Sept. 27, 1927. 1,643,892

G. A. HULL

AIR CIRCULATING MEANS FOR REFRIGERATOR CARS

Filed Dec. 11, 1924 3 Sheets-Sheet 1

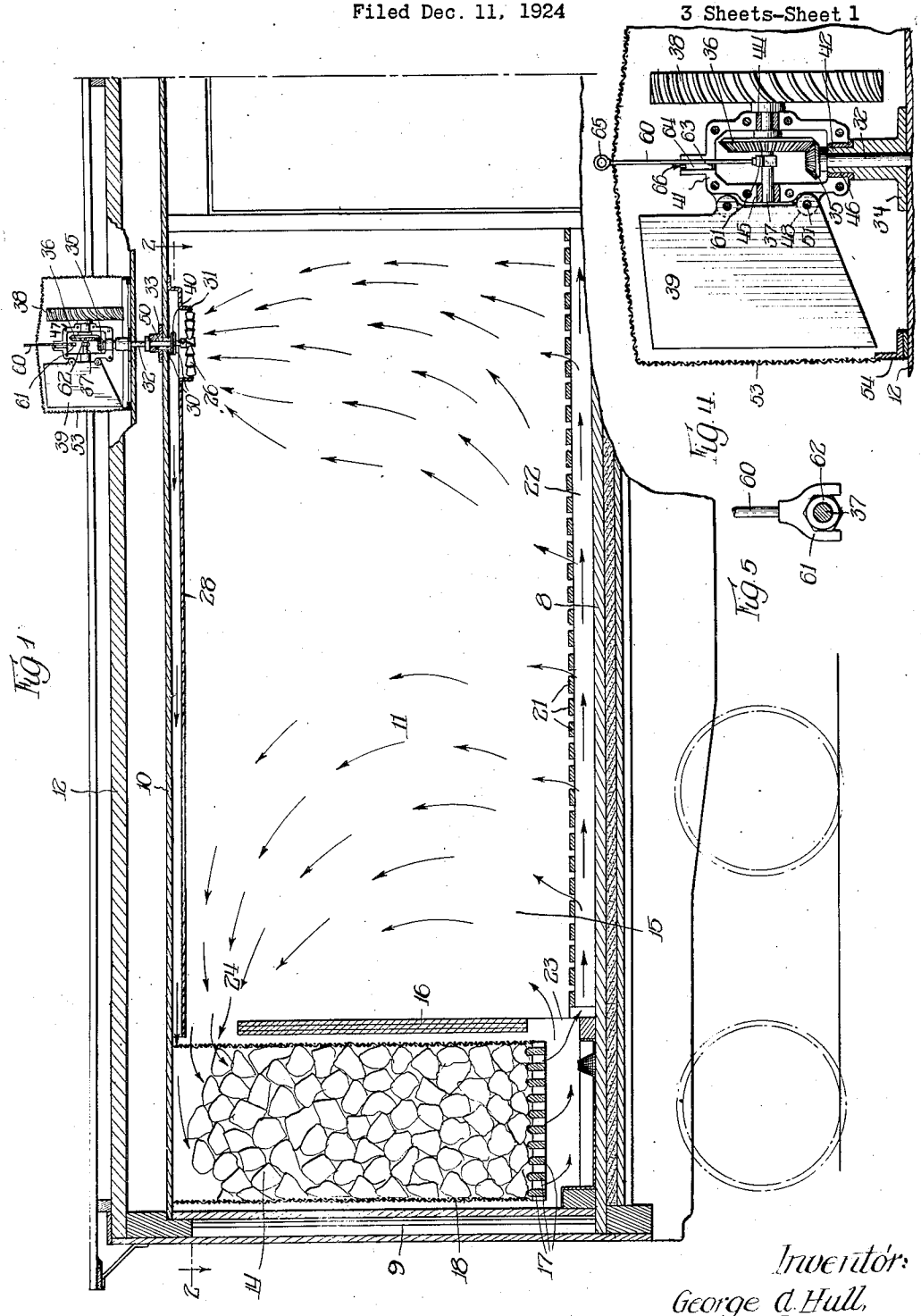


Fig. 1.

Fig. 4.

Fig. 5.

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Filed Dec. 11, 1924 3 Sheets-Sheet 2

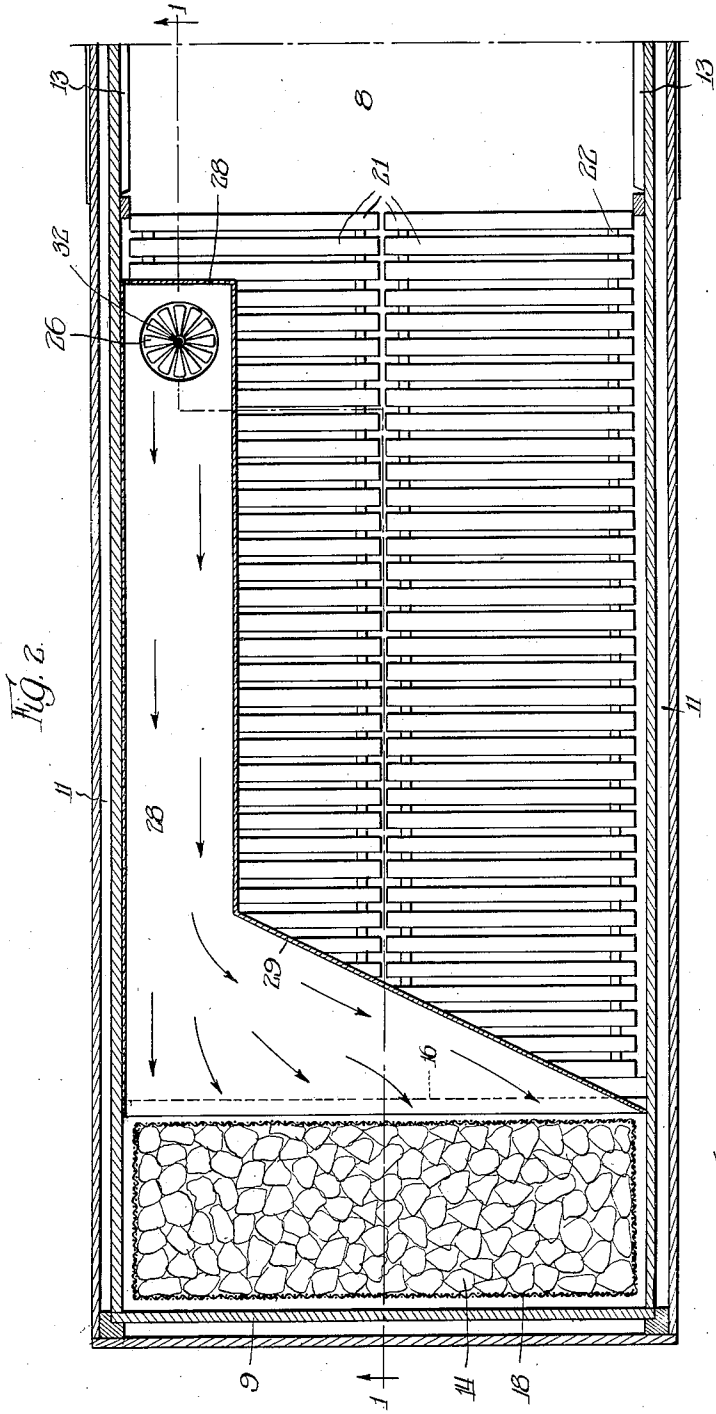


Fig. 2.

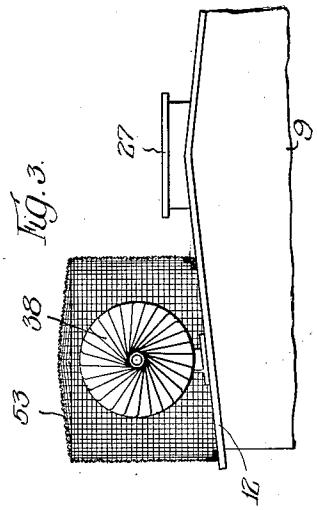


Fig. 3.

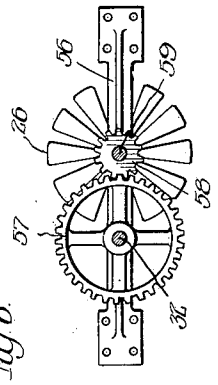


Fig. 6.

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Filed Dec. 11, 1924 3 Sheets-Sheet 3

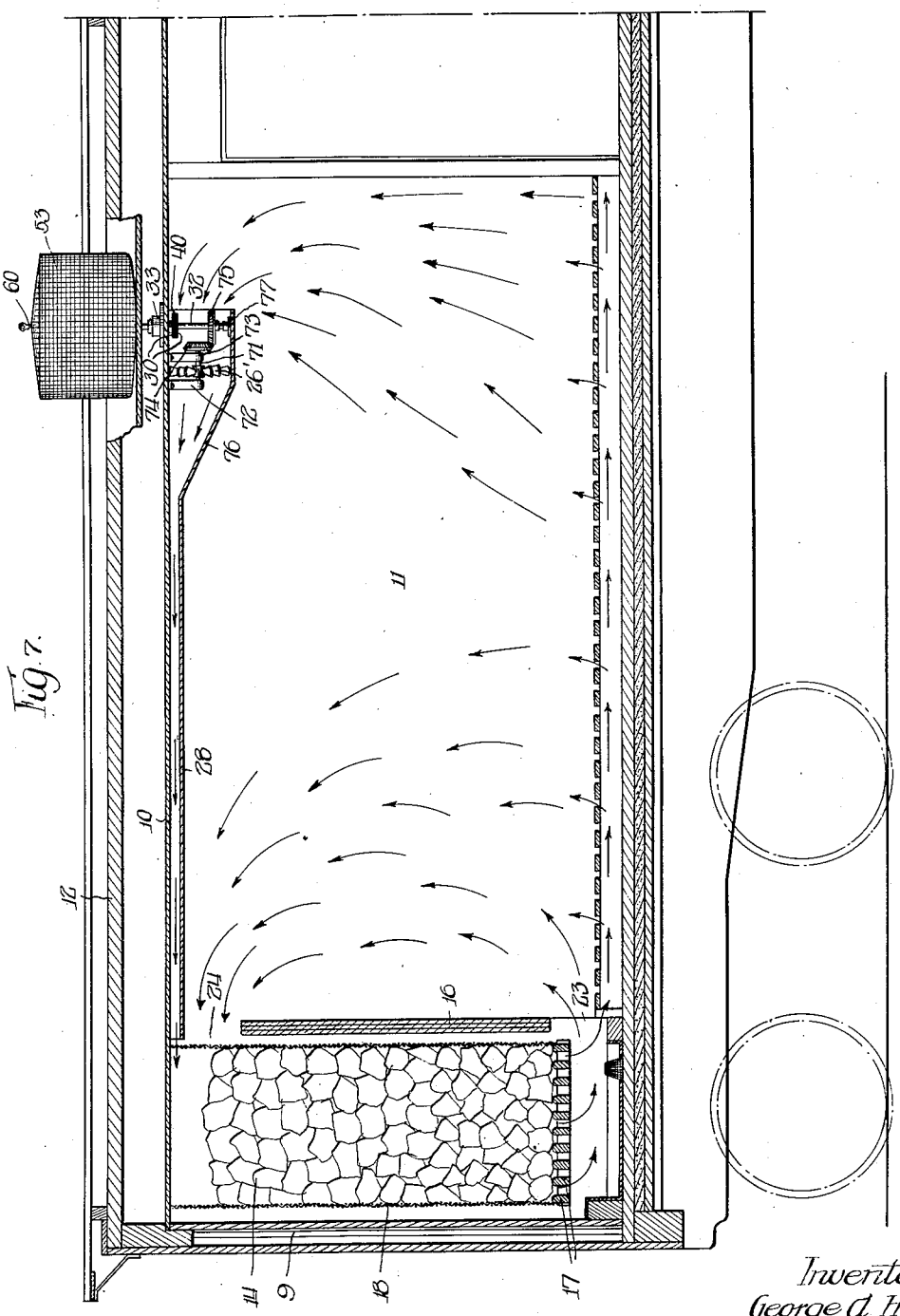


Fig. 7.

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UNITED STATES PATENT OFFICE.

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AIR-CIRCULATING MEANS FOR REFRIGERATOR CARS.

Application filed December 11, 1924. Serial No. 755,200.

The present invention relates to air circulating means for refrigerator cars.

In the operation of these cars a difficult problem is encountered in obtaining an adequate circulation of cold air to the perishable produce which is packed in the central portion of the car. As is well known to those acquainted with refrigerator car construction, the ice for cooling the car is packed in ice compartments located at the ends of the car and the perishable produce is packed in the main compartment which extends between these ice compartments and constitutes the greater portion of the car length. Each end bulkhead which separates the ice compartment from the main compartment is open at top and bottom, and it is intended that a thermal circulation of cold air be set up from the ice compartment, under the floor rack in the main compartment, up through the perishable commodities, and back through the ice compartment over the top of the bulkhead. This thermal circulation generally suffices for the end portions of the main compartment which are in close proximity to the bulkheads, but the produce which is packed in the intermediate portion of the car frequently receives but a very small part of this cooling circulation of air. As a result of this condition, considerable quantities of perishable produce often spoil in the intermediate portion of the car.

The primary object of the present invention is to correct this condition by providing means for stimulating or creating a forced circulation of the cooling air into these central portions of the car. This I achieve without the necessity of complicated operating mechanism and with each car remaining a complete operative unit. More particularly, I contemplate using the motion of the car to operate a circulating fan, pump or other element for creating this induced circulation. The mechanism for utilizing the motion of the car operates with the car travelling in either direction, and, in the embodiment herein disclosed, it is also operative to utilize whatever breeze may be blowing while the car is standing still.

Referring to the accompanying drawings in which I have illustrated a preferred embodiment of my invention:

Figure 1 is a longitudinal sectional view through one end of a refrigerator car, to which my invention has been adapted;

Figure 2 is a horizontal sectional view through the same, taken substantially on the plane of line 2—2 of Figure 1;

Figure 3 is a fragmentary and elevational view of the car, showing the lateral location of each power fan;

Figure 4 is a detail sectional view through the power fan mechanism located outside of the car;

Figure 5 is an isolated sectional view through the locking mechanism for the outer power fan;

Figure 6 is an inverted plan view of a modified construction, and

Figure 7 is a view similar to Fig. 1, showing a modified mounting of the inner circulating fan.

The typical refrigerator car illustrated in Figures 1 and 2 comprises a flooring 8, end walls 9, side walls 11 and roof 12. Below this roof 12 there is usually provided a false roof or ceiling 10, forming a dead air space in the upper part of the car. Side doors 13 afford access to the main compartment of the car, and the usual hatchways in the top of the car afford openings for filling the ice compartments.

These ice compartments 14 are located at the extreme ends of the car, being separated from the main compartment 15 by bulkheads 16. These ice compartments are usually provided with transverse bars 17 forming an open flooring, and have wire screen sides 18 for supporting the ice so that air can circulate down through and around the ice. Supported on the floor 8 in the main compartment 15 are floor racks 21, upon which the perishable commodities are packed. These floor racks form a lower zone 22 between the produce and the floor of the car for the circulation of cold air under the produce.

The bulkhead 16 has a lower opening 23 extending transversely of the car, through which the cold air, chilled by permeating down through the ice, is drawn through the lower zone 22 and around the lower part of the crates, etc. A similar opening 24 at the top of the bulkhead permits the warmer air, drawn from the upper part of the cargo, to

circulate down through the ice compartment.

A thermal circulation is set up from the ice compartment 14 down through the lower bulk head opening 23, through the lower zone 22, under the floor rack, up through the perishable commodities, and back along the underside of the upper panelling 10, through the upper bulkhead opening 24, down into the ice compartment. There is a tendency for this thermal circulation to be confined to that part of the main compartment in proximity to the bulkhead 16, and consequently the produce in the intermediate portion of the car receives a comparatively small volume of this cooling air. For stimulating or creating a circulation of this cold air up through the intermediate portion of the car, I have provided one or more circulating fans 26 which are preferably suspended directly below the false roof 10 in the central portion of the car. I preferably provide a separate fan for each end of the car so that the circulation established by each fan will be individual to its respective ice compartment. I have shown only one of these fans and its associated operating mechanism, because the fan for the other end of the car is merely a duplication thereof.

This fan is preferably located in close proximity to the false roof 10, where it will not interfere with the packing of produce crates to the usual height in the car. As shown in Figure 2, the fan is also offset to one side of the car so that the outer operating unit for propelling the circulating fan will not interfere with the upper runway 27 extending along the top of the car.

The air drawn upwardly by the fan is projected into a sheet metal duct 28 which is in the form of an open trough closed at sides and bottom and which is secured to the underside of the false roof 10. This circulating duct 28 extends along one side of the car towards the end thereof, where it is flared laterally as indicated at 29 for distributing the air currents across the entire top of the ice compartment. The opening in this circulating duct in which the fan operates has a depending flange 31 which houses the fan and protects it from injury in the packing and unpacking of the car.

The fan is secured to a vertical operating shaft 32 which extends up through a bearing 33 supported on the false roof 10, and up through a bearing 34 on the outer roof 12.

For minimizing the heat conductivity of this shaft 32 it is preferably broken into two sections at a point below the false roof 10, these two sections being provided with collars 30 which are connected through a heat insulating disk 40. The bearing 33 is also preferably provided with a heat insulating packing 50 surrounding the shaft. The upper end of the shaft carries a bevel pinion 35 which meshes with a relatively larger bevel gear 36 mounted on the driving shaft 37 of a propelling fan 38. The fan 38 is adapted to be pointed into the wind by a rear vane 39, and to permit of this swinging of the fan, the same has bearing support in a housing 41 which is arranged for swivelling about the axis of the vertical shaft 32. The upper end of the bearing 34 has a reduced portion 42 which constitutes a vertical trunnion on which this housing 41 is journalled. The housing may be of any desired construction for supporting the propeller fan shaft 37 and for housing the gears 35 and 36. As illustrative of an advantageous construction, I have shown a housing which is split vertically into two symmetrical halves adapted to be bolted together over the shaft bearings and over the trunnion portion 42. Secured between these housing sections are two bearing bushings 44 and 45 for the front and rear ends of the horizontal shaft 37. Another bearing bushing 46 is clamped between the housing sections at the bottom thereof for bearing support on the reduced trunnion portion 42 of the standard 34. The two housing sections are joined by bolts or rivets 47, and the vane 39 may be secured to lugs 48 projecting from these housing sections by bolts 51.

For protecting this outer propelling unit against injury, I propose housing the same in a circular wire cage 53 which may be secured to the roof of the car through attachment to a circular angle ring 54. This ring is preferably spaced from the roof of the car so that it will not act as a cinder trap. In addition to pointing the propelling fan 38 in the direction of motion of the car, the vane 39 will point this propelling fan into any breeze which may happen to be blowing when the car is standing still. Thus the circulating fan 26 will generally be in operation a greater part of the time, the car being moving or standing still. To compensate for the reactive effort of the gear 36 tending to revolve around the gear 35, the vane 39 may be set at a slight obliquity to the axis of the fan 38 in the proper direction for maintaining the axis of the fan pointed into the wind. The interior of the housing 41 may contain a lubricating oil or grease for lubricating the bearing bushings 44, 45 and 46 and the gears 35 and 36. At certain times, as when the car is travelling under ventilation in cold weather, it may be desirable to stop the fan against idle running. This I have provided for through a brake rod 60 which extends down through the center of the screen guard 53 and through the top of the gear housing. The lower end of the rod carries a locking fork 61 which has polygonal inner sides adapted to engage over a polygonal hub 62 on the shaft 37 (see Fig. 5). The rod 60 carries a laterally extending pin 63 which is movable up and

down in a vertical slot 64 extending to one side of the bore through which passes the rod 60. This pin prevents the descent of the locking fork at any other than the proper angle to engage over the hub 62. When the fan is to be released, the rod 60 is raised through the upper ring 65 until the pin 63 clears the top of the slot 64, whereupon the rod 60 is turned and the pin 63 is dropped into the secondary slot 66.

It will be noted that the bevel gear 36 is considerably larger than the bevel pinion 35 for the purpose of imparting an increased rotative speed to the shaft 32 so that the circulating fan 26 will operate under a higher efficiency. This rotative speed of the circulating fan 26 may be further increased through an arrangement of gearing, such as shown in Fig. 6. Here a bearing hanger 56 is extended across the fan opening 31 below the circulating duct 28, or transversely of this fan opening, either above or below the false roof 10. The vertical operating shaft 32 is offset from the axis of the fan 26 and has bearing support in this bearing hanger 56. Either above or below this bearing hanger this operating shaft 32 carries a relatively large spur gear 57 which meshes with a spur pinion 58 on the fan shaft 59, also journalled in the bearing hanger 56.

Where two separate circulating units are employed in each car for the separate ice compartments 14, it is preferable that one circulating fan draw from a point along one side wall and the other circulating fan from a point along the other side wall. Hence, the other unit not disclosed in Fig. 2 would preferably be disposed adjacent the lower or opposite side of the car with its circulating duct 28 extending along this opposite side to its individual ice compartment 14.

As an alternative construction, the inner circulating fan may be supported in a vertical plane to operate either with or without an air duct for propelling the air horizontally along the upper part of the car. Fig. 7 illustrates such disposition of the circulating fan in association with an air duct. The fan 26′ is supported in a vertical plane on a horizontal shaft 71 which has bearing support in two spaced bearing hangers 72 and 73 depending from the roof paneling 10. A relatively small bevel gear 74 on the shaft 71 meshes with a relatively large bevel gear 75 on the vertical drive shaft 32, whereby a relatively high rotative speed is transmitted to the circulating fan. This fan may be employed with or without the air duct 28; where the air duct is employed it has a downwardly flared entrance 76 which closely embraces the fan and which supports a bearing 77 for the lower end of the shaft 32.

It will be apparent that the essence of my invention can be practiced by various modifications of structure and the circulation of the cooling medium, within the broad spirit and scope of the invention.

What I claim is new and desire to secure by United States Letters Patent is:

1. In a railroad refrigerator car, the combination of a main compartment, an ice compartment at one end of the car, a ceiling in said main compartment, an air circulating duct secured to said ceiling and extending along one side of the car, one end of said duct being flared laterally to distribute the conveyed air across substantially the entire width of said ice compartment, a downwardly facing opening in the other end of said duct, a circulating fan rotating in said opening for drawing the air upwardly from the central portion of the car and circulating it through said duct towards said ice compartment, an operating shaft extending out through the roof of said car, said circulating fan being mounted on said shaft, and a propelling fan supported on the roof of the car and to one side of the central runway and operatively connected to said shaft for driving the same.

2. In a railroad refrigerator car, the combination of a main compartment, an ice compartment at one end thereof, a ceiling in said main compartment, a circulating duct comprising a sheet metal member secured to said ceiling and having one horizontal wall and two side walls, said duct being defined between the walls of sheet metal member and said ceiling and flaring laterally to discharge the conveyed air over substantially the entire width of said ice compartment, a vertical aligned opening in said circulating duct, a vertical aligned circulating fan in said opening, an operating shaft extending from said circulating fan up through the roof of the car to one side of the central runway, a bearing secured to the roof of the car and through which said operating shaft passes, a housing swivelled on said bearing, a propelling fan journaled on a horizontal axis in said housing, bevel gears in said housing operatively connecting said propelling fan with said shaft, a directing vane connected to said housing for pointing said propelling fan in the plane of the wind, a foraminous guard enclosing said propelling fan and directing the vane, and means operable from the outside of the refrigerator car for locking said propelling fan against effective operation.

3. In a refrigerator car, an air circulating system consisting of a main compartment, an exposed ice chamber comprising a cross-section of the end of said car, a bulkhead enclosing and protecting said ice chamber, said bulkhead having openings permitting access of air in the main compartment through the bottom and top of the same, a cold air duct extending under and permit-

ting air access to all of the floor area, and an air duct located on said ceiling to direct the flow of air over the top area of said ice chamber, said latter air duct being flared laterally to distribute air across substantially the entire width of said ice chamber.

4. In a refrigerator car, an air circulating system consisting of a main compartment, an exposed ice chamber comprising a cross-section of the end of said car, a bulkhead enclosing and protecting said ice chamber, said bulkhead having openings permitting access of air in the main compartment through the bottom and top of the same, a cold air duct extending under and permitting air access to all of the floor area, air propelled means located on the ceiling at a point remote from said ice chamber to stimulate air circulation toward said chamber, an air duct located on said ceiling to convey air to the top of said ice chamber, said air duct being flared at the end adjacent the ice chamber to distribute air across substantially the entire width of said ice chamber.

In witness whereof, I hereunto subscribe my name this 9th day of December, 1924.

GEORGE A. HULL.