Oct. 7, 1941. W. E. BAILLIE 2,258,402

REFRIGERATOR CAR

Filed April 14, 1939 2 Sheets-Sheet 1

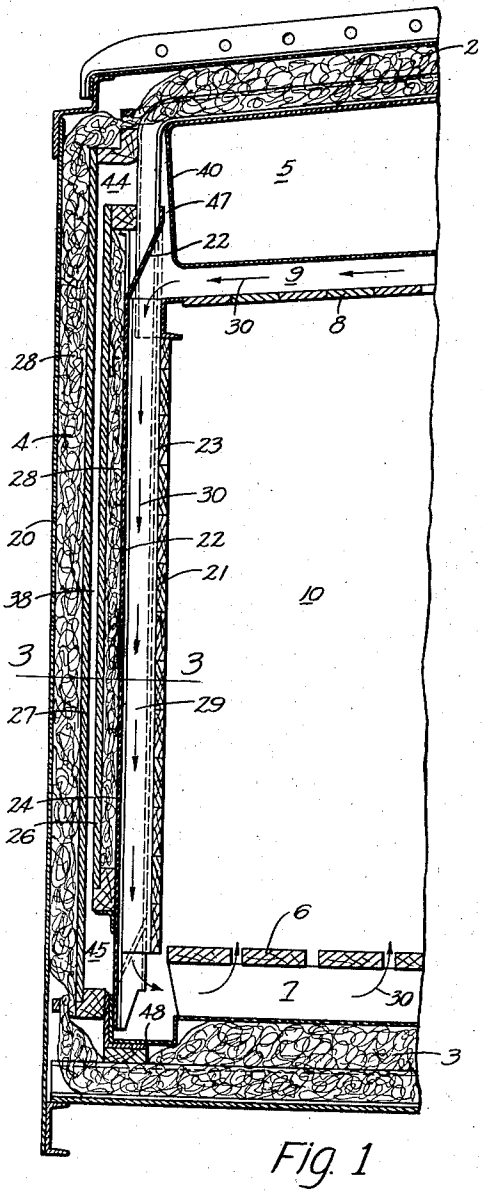


Fig. 1

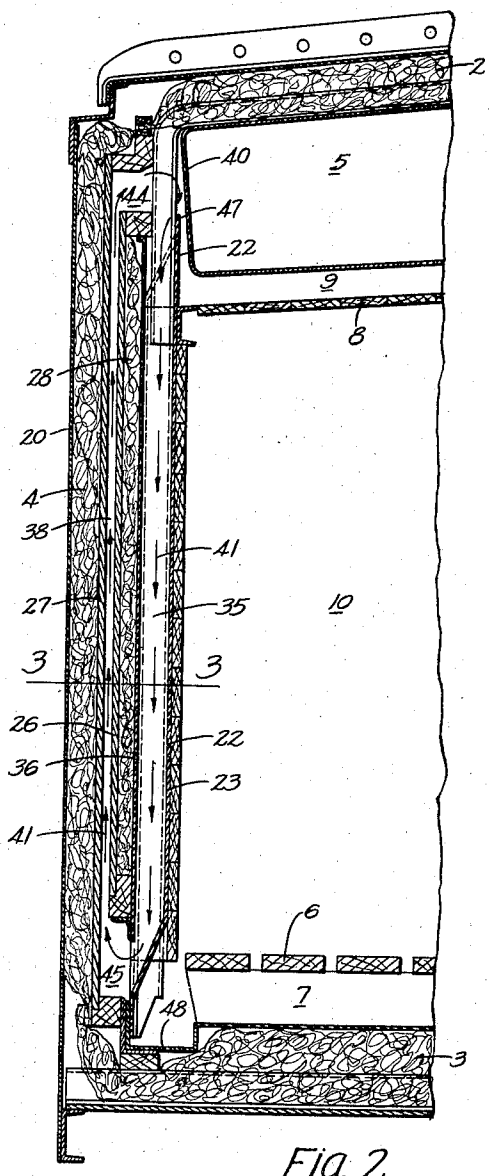


Fig. 2

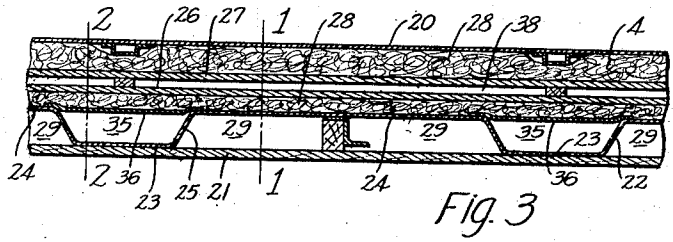


Fig. 3

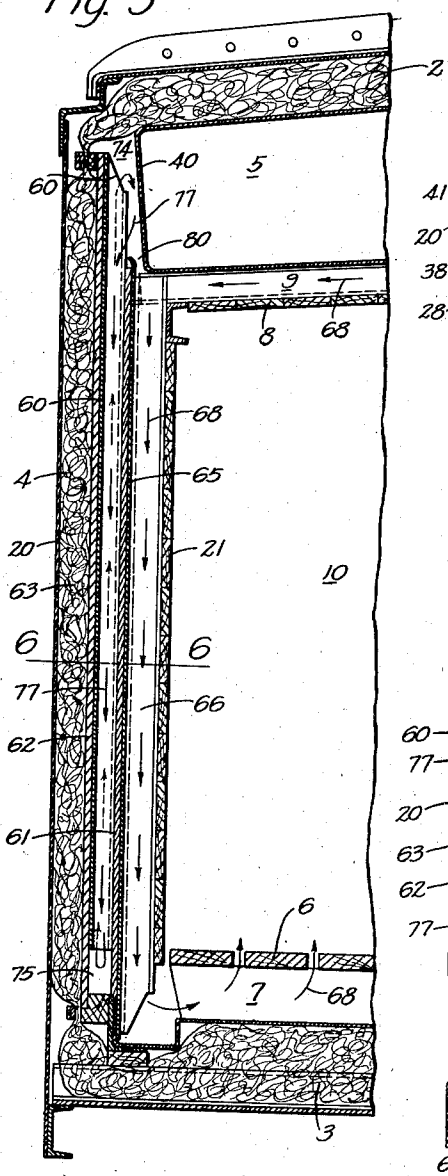
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Fig. 5



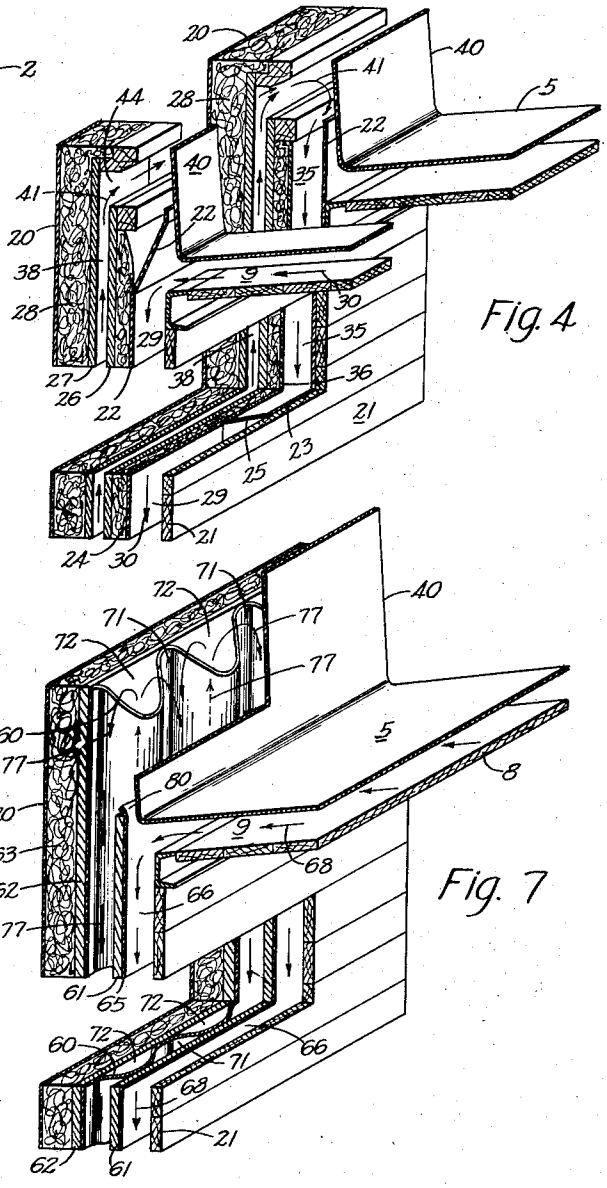


Fig. 4

Fig. 7

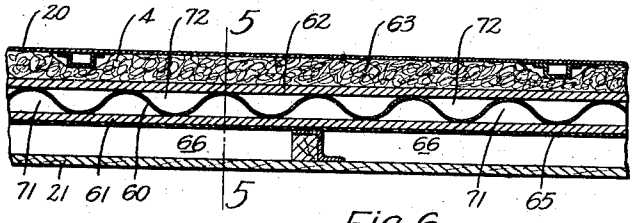


Fig. 6

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REFRIGERATOR CAR

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Application April 14, 1939, Serial No. 267,786

8 Claims. (Cl. 62—17)

The invention relates to refrigerator cars used to transport perishable commodities at a predetermined temperature. The essential features of a refrigerator car are an insulated house-like structure and a refrigerating means when used in summer or a heating means when used in winter.

This invention relates particularly to refrigerator cars of the overhead bunker type. Cars of this type have ice bunkers or refrigerant containers suspended immediately below the roof and the lading supported on a rack which rests on the floor so as to provide a space between the floor and the lading. Enclosing structures are usually provided for the refrigerant containers and flues are associated with the walls of the car, which flues communicate between the enclosing structures for the refrigerant containers and the space under the floor rack. Then air, upon being cooled by the refrigerant, flows downwardly through the side wall flue to the space under the floor rack and is distributed to the lading by the rack which is foraminous for this purpose. The air absorbs heat from the lading and returns to the refrigerant containers through openings in the enclosing structures at a higher elevation than the cold air openings leading to the side wall flues. The side wall flues are also used to conduct melted refrigerant or condensation to the lower part of the car from where it may be drained off.

An object of the invention is to provide additional insulation for the walls of the car. Refrigerator car walls are usually insulated with blankets or panels of a material having high resistance to the flow of heat therethrough, such as hair, kapok or spun glass. Dead air spaces are also often provided within the walls. I provide a system of air circulation substantially enclosed within the wall, the circulating air being cooled preferably by a portion of the refrigerant containers normally used to refrigerate the car. There is thus provided a continuously renewed blanket of cold air within the wall.

Another object is to provide means to insure delivery of very cold air to the lading compartment of the car. The temperature of the refrigerant in the container is approximately 32 degrees when water ice is used, zero when a concentrated solution of brine is used, and much lower when dry ice is used. Circulating air coming into contact with the refrigerant container is cooled to within a few degrees of the refrigerant temperature, but the temperature of the air is increased during flow through the wall flues. The air reaching the lading compartment is therefore considerably warmer than when it left the refrigerant chamber. To retard flow of heat from outside the car to the wall flue, I provide a secondary system for circulation of refrigerated air between the exterior sheathing of the car and the flue through which air circulates to the lading compartment. Heat which would normally warm air within the flue is thus intercepted by said secondary system.

A further object of the invention is to provide means for the absorption of moisture from the wall insulation. In the above-mentioned secondary system of air circulation, the air comes into contact with the insulation and absorbs moisture therefrom. When the air comes into contact with the relatively cold refrigerant container, the temperature of the air is lowered below the dew point, thus condensing some of the moisture and permitting additional absorption of moisture during the next cycle.

Another object is to provide means to utilize a portion of the container often not normally used. Cars are frequently designed so that the refrigerating air passes under the container, thus leaving some of the walls of the container out of contact with circulating air. I provide means by which said walls may be used to cool the air for the above-mentioned secondary system of circulation and thus further insulate the walls of the car.

Other objects and advantages of my invention will be apparent from the following detailed description taken in reference to the drawings in which:

Fig. 1 is a partial transverse section of a refrigerator car embodying my invention. The section is on line 1—1 of Fig. 3 and shows the path of the primary air circulation.

Fig. 2 is a view similar to Fig. 1 but on line 2—2 of Fig. 3 and shows the path of the secondary air circulation.

Fig. 3 is a section on line 3—3 of Figs. 1 and 2.

Fig. 4 is a fragmentary and broken away perspective view of the device shown in Figs. 1 to 3.

Fig. 5 is a section similar to Figs. 1 and 2 showing a modified system of air circulation. The section is on line 5—5 of Fig. 6.

Fig. 6 is a section on line 6—6 of Fig. 5.

Fig. 7 is a fragmentary and broken away perspective view of the device shown in Figs. 5 and 6.

The drawings show a refrigerator car having an insulated roof 2, floor 3, and side wall 4. A refrigerant container 5 is provided below the roof

2 and a foraminous rack 6 rests upon the floor 2 in spaced relation thereto to provide the space 7. A drip pan 8 is spaced below the container 5 to provide a duct 9 for flow of air, the air being cooled during flow through said duct by contact with the container 5. Means which will be hereinafter described are provided so that the refrigerated air may circulate from the duct 9 to the space 7 from where it is distributed by the foraminous rack 6 to the lading compartment 10 of the car. Means not shown are also provided for the return of air from the lading compartment 10 to the duct 9.

In the form of the invention shown in Figs. 1 to 4, the wall 4 comprises an outer sheathing 20, an inner lining 21, a sheet 22 having inwardly (23) and outwardly (24) disposed portions connected by webs 25, inner (26) and outer (27) plate-like members and insulation 28. The spaces between the outwardly disposed portions 24 of the sheet 22 and the lining 21 form flues 29 to conduct refrigerated air from the duct 9 to the space 7. The arrows 30 in Figs. 1 and 4 indicate the path followed by the refrigerating air.

The spaces exterior of the inwardly disposed portions 23 of the sheet 22 form ducts 35 for the secondary circulatory system, the plates 36 preferably being provided to prevent the insulation 28 from entering the ducts 35. The members 26, 27 are spaced apart a short distance to provide a passage 38 for the return of air to the upper part of the car. The air adjacent the wall 40 of the container is cooled by the refrigerant and falls due to its greater density through the ducts 35 while the air in the passage 38 is warmed by heat flowing from the exterior of the car. A secondary circulation is thus established downwardly through the ducts 35 and upwardly through the passage 38 as shown by the arrows 41 in Figs. 2 and 4.

The passage 38 is substantially continuous longitudinally of the car and is positioned relatively remote from the flues 29 so that heat flowing through the wall 4 from exterior of the car is intercepted by the air flowing through the passage 38 and is therefore prevented from reaching the flues 29. The heat thus intercepted is absorbed by the refrigerant when the air in the passage 38 reaches the wall 40 of the refrigerant container 5. The upper (44) and lower (45) headers extend continuously the length of the car to permit air from the continuous passage 38 to converge into the spaced apart ducts 35 and to permit air emerging from said ducts to spread into the passage 38.

The members 26, 27 are preferably made from a relatively rigid, porous insulating material, such as Celotex. The air ascending the passage 38 will therefore tend to absorb a quantity of moisture from the insulation 28 on either side of the passage 38. When the air comes in contact with the cold wall 40 of the container 5, a portion of the moisture is condensed and flows through the opening 47 between the sheet 22 and the wall 40. The moisture thus condensed may be disposed of in the manner provided for the disposition of condensate from the container 5, i. e., through the flues 29 to the gutter 48 and thence through a drain not shown in the drawings.

Figs. 5 to 7 show a modified form of my invention wherein the wall 4 of the refrigerator car comprises an outer sheathing 20, an inner lining 21, a plate 60 formed with vertically disposed corrugations, inner (61) and outer (62) plate-like members positioned adjacent the plate 60 and insulation 63 between the sheathing 20 and the outer member 62. A waterproof metallic lining 65 is disposed on the inner surface of the inner member 61. A flue 66 is thus provided between the lining 21 and the metallic lining 65 which serves to conduct refrigerated air from the duct 9 to the space 7. As shown in Fig. 6, the flue 66 is substantially continuous longitudinally of the car. The arrows 68 in Figs. 5 and 7 show the path of the refrigerated air through the flue 66 to the lading space 10.

The spaces between the outwardly projecting corrugations of the plate 60 and the inner member 61 form a plurality of ducts 71 while the spaces between the inwardly projecting corrugations and the outer member 62 constitute a plurality of passages 72. Continuously extending upper (74) and lower (75) headers provide communication between the ducts 71 and passages 72 at both the tops and bottoms thereof. The upper header 74 is positioned adjacent the wall 40 of the refrigerant container 5 so that the air in the upper header 74, being cooled and therefore densified by contact with the wall 40, falls through the ducts 71. Simultaneously, the air in the passages 72 is warmed and rarified by the heat flowing through the wall 4. A secondary circulatory system is thus established, the air flowing upwardly through the passages 72 absorbing the heat from the wall 4, and the refrigerant adjacent the wall 40 in turn absorbing the heat. As shown in Fig. 6, the plurality of passages 72 form a substantial continuous insulating blanket between the flue 66 and the exterior of the car. The arrows 77 in Figs. 5 and 7 show the path of the secondary circulatory system.

An opening 80 between the metallic lining 65 and the wall 40 of the container 5 is provided for the drainage of condensed moisture as heretofore described with reference to Figs. 1 to 4.

I have illustrated and described two methods of providing a secondary circulatory system within the walls of a refrigerator car. 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 having a wall and a flue associated with said wall for distributing refrigerated air to the lading space of the refrigerator, a system for circulation of refrigerated air disposed entirely within said wall interposed between said flue and the exterior of said wall comprising a duct adjacent said flue for downward flow of refrigerated air and a return air passage and communicating with said duct at the top and bottom thereof, and means to refrigerate the air entering said duct.

2. In a refrigerator having a refrigerant chamber near the roof and adjacent one of the walls, a container in said chamber, a vertically disposed flue associated with said wall and a rack spaced above the floor for supporting a lading, said rack being foraminous to provide for the distribution to the lading of refrigerated air which is conducted by said flue from the refrigerated air which is conducted by said flue from the refrigerant chamber to the space under said rack, a secondary system for circulation of refrigerated air disposed entirely within said wall exterior of said flue, said system comprising a duct for downward flow of refrigerated air, a re-

turn air passage communicating with said duct at the top and bottom thereof, and means to refrigerate the air entering said duct, said means comprising a portion of said container.

3. In a refrigerator having a refrigerant chamber near the roof and adjacent one of the walls, a vertically disposed flue associated with said wall and a rack spaced above the floor for supporting a lading, said rack being foraminous to provide for the distribution to the lading of refrigerated air which is conducted by said flue from the refrigerant chamber to the space under said rack, a secondary system for circulation of refrigerated air disposed entirely within said wall exterior of said flue, said system comprising a duct for downward flow of refrigerated air, a return air passage communicating with said duct at the top and bottom thereof, and means to refrigerate the air entering said duct.

4. In a refrigerator having a wall comprising sheathing, lining and insulation disposed therebetween, refrigerating means below the roof and adjacent said wall, and means to dry said insulation, said last mentioned means comprising a passage adjacent said insulation arranged to conduct warm air upwardly to adjacent said refrigerating means, means to dispose of the condensed moisture, and a duct to conduct air from said refrigerating means to the lower part of said warm air passage.

5. In a refrigerator car having a wall, a plate associated with said wall and formed with oppositely projecting corrugations extending between the upper and lower parts of said wall, relatively rigid members on both sides of said plate to form ducts on one side and passages on the opposite side of the plate, means providing communication between said ducts and said passages at the upper and lower ends thereof, and means to cool the air entering the upper ends of said ducts.

6. In a refrigerator car having a roof and a wall, refrigerating means below said roof and adjacent said wall, a flue associated with said wall adjacent the interior side of said wall and arranged to deliver cooled air from said means into the lower part of the interior of said car, a duct associated with said wall adjacent said flue and arranged to conduct cooled air from said means to the lower part of said wall, and a return air passage interposed between said flue and the exterior of said wall and arranged to conduct air from the lower end of said duct to said refrigerating means.

7. In a refrigerator car having a wall, a sheet associated with said wall and formed with oppositely projecting corrugations extending between the upper and lower parts of said wall, means forming flues on one side and ducts on the opposite side of said sheet, means to cool the air entering the upper ends of said flues, said flues arranged to provide for the flow of cooled air from the lower parts thereof into the interior of the car, a return air passage communicating at the upper and lower parts thereof with said ducts, and means to refrigerate the air entering the upper parts of said ducts.

8. In a refrigerator car having a roof and a wall, a refrigerant container below said roof and adjacent said wall, a flue associated with said wall and communicating at the lower part thereof with the interior of the car, means to direct circulating air into contact with the bottom of said container and thence downwardly through said flue, a circulatory system associated in its entirety with said wall comprising a duct adjacent said flue for downwardly flow of air, a passage communicating at its lower part with said duct for upward return of the air, said passage being interposed between said flue and the exterior of said wall, and means to utilize a side of said container to cool the air entering said duct.

WALLACE E. BAILLIE.