or bunkers 14, supplied with ice from above through the opening provided with a closure 15. The ice bunker space is separated in the usual manner from the lading space of the car by a partition or bulkhead 16 which is spaced from the ceiling and floor of the car, so as to function as an air-guiding baffle effective to permit the warm air to move into contact with the bunker at the top of the car and thereafter retain it in intimate association with the bunker to effect its cooling, as a result of which it moves downwardly and returns to the lading space by moving outwardly below the bulkhead. Below the ice bunker there is provided the usual drip tray 17 from which the waste is drawn off through an opening provided with a trap, not shown.

According to my invention, the car is equipped additionally with an inlet pipe 18 for fluid refrigerant such as low temperature brine, the outer end of the inlet pipe being closed by a screw cap 19 which may be removed for connection of the inlet pipe with a supply pipe from a source of brine under pressure.

At its inner end the inlet pipe 18 connects with a cross-head 20 provided with a series of downwardly projecting injector nozzles 21. This cross-head with the nozzles is disposed in the upper portion of a well or conduit 22 formed between the partition 16 and a wall 23. The conduit is open at its upper end to the upper part of the lading space of the car adjacent the bunker and in its lower portion is disposed a tray 24 for the collection of any excess of the liquid refrigerant discharged by the nozzles. From its lower end the conduit has outlet communication with the lading space through another branch 25 which extends upwardly and then opens towards the lading space at 26. A draw-off pipe 27 is provided for the excess refrigerant, and at its outer end is equipped with a cap 28 to which may be connected a waste pipe or a return pipe if the refrigerant is to be reused.

Having reference to Fig. 3 of the drawing, the branch 25 of conduit illustrated in Figs. 1 and 2 is dispensed with, and the conduit 29, open above to the lading space adjacent the bunker has a lateral opening below at 30 towards the ice bunker.

Above the opening 30 there is a deflector 31 which directs the outcoming refrigerated air downwardly through the bunker space, whence it flows forwardly beneath the tray 32 which is arranged below the open end of the conduit to collect the fluid freed by the air. The draw-off pipe 27 extends from the tray through the end of the car and is provided as before with a closure cap 28.

Both in that form of construction shown in Figs. 1 and 2 and that shown in Fig. 3 a pendent lattice shield 33 shuts off the bunker space below the injector pipe system from the lading space of the car or other compartment.

In both forms of the invention hereinabove described the fluid refrigerant under pressure admitted to the pipe system of the car through the inlet pipe 18 is discharged downwardly by the nozzles 21 into the conduit, thereby causing by injector action an inflow of warm air to the top of the conduit from the lading space. The air and refrigerant fluid are thus forced together through the conduit and are separated at the bottom thereof, the fluid being collected in the tray and carried off, and the cool air discharging laterally either towards the ice bunker or directly into the car interior, thus setting up circulatory air currents which speedily bring about an equable low temperature within the car. At the same time, the circulation of air thus induced increases the circulation in contact with the bunker, so that, acting in conjunction with the refrigerating spray, the ice within the bunker 14 performs its function, which continues, after the supply of refrigerant fluid is cut off, to maintain a gravity circulation of the air within the car whereby the temperature is maintained substantially constant so long as the ice supply lasts.

Whether the quick acting refrigerating pipe system is employed only at the time of loading or in transit at the icing stations, the ice in the bunkers is assisted in quickly lowering the temperature of the car interior to a point where the after-consumption of the ice while the car is moving will be materially reduced and the amount of ice required periodically at the icing stations will be kept at a minimum. The apparatus thus quickly extracts the heat from the car and cargo before it is started in transit, so that the bunker ice thereafter is required to take care only of the heat absorbed through the car insulation.

With particular reference to that form of the invention shown in Figs. 4, 5, 6 and 7, the principle is the same as that previously described, but instead of the pipe system and injector nozzles operating vertically, the pipes and nozzles are disposed horizontally. By reference to these figures it will be observed that in addition to the usual ice bunkers at the ends of the car, an inlet pipe

34, closed by a cap 35, extends through the end wall of the car and is slightly offset at 36 so as to bring the same to one side of the central car timber 37. It then extends longitudinally of the car at 38 and is provided at intervals with upstanding forwardly directed injector nozzles 39 arranged in tandem. A trough-like conduit 40 is disposed about the pipe 39 to collect the fluid discharged from the nozzles and to deliver the same through the short pipe 41 to a draw-off pipe 42 extending to the outside of the car and closed by a cap 43. The conduit 40 is cut away above at intervals to provide inlets 44 for warm air and outlets 45 for chilled air, the inlet openings being disposed at the rear of and adjacent the nozzles 39 and the outlets in advance of said nozzles. Within the conduit adjacent the outlets are disposed inclined deflecting plates 46 by which the air entrained within the conduit by the injector nozzles is guided upwardly through the outlet openings. At the outlet openings the conduit is flanged over as indicated at 47 for attachment to the car ceiling and is also widened as indicated at 48 to catch any moisture which may be carried upwardly by the outflowing chilled air.

In this form of construction, the warm air at the top of the car is drawn by the injector action of the nozzles into contact with the refrigerant spray and is then, after chilling, discharged in the upper portion of the car from whence it settles to the lower area replacing warm air which rises to be chilled. A general movement of the air is also caused longitudinally of the car. As in the former case the fluid refrigerant cooperates with the refrigerating action of the ice in the bunkers whereby the car may be quickly lowered in temperature while the lading is being placed in position from refrigerated docks or loading platforms, and either before or after the car is loaded. It may be rechilled along the road without opening the car, thus securing a considerable saving of time, of inconvenience, and a great reduction in the amount of ice used both at the loading station and in transit, accompanied by a higher efficiency in the preservation of perishable lading.

While I have described the invention with particular reference to its employment in a movable refrigerator compartment, such as a railway car, and while it finds its principal utility in such installations, it will be understood that the invention is not limited to such application, but is adaptable for employment in connection with stationary cold storage plants and cooling rooms of packing houses, etc.

I claim:

1. In a refrigerating compartment, the combination of a bunker exposed therein, an air directing conduit disposed adjacent the bunker and having air inlet and outlet com-

munication with the compartment adjacent the bunker, a nozzle arranged to discharge longitudinally of the conduit, and a pipe for conveying refrigerating fluid to the nozzle from externally of the compartment. 70

2. Refrigerating apparatus comprising the combination with a refrigerating compartment, of a refrigerating bunker exposed therein, an air conduit extending alongside the bunker and having air inlet and outlet communication with the compartment adjacent the bunker, a nozzle arranged to discharge fluid in the conduit to induce movement of air therethrough, and a pipe for supplying fluid to the nozzle from externally of the compartment. 75

3. Refrigerating apparatus comprising the combination with a refrigerating compartment, of refrigerating bunkers exposed therein, an air conduit disposed in the compartment and having air inlet and outlet communication therewith adjacent the bunkers, a nozzle arranged to discharge fluid in the conduit to induce movement of air therethrough, and a pipe for supplying fluid to the nozzle from externally of the compartment. 80

4. In refrigerating apparatus, the combination with a refrigerating compartment, of a refrigerating bunker exposed therein, an air directing conduit in the compartment and having air inlet communication therewith adjacent the bunker, a nozzle arranged to discharge fluid in the conduit to induce movement of air thereinto, and a pipe for conveying fluid to the nozzle from externally of the compartment. 85

5. Refrigerating apparatus comprising the combination with a refrigerating compartment, of a refrigerating bunker exposed therein, a conduit extending adjacent the bunker and having air inlet communication with the compartment adjacent the upper portion of the bunker and air outlet communication with the compartment adjacent the lower portion of the bunker, a nozzle arranged to discharge fluid in the conduit to induce movement of air therethrough, and means for supplying refrigerating fluid to the nozzle. 90

6. Refrigerating apparatus, comprising the combination with a refrigerating compartment, of a refrigerating bunker exposed therein, a bulkhead arranged alongside but spaced from the bunker, a nozzle arranged to discharge fluid along the side of the bulkhead, and means for supplying refrigerating fluid to the nozzle. 105

7. Refrigerating apparatus comprising the combination with a refrigerating compartment, of a refrigerating bunker exposed therein, a conduit extending alongside the bunker and forming a bulkhead spaced apart therefrom, said conduit having air inlet and outlet communication with the compartment 110

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adjacent the bunker, and means for injecting refrigerating fluid into the conduit to induce movement of air therethrough.

8. In a railway car, the combination with an insulated compartment affording lading space, of a refrigerating bunker exposed therein, an air conduit in the compartment adjacent to but spaced from said bunker, injecting means for spraying liquid refrigerant through said conduit to induce circulation of air from the lading space into contact with the bunker, an inlet pipe leading to said injecting means, an outlet pipe for refrigerating liquid discharged from the injecting means, said inlet pipe affording a supply connection externally of the compartment, and said outlet pipe affording a discharge connection externally of the compartment.

9. In refrigerating apparatus, the combination with a refrigerating compartment, of a vertically extending refrigerating bunker exposed therein, a bulkhead associated with said bunker to afford a segregated space for circulation of air along the bunker, a nozzle arranged to discharge in a substantially vertical direction adjacent the bunker, and means for supplying refrigerating fluid to the nozzle under pressure, whereby ejection of the same from the nozzle induces air circulation through said space.

10. In a refrigerating car, the combination with a refrigerating compartment affording lading space, of a refrigerating bunker having a vertically extending heat absorbing surface exposed in the compartment, a vertically extending conduit adjacent the bunker and lading space and having its inlet adjacent the upper portion of the compartment and its outlet adjacent the lower portion thereof, means arranged to spray fluid downwardly through said conduit, and a pipe for conveying refrigerating fluid to said means under pressure from outside the compartment for discharge through the conduit, whereby circulation of air is induced in the lading space and in association with the bunker.

11. Refrigerating apparatus, comprising

the combination with a refrigerating compartment, of a bunker exposed therein and adapted for retention of liquid refrigerant, a conduit housed in the compartment and having inlet and outlet communication therewith, a nozzle disposed to inject fluid refrigerant in the conduit to induce circulation of air into contact with the bunker, and means for conducting fluid to the nozzle from externally of the compartment.

12. Refrigerating apparatus, comprising the combination with a refrigerating compartment, of a bunker exposed therein, a conduit arranged in association with the bunker and having an outlet adjacent the lower portion thereof, a nozzle arranged to direct fluid through the conduit, and means for conducting refrigerating fluid to the nozzle.

13. Refrigerating apparatus, comprising the combination with a refrigerating compartment of a refrigerating bunker exposed therein, a member disposed alongside the bunker to form a conduit having its terminals adjacent the bunker, and means for spraying refrigerating fluid in the conduit to induce movement of air therethrough.

14. Refrigerating apparatus, comprising the combination with a refrigerating compartment of a refrigerating bunker exposed therein, a bulkhead associated with the bunker to afford air circulation space therebetween, a nozzle arranged to discharge fluid adjacent the bunker, and a pipe for conducting refrigerating fluid to the nozzle from externally of the compartment.

15. In a railway car, the combination with the refrigerating compartment, of refrigerating bunkers exposed therein, an air conduit disposed in the compartment and having air inlet and outlet communication therewith adjacent the bunkers, injecting means arranged to spray fluid in the conduit to induce movement of air therethrough, and a pipe for supplying fluid to the injecting means.

In testimony whereof I have hereunto subscribed my name.

JOHN PERCIVAL DOWDING.