Dec. 14, 1937. J. H. McCORMICK 2,102,182

REFRIGERATOR CAR

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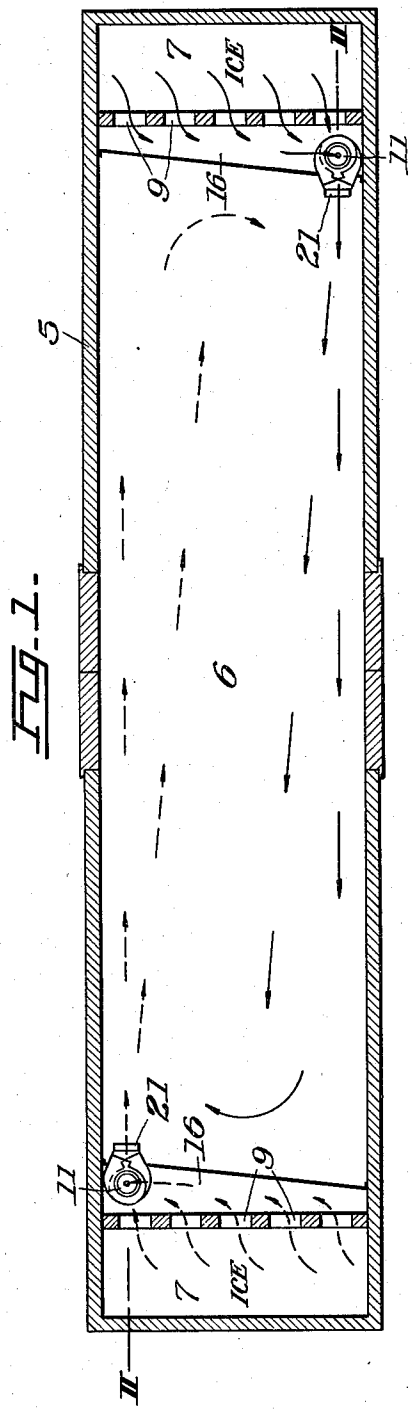


Fig. 1.

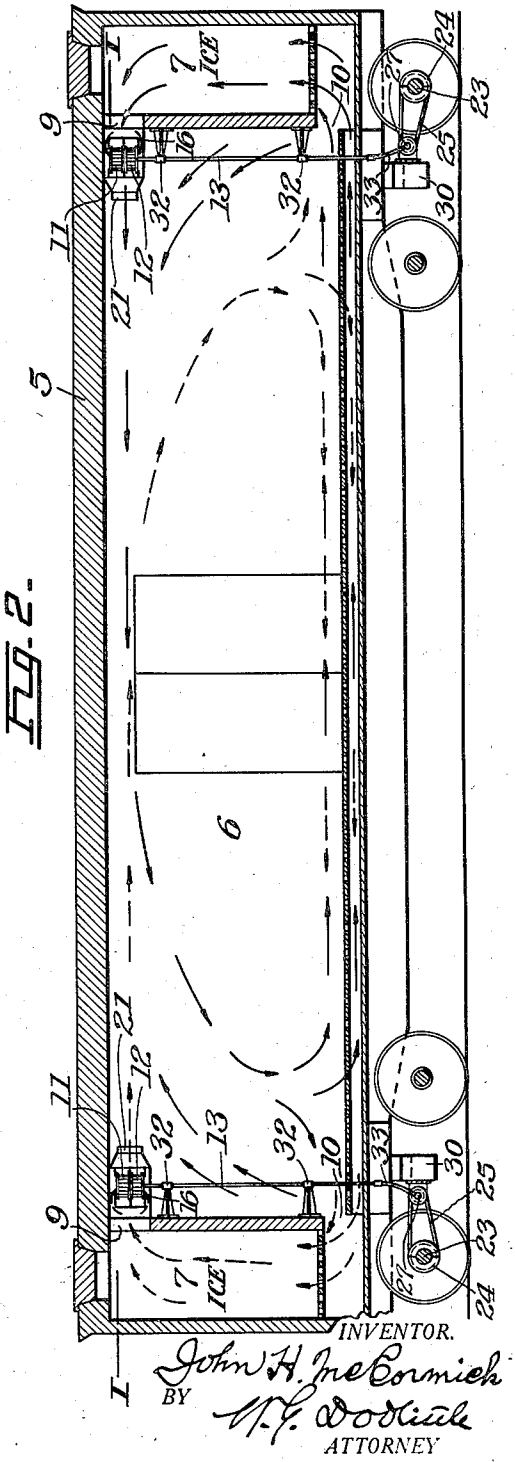


Fig. 2.

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Fig. 3.

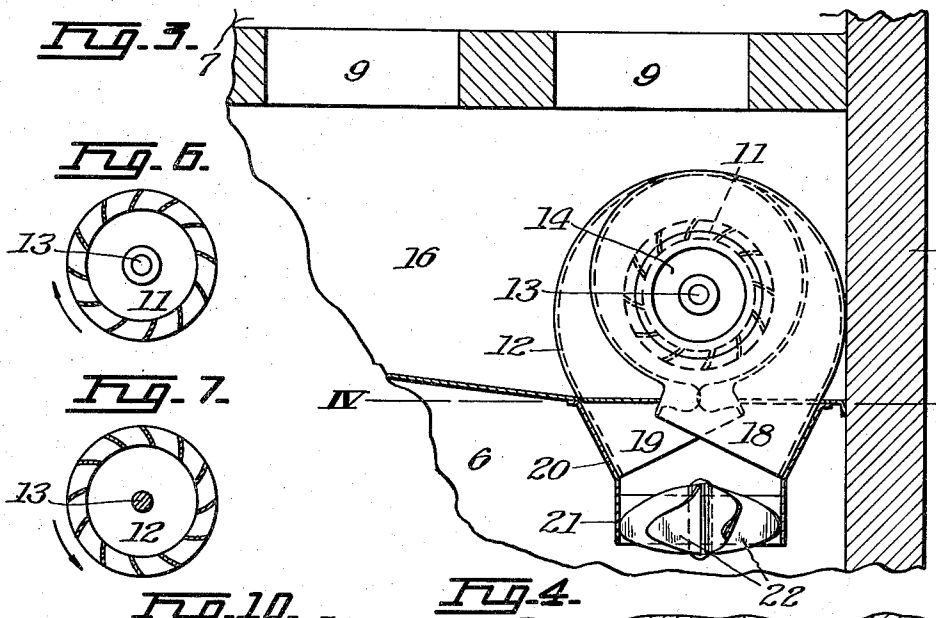


Fig. 6.

Fig. 7.

Fig. 10.

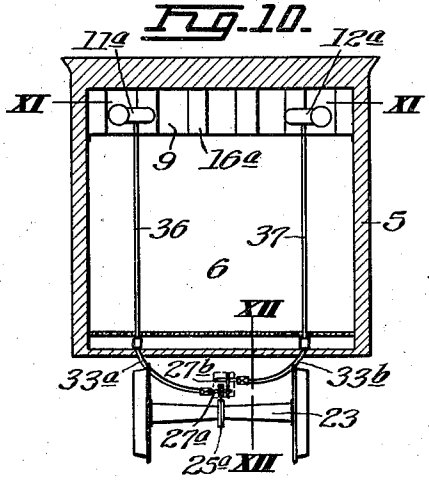


Fig. 4.

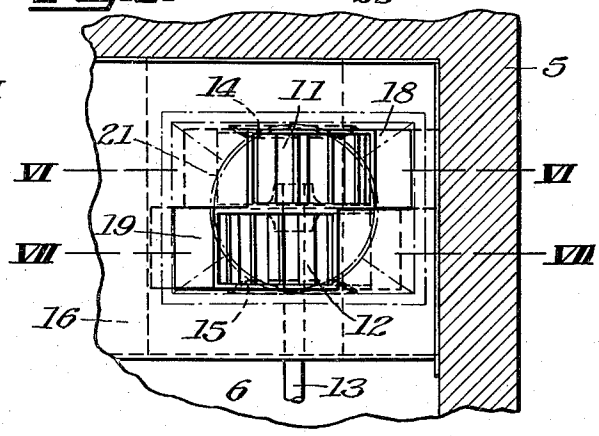


Fig. 11.

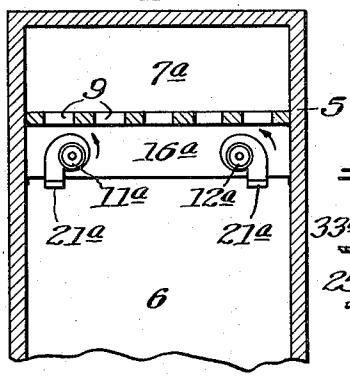


Fig. 5.

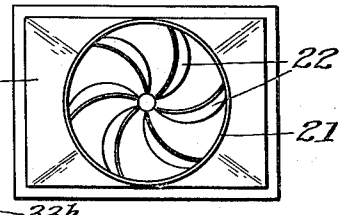
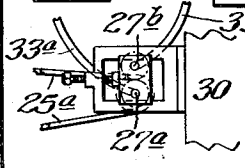


Fig. 12.



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Fig. 8.

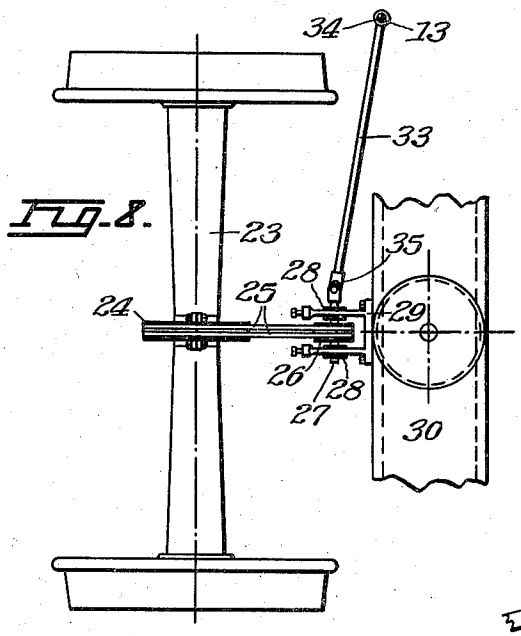


Fig. 9.

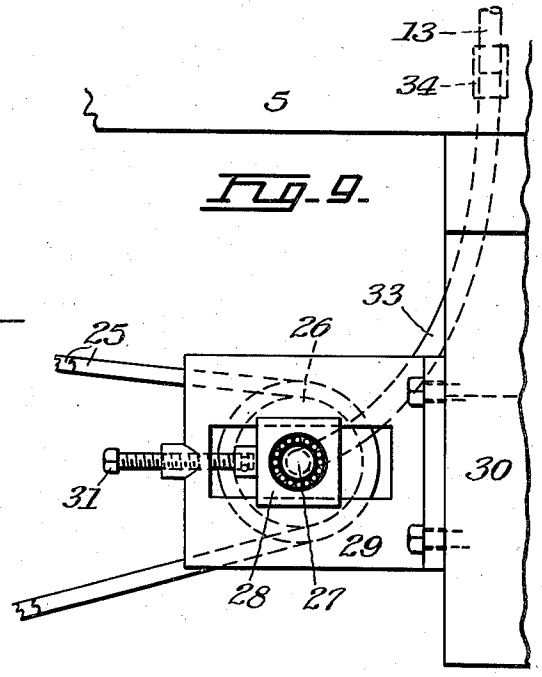


Fig. 13.

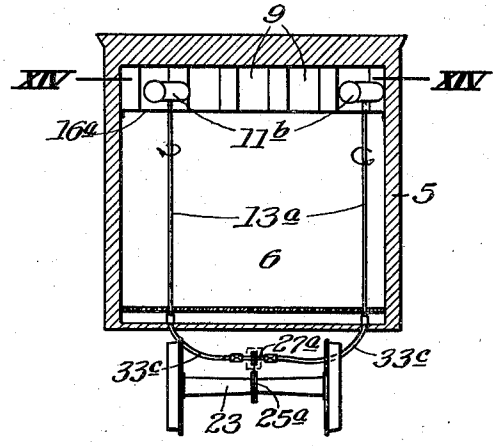
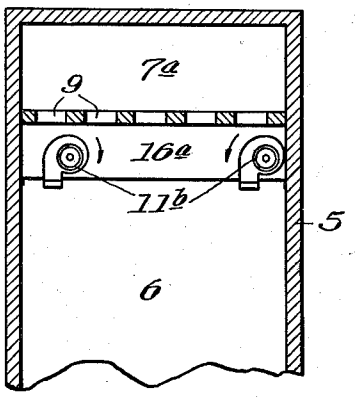


Fig. 14.



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Patented Dec. 14, 1937 2,102,182

UNITED STATES PATENT OFFICE

2,102,182

REFRIGERATOR CAR

John H. McCormick, Williamsport, Pa.

Application February 6, 1936, Serial No. 62,613

7 Claims. (Cl. 62—24)

This invention relates to refrigerator cars and especially to cars of the type in which mechanical means are provided for circulating air through the storage compartment and through the ice bunkers of said cars for the purpose of cooling or refrigerating the contents of the car while in transit.

Under present commercial practice refrigerator cars are equipped with ice bunkers located at each end of the car and warm air from the top passes downwardly through the ice bunkers and thence upwardly into the storage compartment or loading zone of the car thus establishing a circulation therethrough. This so-called natural circulation is not satisfactory in creating and maintaining the desired temperature. In some instances forced or mechanical circulation has been tried, but for various reasons has not proven commercially successful.

Among the objects of my invention are; to provide simple and effective means that may be employed in connection with standard refrigerator cars whereby protective temperatures may be established and maintained throughout the storage compartment; to provide new and improved means for supplying to the storage compartment sufficient volumes of air at velocities corresponding to the requirements that are entirely self-operating and operable to effect the desired temperature results regardless of direction of movement of the car; to provide a new forced air circulation system involving the continuous circulation of air up through the ice bunkers and thence over and under the loading zone to produce a substantially uniform refrigeration temperature throughout the storage compartment; and to provide a new and improved mechanical drive for the fans or fan wheels operable to effect a continuous drive during transit.

In the accompanying drawings, which illustrate applications of my invention:

Fig. 1 is a horizontal longitudinal sectional view of a refrigerator car embodying my invention, said section being indicated by the line I—I of Fig. 2;

Fig. 2, a vertical longitudinal sectional view thereof, said section being indicated by the line II—II of Fig. 1;

Fig. 3, an enlarged view of a portion of Fig. 1, particularly showing the superimposed fans of one of the circulation units in connection with the common discharge nozzle;

Fig. 4, a sectional view taken on line IV—IV of Fig. 3;

Fig. 5, a detail elevational view of a preferred form of discharge nozzle with its conductor casing;

Figs. 6 and 7, detail sectional views taken along lines VI—VI and VII—VII of Fig. 4 respectively, and particularly illustrating the opposite disposition of the blades of the wheels of the superimposed fans;

Fig. 8, a horizontal plan view of a portion of one of the car trucks, showing the means for driving a circulating unit shaft from the truck axle;

Fig. 9, an enlarged elevational view of the drive of Fig. 8;

Fig. 10, a vertical transverse section of a refrigerator car showing a modified embodiment of my invention;

Fig. 11, a horizontal section taken along the line XI—XI of Fig. 10;

Fig. 12, a detail vertical section of the modified drive means of Fig. 10, said section being indicated by the line XII—XII of Fig. 10;

Fig. 13, a view similar to Fig. 10, showing a further modification; and

Fig. 14, a horizontal section taken along the line XIV—XIV of Fig. 13.

Referring to the drawings 5 designates a refrigerator car of the usual and well known construction having a loading or storage zone or compartment 6 and ice bunkers 7, the latter being disposed at the ends of the car as is usual, and having top and bottom openings 9 and 10 respectively, for communication with the upper and lower portions of the storage compartment 6.

Associated with one or both of the ice bunkers 7, I provide an air circulating unit for inducing an upward flow of air through the bunker and discharging the thereby pre-cooled air into the upper portion of the storage compartment in a direction longitudinally thereof. As shown, I employ two of these units, one at each end of the compartment 6. Each of the circulating units comprises a pair of fans designed to be actuated by a movement of the car to produce the aforesaid circulating discharge of air, irrespective of the direction of movement of said car.

In the preferred form of my circulating units, each unit comprises a pair of fans 11 and 12, said fans being superimposed in tandem relation upon a common vertical drive shaft 13. The pair of fans may be of the type having a common hub for their wheels, or may have separate wheels mounted on the shaft 13, said wheels being rotatably contained within a suitable housing or housings.

As illustrated, the housing preferably comprises upper and lower oppositely disposed scroll por-

tions of well known contour, enclosing the wheels or rotors of the fans, or, if preferred, separate oppositely disposed scroll housings may be provided for the said fans. In either event, the discharge ends 18 and 19 of the respective fans 11 and 12, are oppositely disposed for alternate discharge depending upon the direction of rotation of the shaft 13.

The fans are of equal size and capacity, and as shown in Figs. 3 and 4, the upper fan 11 has its inlet 14 on the upward side thereof, and the lower fan 12 has its inlet 15 disposed at the lower side. The fans are thereby related with respect to their common direction of rotation, as left and right hand fans, so that one fan becomes operative to discharge air when the shaft 13 is rotating in one direction, and the other fan is alternately operative upon rotation in a reverse direction. The blades of the wheels of fans 11 and 12 are preferably oppositely related, as clearly illustrated in Figs. 6 and 7.

For the purpose of inducing a maximum volume of air to circulate upwardly through the ice bunker to the circulating unit, the fans are positioned in a feeder duct or manifold 16 extending transversely of the bunker 7, and in open communication with the upper portion of the interior of the bunker through openings 9. The unit is preferably located adjacent one side of the car or at one end of its manifold 16, and to provide uniform flow throughout the bunker openings 9 and said manifold, the latter is tapered as shown, having increasing cross section in a direction toward the fans.

The fans 11 and 12 are supported by their housing or housings within the manifold 16 in any suitable manner and are centrally located with sufficient spacing between the top and bottom limits of the manifold to insure the unrestricted flow of air from the manifold into the inlet openings 14 and 15 of the respective fans.

In order to produce a directed high velocity flow of cooling air from the circulating unit into the storage chamber 6, I have provided a common discharge nozzle for alternately receiving the discharge from the fans 11 and 12. To enable such common discharge, the outlet ends 18 and 19 of the housing or housings of the respective fans 11 and 12 are disposed in angular overlapped relation, as shown in Figs. 3 and 4, and in such relation are projected through suitable openings in the vertical wall of the manifold 16.

20 designates a casing surrounding the said outlet ends 18 and 19 of the fans; this casing extends outwardly from the wall of the manifold, and terminates in an annular discharge nozzle 21. The design and characteristics of the nozzles 21 are intended to insure a high velocity flow from the circulating fans. In this connection also, I prefer to mount in said nozzle 21 a cluster of radially disposed deflector vanes 22, for imparting a spiral motion to the air passing therethrough, which is of considerable advantage in creating and maintaining the desired circulation of cooling air through the storage chamber of the car.

The air placed in circulation by my apparatus is delivered at high velocities from each unit from the tops of the respective bunkers longitudinally of the upper portion of the storage compartment and thence flows downwardly to the bottom portion thereof and then rearwardly and longitudinally of the storage chamber to the bottom openings of the ice bunkers. This air circulation is particularly shown by the full line and broken line arrows of Figs. 1 and 2.

The drawings clearly show that the type of fan employed is such that it will not blow air unless running in the direction of the blade curvature. Therefore, if the upper fan is rotating toward the blade curvature, it will deliver air to the discharge nozzle only at the same time that the lower fan is running away from the blade curvature and will not handle or move any appreciable amount of air. In other words, the type illustrated rotating away from the blade curvature will not produce air movement. Centrifugal fans having such casings are known to be operative for effective discharge when rotated in one direction, and inoperative for real fan operation, when oppositely rotated. The scroll design provides an increasing area toward the discharge end of the fan, and has a "cut-off" or minimum clearance preventing effective discharge of fluid during reverse rotation of the fan.

My invention contemplates the employment of a mechanical drive for the fans of a construction that is operable to effect a continuous drive of the fans to produce air circulation, irrespective of direction of car travel, track curvature and the variable conditions arising in car under-framing and truck constructions.

As illustrated, the mechanical drive, operable from a truck axle 23, includes a split pulley 24 secured to said axle and grooved for receiving two V-belts 25, the latter leading therefrom to a smaller pulley 26 mounted on and rotatable with a horizontal jack shaft 27. The jack shaft 27 is mounted in adjustable or slide bearings 28, carried by a slotted supporting frame 29, the latter being secured to and extending from a side of a truck bolster 30. 31 designates screws for sliding adjustment of the jack shaft bearings 28 to maintain the desired tension on the belts 25.

The vertical fan shaft 13 is supported in suitable bearings 32, and is driven by its lower end from the jack shaft 27 by means of a flexible shaft 33 having a rigid coupling 34 with said vertical shaft, and being connected with an end of the jack shaft 27 by means of a universal joint 35, as in Fig. 8.

In this manner, the vertical fan shaft 13 is driven at a desired speed, proportionate to the speed of the car 5, thereby driving either of the fans 11 or 12, depending upon the direction of travel of said car. By mounting the pulley drive entirely on the car truck, any variations due to angularity or curvature in the movements of the car relative to its truck will be compensated for by means of the flexible shaft, resulting in a constant uniform drive.

While I have described the construction and operation of my invention in connection with circulating units composed of superimposed fans or fan wheels driven by a common shaft, I contemplate employing two or more fans arranged in pairs, but having individual drive shafts actuated, however, as before described, from the car trucks to produce the desired continuous circulation irrespective of the directional movement of said car.

For example, in Figs. 10 and 11, I have shown fans 11*a* and 12*a*, mounted within a manifold 16*a* in communication with the ice bunker 7*a*, and having separate vertical shafts 36 and 37 respectively. Viewed from the top or inlet sides of the fans, the fan 11*a* is a left hand fan and 12*a* a right hand fan, each having suitably designed

housings, each of which may be provided with individual discharge nozzles 21*a* for discharge of air into the storage chamber of the car.

By simultaneously rotating said shafts 36 and 37 in the same direction from the car axle, it will be seen that the fans 11*a* and 12*a* will be alternately operative to discharge air for circulation upon a change of direction of movement of the car.

Means similar to the means above described may be employed for driving the fan shafts from the car axle, including the pulley drive 25*a* driving a jack shaft 27*a*. In this case however, to simultaneously drive the fan shafts in like direction, a second jack shaft 27*b* is employed geared to and driven from the first jack shaft 27*a* as particularly shown in Fig. 12, said shafts thereby being rotated in opposite directions. 33*a* designates a flexible shaft connecting the fan shaft 36 with one end of the jack shaft 27*a*, and 33*b* indicates a flexible shaft connecting the fan shaft 37 with the opposite end of the other jack shaft 27*b*.

In Figs. 13 and 14, I have shown a further modification, wherein a pair of like fans 11*b*, both right hand or both left hand, are mounted upon separate shafts 13*a*, driven from opposite ends of a single jack shaft 27*a* by means of flexible shafts 33*c*, said jack shaft being driven from the car axle by a belt drive 25*a*. In this manner, the fan shafts 13*a* are simultaneously driven in opposite direction from the car axle, and since their fans are of like construction, they will be alternately operative to circulate cooling air within the storage chamber upon a change of direction of movement of the car.

I claim:

1. In a refrigerator car having a storage compartment and an ice bunker therein having air discharge openings at the top thereof, a manifold casing positioned adjacent the bunker openings, a pair of superimposed fans for drawing air upwardly through the bunker and for circulating cooling air in the storage compartment, said fans being located in the manifold, a common air discharge nozzle, and a mechanical drive for the fans including a vertically extending shaft on which the fans are mounted and means actuated by the movement of an axle of the car for turning said shaft.

2. In a refrigerator car having axles, means for creating substantially uniform temperature throughout the loading zone of the car including ice bunkers located at opposite ends of the car and having openings for air at the top and bottom thereof, an air manifold positioned adjacent the top openings of each bunker having an increasing cross sectional area and in open communication with the interior of each bunker, a pair of fans positioned in the large cross sectional area of each manifold, one fan of each pair being operable upon right hand rotation and the other upon left hand rotation, and a mechanical drive for the fans comprising means actuated by the movements of the car axles.

3. In a refrigerator car having a storage compartment and an ice bunker therein, a pair of fans for circulating cooling air in the storage compartment, means for driving the fans actuated by a movement of the car, the blades of one of said fans being so disposed with respect to the blades of the other fan that one fan may discharge air into said compartment while the other fan is substantially idly rotating, said driving means operable to actuate the fans to produce an effective discharge of air regardless of the direction of movement of the car.

4. In a refrigerator car having a storage compartment and an ice bunker therein having openings in the top thereof, and an air manifold positioned adjacent the top of the bunker in communication with the openings, a pair of fans in the manifold having opposed blade curvatures for circulating air in the storage compartment, means for driving the fans actuated by a movement of the car and operable to drive one fan in the direction of its blade curvature while driving the other fan in the direction opposed to the direction of its blade curvature whereby one of said fans is driven in a direction for effective discharge of air while the other is ineffective for such discharge, said driving means operable to produce the effective discharge of a fan upon a change of directional movement of the car.

5. In a refrigerator car having a storage compartment and an ice bunker therein having air discharge openings at the top thereof, and having a rotatable axle; a manifold casing positioned adjacent the bunker openings, a pair of superimposed fans located in the manifold casing for drawing air upwardly through the bunker and for circulating cooling air in the storage compartment, said fans being simultaneously rotatable, the curvature of the blades of one fan being opposite to the curvature of the other blades so that as one fan rotates to move air the other fan although rotating will not move air, a common air discharge nozzle, and means for driving either fan from the axle in a direction for effective discharge of circulating air while driving the other fan in the direction opposite to the direction of its blade curvature.

6. In a mobile body, air-circulating fans therein having curved blades, the curvature of the blades of one fan being opposite to the curvature of the blades of the other fan, and means for alternatively driving the fans simultaneously in one direction or for driving the fans simultaneously in the opposite direction, the curvature of the blades of one fan functioning to circulate air and the curvature of the blades of the other fan failing to circulate air as the fans are simultaneously driven in either of the opposite directions.

7. In a refrigerator car having a storage compartment and an ice bunker therein and a rotatable axis; a pair of fans having opposed blade curvatures for circulating air in the storage compartment, interconnecting means between the axle of the car and the fans for driving either fan in the direction of its blade curvature while driving the other fan in the direction opposed to the direction of its blade curvature, whereby one of said fans is driven in a direction for effective discharge of air while the other is ineffective for such discharge.

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