Dec. 15, 1942. G. G. GILPIN 2,305,075

REFRIGERATOR CAR CONSTRUCTION

Filed July 28, 1941 2 Sheets-Sheet 1

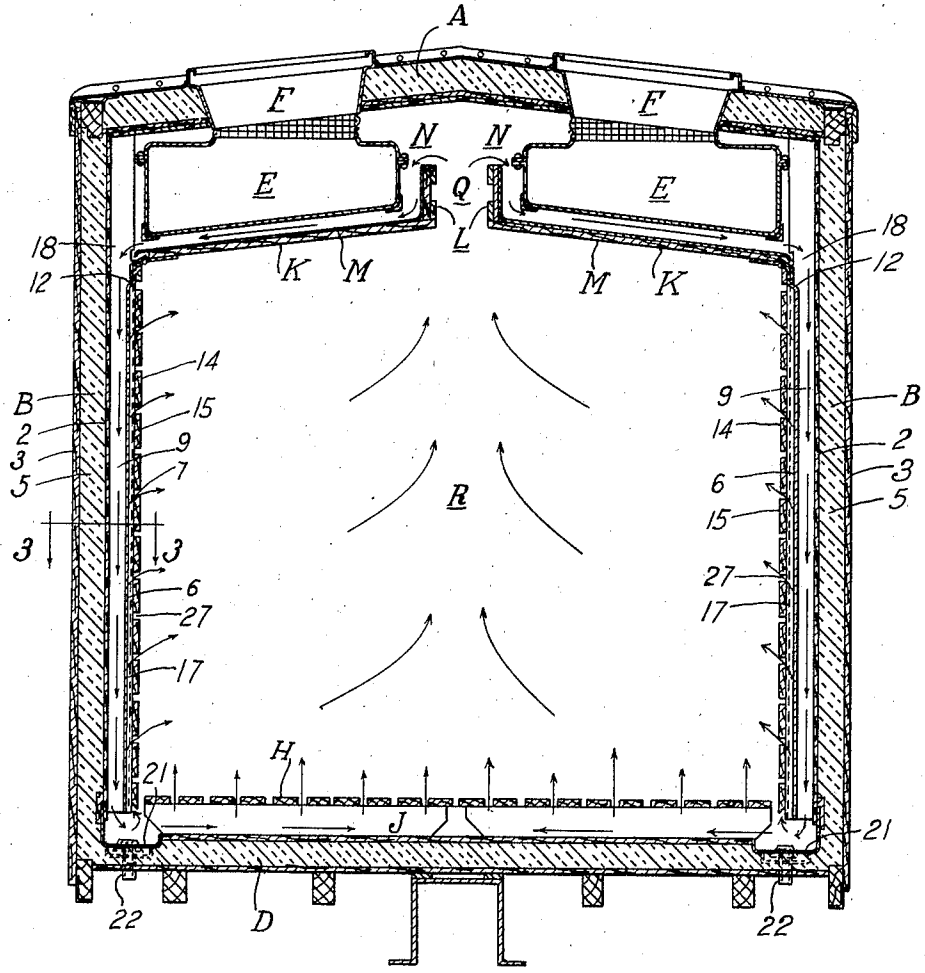

Fig. 1

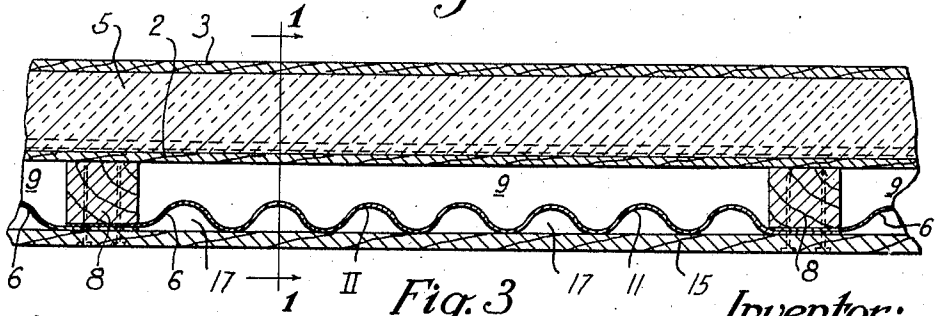

Fig. 3

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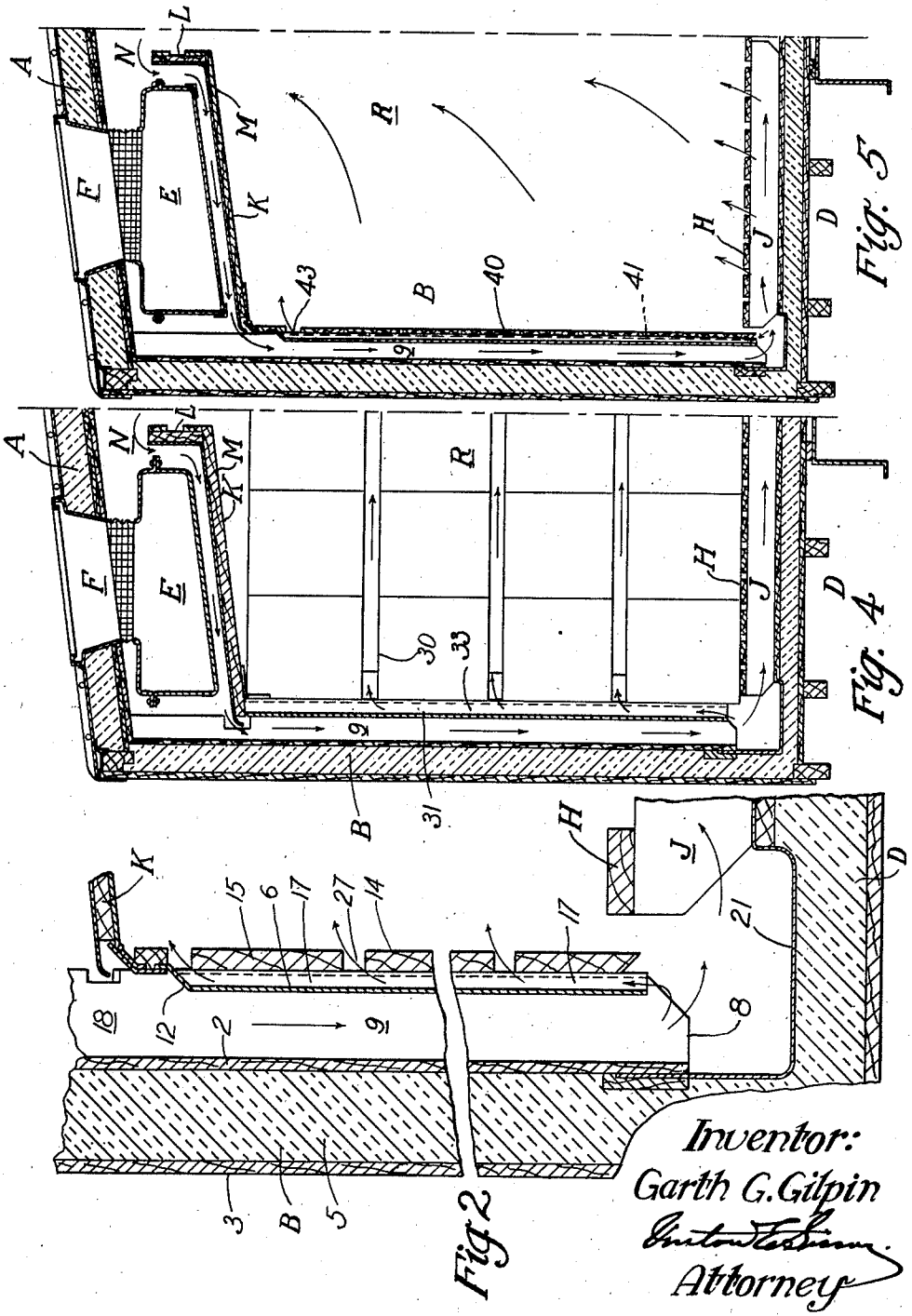

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REFRIGERATOR CAR CONSTRUCTION

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20 Claims. (Cl. 62—17)

This invention relates to refrigerator cars used to transport perishable commodities at a predetermined temperature. The usual features of a refrigerator car are an insulated body to prevent or retard ingress of heat during warm weather and egress of heat during cold weather and a cooling means and preferably a heating means to be used during warm and cold weather respectively.

This invention applies particularly to cars in which the cooling means, preferably containers for water ice, eutectic ice, brine or dry ice, are disposed immediately below the roof of the car. The lading is supported in spaced relation to the floor by a foraminous rack. Flues, preferably associated with the side walls of the car, communicate between the cooling means and the space under the floor rack to provide a path for the circulation of air. The basic air circulation in a car of this type, when the lading is of a nature to permit air permeation therethrough, is from the cooling means downwardly through the aforementioned flues, through the space under the floor rack, upwardly through the lading compartment thereby cooling the lading, and finally to the cooling means from where the cycle is repeated.

The commodities usually carried in refrigerator cars are packed in various ways, such as in boxes or crates; in bags; in bulk without any packaging; and even by bunches or stems, as bananas. When the commodity is loaded in boxes or crates, it may be loaded into the car either solidly from side wall to side wall and substantially from floor to ceiling, or it may be provided with spacing strips or other means between the boxes or crates to allow for the circulation of cold air. In the type of refrigerator car herein disclosed and with a loosely loaded lading, the cold air circulates from the space under the floor rack upwardly through the lading compartment toward the roof of the car, thereby cooling the lading, but if such lading is tightly packed within the car, the cold air may be prevented from reaching certain parts thereof with a consequent increase in the temperature of those parts.

Furthermore, in certain types of lading, such as fresh fruits and vegetables, the ripening thereof in transit releases heat which is known as the heat of respiration, the amount of which heat varies greatly from one product to another, as well as for different temperature ranges. This heat has a tendency to collect in the upper part of the car and thereby prevent the lading in such upper part from reaching the low temperature required for preservation of the commodity.

An object of the invention is to supply cold air preferably substantially uniformly between the top and the bottom of the lading compartment, which air is injected into the compartment preferably from one or both side walls of the car so as to overcome the harmful effects caused by the restriction of air flow from the space under the floor rack upwardly through the lading compartment.

A further object is to inject such distributed supply of cold air into the lading compartment without in any way interfering with the basic circulatory system for the overhead bunker type of car as hereinabove described.

A further object of the invention is to provide means for injecting a supply of cold air over the top of the lading to counteract the harmful effects of the heat of respiration which heat has a tendency to maintain the upper part of the car at a high temperature. The cold air distributed over the top of the lading also overcomes the deficiency of cold air in the upper part of the car caused by the lading being so tightly loaded into the car that air circulation from under the floor rack to the upper part of the car is restricted.

Other objects and advantages of my invention will be apparent from the following detailed description by referring to the accompanying drawings.

In the drawings:

Fig. 1 is a transverse section of a refrigerator embodying my invention.

Fig. 2 is an enlarged view of a portion of Fig. 1.

Fig. 3 is an enlarged plan section on line 3—3 of Fig. 1.

Figs. 4 and 5 are views similar to one-half of Fig. 1, each showing a modified form of the invention.

The general parts of the refrigerator car shown are insulated roof A; side walls B; floor D; refrigerant containers E; hatches F for loading refrigerant into the container E foraminous floor rack H and space J between the rack H and the floor D. The refrigerant containers E are positioned directly below the roof A and adjacent the respective side walls B. Drip pans K are provided below the containers E and partitions L are disposed in upstanding positions at the edges of the drip pans K. The drip pans K and the partitions L cooperate with the roof A and the upper parts of the side walls B to form enclosures M around the containers E, air inlet openings N to the enclosures M being provided by spacing the partitions L from the roof A. The partitions L on opposite sides of the car are

spaced apart to form a duct Q which communicates between the lading compartment R and openings N.

In the modification shown in Figs. 1 to 3, the side walls B of the car are formed in the usual manner and each comprises spaced apart inner (2) and outer (3) sheathing with insulation 5 included therebetween. A plurality of sheets 6, preferably metallic, are supported in spaced relation to the inner sheathing 2, preferably by spaced apart, substantially vertical posts 8 so as to form a plurality of vertically extending flues 9 leading from the upper to the lower part of the car. The metallic sheets 6 are formed with a plurality of vertically extending corrugations 11 which preferably die out (12) adjacent the upper margins of the sheets 6. The lining 14 is preferably comprised of a plurality of horizontally extending, vertically spaced slats 15 preferably secured to the posts 8. The slats 15, in cooperation with the corrugations 11 in the metallic sheets 6, form vertically extending ducts 17 which communicate through the spaces between the slats 15 with the lading compartment R of the car. Cold air discharge openings 18 are provided which lead from the enclosures M to the upper ends of the flues 9.

The basic air circulation in a car of the type disclosed takes place when the lading is loosely loaded. The air is cooled by contact with the refrigerant containers E which are loaded preferably with ice or other refrigerant, which cold air circulates downwardly through the side wall flues 9 and into the space J below the floor rack H from where it permeates upwardly through the lading compartment R, thereby cooling the lading, and finally flows through the duct Q and openings N to a position wherein it may be again cooled by contact with the refrigerant containers E. This cooling cycle is continuously repeated thereafter. Overflow of melted refrigerant from the containers E or condensation dripping from the exterior thereof is conducted downwardly by the side wall flues 9 to the gutters 21 and finally disposed of to the exterior of the car by the drainage traps 22 shown in Fig. 1.

In cases where the lading is tightly loaded within the car, the air is cooled by contact with the refrigerant containers E, as hereinabove described, and flows downwardly through the side wall flues 9 to the lower part of the car. The air, upon being partially or entirely trapped in the lower part of the car, flows upwardly through the ducts 17 and into the lading compartment R through the spaces 27 between the slats 15. The cold air is, therefore, distributively injected into the lading compartment R between the top and bottom thereof and provides a relatively uniform blanket of cold air throughout the compartment. Such air then flows upwardly through the duct Q between the containers E and is recooled by contact with the containers. It is to be understood that in many cases the cold air will not flow exclusively through the floor rack H nor exclusively through the ducts 17, but that in a great majority of cases some of the air will flow into the space under the floor rack H and thence upwardly through the lading compartment R, while other parts of the air will flow upwardly through the ducts 17 and thence into the lading compartment R.

Fig. 4 shows a modification wherein the operation is substantially similar to that heretofore described, with the exception that the lining or spaced apart slats have been omitted. In this case, the packages of lading 30 are placed in contact with the corrugated sheet 31 so that the ducts 33 are formed between the lading 30 and the corrugated sheet 31. The air flow in cases where the lading is packed either loosely or tightly is substantially similar to that described in reference to Figs. 1 to 3.

In the modification shown in Fig. 5, the structure is somewhat similar to that disclosed in Figs. 1 to 3 except that the lining 40 is substantially imperforate from the lower ends of the ducts 41 to adjacent the upper part of the lading compartment R. An opening 43 in the lining 40 at the upper part thereof permits air to flow from the ducts 41 over the upper part of the lading, thereby cooling such upper part to compensate for a lack of refrigeration in a tightly packed load. The structure disclosed in Fig. 5 is also of considerable use when the lading is of a type which releases heat of respiration, which heat tends to accumulate in the upper part of the car and the effect thereof may be overcome by the means herein disclosed for injecting a supply of cold air into such upper part.

The accompanying drawings illustrate the preferred form of the invention, though it is to be understood that the invention is not limited to the exact details of construction shown and described, as it is obvious that various modifications thereof, within the scope of the claims, will occur to persons skilled in the art.

I claim:

1. In a refrigerator car having spaced apart walls, roof and floor, which enclose a lading compartment, the combination of a foraminous rack arranged to support a lading and provide a space between the lading and the floor, refrigerating means below the roof and above the lading compartment, flue means associated with at least one of said walls leading without discharge opening in its intermediate portion from said refrigerating means to said space, duct means also associated with said last mentioned wall arranged to receive air cooled by said refrigerating means and means arranged to direct air from said duct means into said lading compartment distributively between the upper and lower parts thereof.

2. In a refrigerator car having spaced apart walls, roof and floor which enclose a lading compartment, the combination of refrigerating means below the roof and above the lading compartment, flue means associated with at least one of said walls without discharge opening in its intermediate portion from said refrigerating means to the lower part of said compartment, duct means also associated with said last mentioned wall arranged to receive air cooled by said refrigerating means and means arranged to direct air from said duct means into said lading compartment distributively between the upper and lower parts thereof.

3. In a refrigerator car having spaced apart walls, roof and floor which enclose a lading compartment, the combination of refrigerating means below the roof and above the lading compartment, flue means associated with one of said walls arranged to conduct cold air from said refrigerating means to the lower part of said compartment, duct means also associated with said wall arranged to receive air from the lower part of said flue means and means arranged to direct air from said duct means into said lading compartment.

4. In a refrigerator car having spaced apart

walls, roof and floor which enclose a lading compartment, the combination of refrigerating means below the roof and above the lading compartment, flue means associated with one of said walls arranged to conduct cold air from said refrigerating means to the lower part of said compartment, duct means also associated with said wall arranged to receive air from the lower part of said flue means and means arranged to direct air from said duct means into said lading compartment at the upper part thereof.

5. In a refrigerator car having spaced apart walls, roof and floor which enclose, a lading compartment, the combination of a foraminous rack arranged to support a lading and provide a space between the lading and the floor, refrigerating means below the roof and above the lading compartment, means without discharge opening between said compartment and said space arranged to direct air cooled by said refrigerating means to said space and means to direct a portion of said air cooled by said refrigerating means into said lading compartment distributively between the upper and lower parts thereof.

6. In a refrigerator car having spaced apart walls, roof and floor which enclose a lading compartment, the combination of a refrigerant container below the roof and a foraminous rack arranged to support a lading and provide a space between the lading and the floor, one of said walls comprising an outer insulated part, and a vertically corrugated metallic sheet spaced from said insulated part to provide flue means therebetween and to form, duct means on the opposite side of said sheet from the flue means, said duct means arranged to communicate at the lower part thereof with said flue means and a drip pan arranged to direct air cooled by said refrigerant container into said flue means, whereby said air flows downwardly through said flue means, some of said air flowing into said space and thence into said lading compartment and other of said air flowing upwardly through said duct means into said lading compartment.

7. In a refrigerator car having spaced apart walls, roof and floor which enclose a lading compartment, the combination of a refrigerant container below the roof and a foraminous rack arranged to support a lading and provide a space between the lading and the floor, one of said walls comprising an outer insulated part, a vertically corrugated metallic sheet spaced from said insulated part to provide flue means therebetween and lining comprising vertically spaced, horizontally extending slats arranged flatwise with said corrugated sheet to form duct means therebetween, arranged to communicate at the lower part thereof, with said flue means and a drip pan arranged to direct air cooled by said refrigerant container into said flue means, whereby said air flows downwardly through said flue means, some of said air flowing into said space and thence into said lading compartment and other of said air flowing upwardly through said duct means and between said slats into said lading compartment.

8. A structure as defined in claim 3 wherein said last mentioned wall includes an insulated part, a member spaced from said insulated part to form said flue means and lining adjacent said member in spaced relation to portions thereof, thereby forming said duct means.

9. A structure as defined in claim 3, wherein said last mentioned wall includes an insulated part, a member having vertically extending corrugations spaced from said insulated parts to form said flue means and lining adjacent said member, thereby forming said duct means between said lining and certain of said corrugations.

10. A structure as defined in claim 3, wherein said last mentioned wall includes an insulated part, a member spaced from said insulated part to form said flue means and lining adjacent said member in spaced relation to portions thereof, thereby forming said duct means, said lining comprising substantially horizontal slats spaced apart vertically to provide air communication between said duct means and said lading compartment.

11. In a refrigerator car, in combination with the walls, roof and floor which enclose the lading compartment, refrigerating means below the roof and above the lading compartment, sheet means associated with one of said walls to provide a flue on one side of said sheet means; to direct air cooled by said refrigerating means downwardly to the lower part of the car, and a duct on the other side of said sheet means having an opening at its bottom to direct part of said air upwardly from the lower part of the car into said lading compartment distributively between the upper and lower parts thereof.

12. In a refrigerator car, in combination with the walls, roof and floor which enclose the lading compartment, refrigerating means below the roof and above the lading compartment, sheet means associated with one of said walls to provide a flue on one side of said sheet means; to direct air cooled by said refrigerating means downwardly to the lower part of the car, and a duct on the other side of said sheet means having an opening at its bottom to direct part of said air upwardly into the upper part of said lading compartment.

13. In a refrigerator car, in combination with the walls, roof and floor which enclose the lading compartment, a foraminous rack arranged to support a lading and provide a space between the lading and the floor, refrigerating means below the roof and above the lading compartment, means to direct air cooled by said refrigerating means to the lower part of the car, means to direct part of said air into said space, and means to direct another part of said air from the lower part of the car into said lading compartment distributively between the upper and lower parts thereof.

14. In a refrigerator car having spaced apart walls, roof and floor which enclose a lading compartment, the combination of refrigerating means below the roof and above the lading compartment, flue means associated with one of said walls arranged to conduct cold air from said refrigerating means to the lower part of said compartment, duct means also associated with said wall arranged to receive air from the lower part of said flue means and means arranged to direct air from said duct means into said lading compartment distributively between the upper and lower parts thereof.

15. A refrigerator lading compartment wall comprising flue means associated therewith having a cold air inlet at the top and arranged to conduct cooled air from the upper to the lower end thereof, duct means also associated with said wall and having a cold air inlet at its bottom and arranged to receive cooled air from the lower part of said flue means, and means arranged to direct air from said duct means

distributively between the upper and lower parts of the duct means.

16. A refrigerator lading compartment wall comprising an insulated part, a corrugated member spaced from said insulated part to form flue means associated with one side of said member, and lining adjacent said member, in spaced relation to portions of said member, to thereby form duct means associated with the other side of said member, said duct means being arranged to receive air from the lower part of said flue means.

17. A refrigerator lading compartment wall comprising an insulated part, flue means associated therewith having a cold air inlet at its top and arranged to conduct cooled air from the upper to the lower portions of said flue means, duct means also associated with said wall and having a cold air inlet at its bottom arranged to receive air from the lower part of said flue means and direct same to the upper part of said duct means.

18. In a refrigerator car having spaced apart walls, roof and floor which enclose a lading compartment, the combination of a refrigerant container below the roof, a foraminous rack arranged to support a lading and provide a space between the compartment and the floor, one of said walls comprising an outer insulated part, a vertically corrugated sheet, spaced from said insulated part to form flue means therebetween, and a drip pan arranged to direct air cooled by a refrigerant in said container into the upper part of said flue means, to flow downwardly through said flue means, whereby a lading stored in said lading compartment contiguous to said corrugated sheet, and substantially closing circulation through said foraminous rack, cooperates to form duct means between said lading and said sheet communicating at the lower part thereof with said flue means to receive air cooled by said refrigerant and direct same upwardly therethrough.

19. In a refrigerator car having spaced apart walls, roof and floor which enclose a lading compartment, the combination of refrigerating means below the roof and above the lading compartment, flue means associated with one of said walls arranged to conduct cold air from said refrigerating means to the lower part of said compartment, duct means also associated with said wall and having an opening at its bottom arranged to conduct cold air upwardly from the lower part of said flue means, and means to provide air communication between said duct means and said lading compartment between the upper and lower parts of said duct means.

20. In a refrigerator car, in combination with the walls, roof and floor which enclose a lading compartment, a foraminous rack for supporting a lading and providing a space between the compartment and the floor, refrigerating means below the roof and above the lading compartment, means associated with one of said walls to provide a flue arranged to conduct refrigerated air from said refrigerating means to said space, a lining interposed between said flue and said compartment and comprising a series of horizontally disposed spaced slats, the second mentioned means cooperating with the lining to form duct means arranged between said flue and said compartment to receive refrigerated air and discharge the same through the spaces between said slats into said lading compartment between the upper and lower portions thereof.

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