

Sept. 12, 1933.

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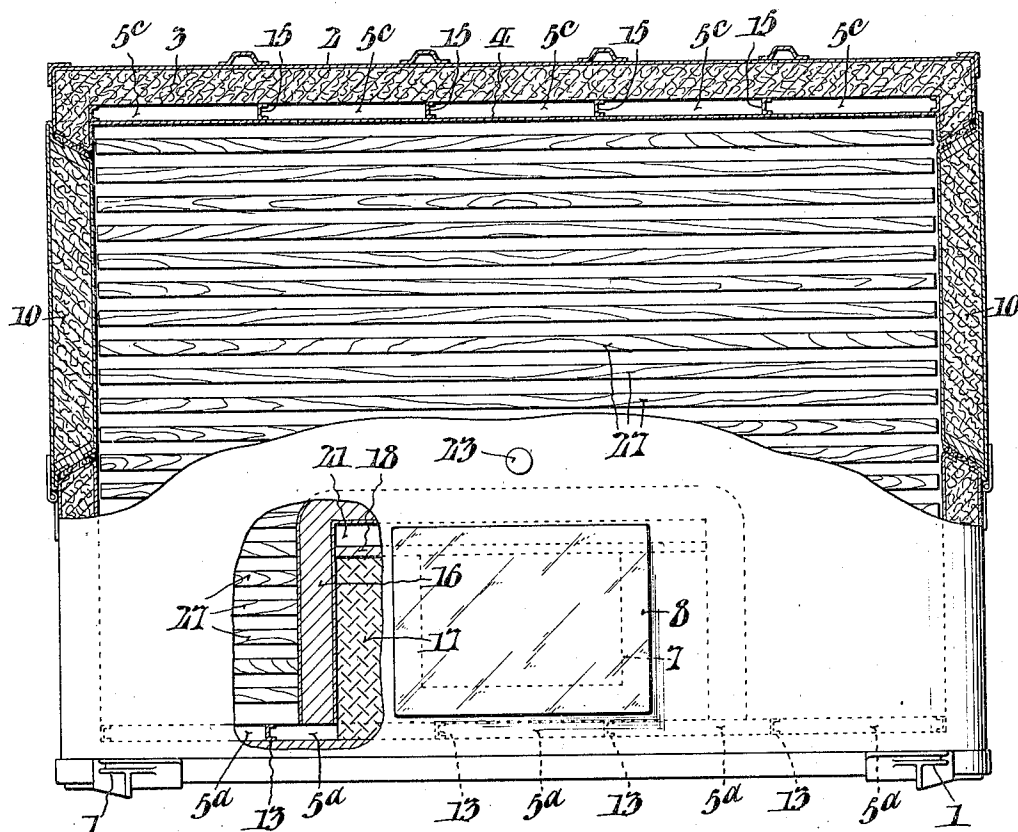
1,926,700

RAILWAY REFRIGERATOR CONTAINER

Filed Oct. 6, 1932

3 Sheets-Sheet 1

FIG. I.



WITNESSES:

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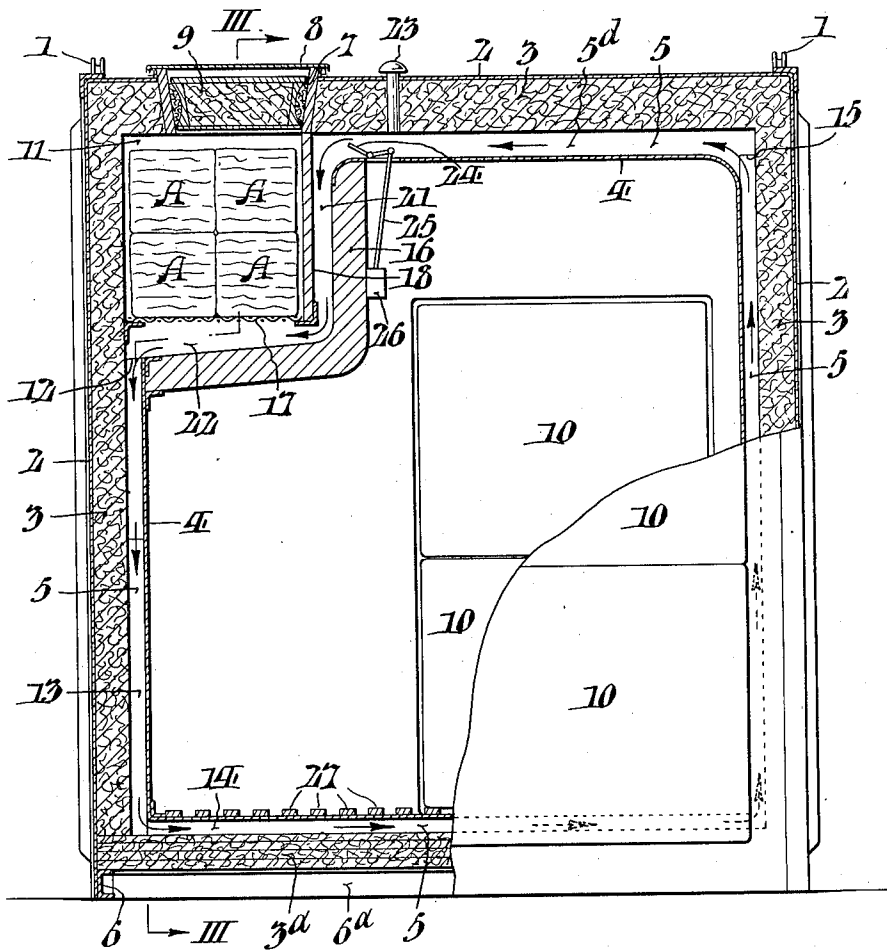
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3 Sheets-Sheet 2

FIG. II.



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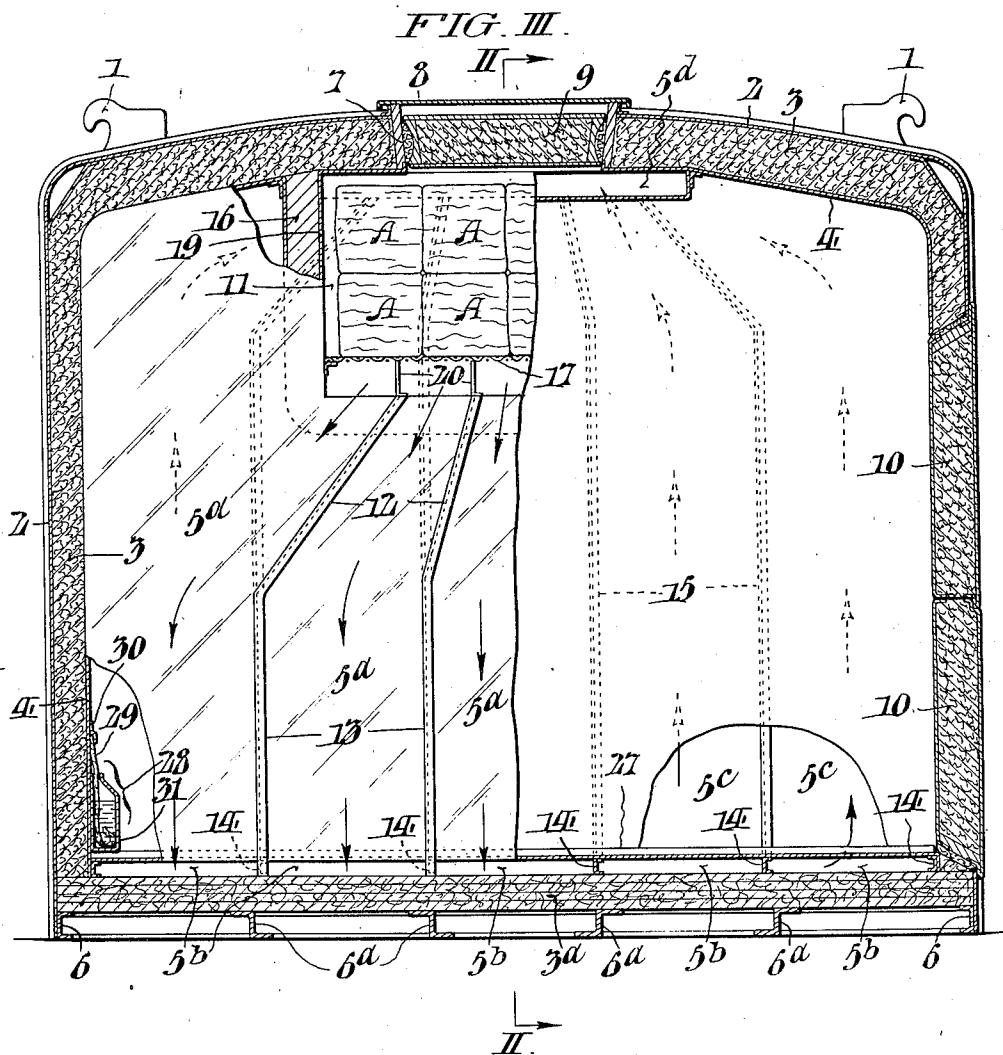
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RAILWAY REFRIGERATOR CONTAINER

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3 Sheets-Sheet 3



WITNESSES:
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UNITED STATES PATENT OFFICE

1,926,700

RAILWAY REFRIGERATOR CONTAINER

Samuel H. Owens, Altoona, Pa., assignor to The Pennsylvania Railroad Company, Philadelphia, Pa., a corporation of Pennsylvania

Application October 6, 1932. Serial No. 636,430

3 Claims. (Cl. 62—91.5)

My invention relates to railway refrigerator containers of a type and size comparable to less-than-carload-lot shipping containers such as are now used by railroads for the transportation of package freight on flat cars or other suitable vehicles. More particularly the invention relates to a refrigerator container of this character wherein solid carbon dioxide is used as the refrigerant medium.

The principal object of my invention is to provide a railway refrigerator container, utilizing solid carbon dioxide as the refrigerant, which is interiorly designed to produce uniform and efficient refrigeration over a comparatively long period of time, whereby perishable products may be transported for long distances without danger of deterioration, and without the necessity of recharging the container with additional refrigerant.

Other more specific objects and advantages characteristic of my invention will become more fully apparent from the description of one embodiment or example of my invention which follows hereinafter having reference to the accompanying drawings. Of the drawings:

Fig. I represents a plan view of a railway refrigerator container of my invention with a portion thereof shown in horizontal cross section.

Fig. II represents a vertical cross section of the same, taken as indicated by the lines II—II of Fig. III; and,

Fig. III represents a vertical cross section of the same, taken as indicated by the lines III—III of Fig. II, with a portion of the inner shell broken away to better disclose certain important features of the container.

In the drawings there is shown a container which, in its exterior dimensions and form, corresponds closely to merchandise containers such as are transported on railway cars, trucks, or the like, and are generally arranged end to end in a single row, occupying the full platform space of the vehicle. The container is provided with the usual lifting hooks 1 by which it may be connected to a hoist for the purpose of shifting it from car to truck, from car to stationary platform, or vice versa.

The container comprises generally an outer metal casing 2 lined with insulating material 3 and an inner metal shell 4 spaced inward therefrom to afford a continuous narrow passage 5 for the circulation of gas. The outer casing 2 is so made and fitted at the joints as to render it substantially gas tight and sturdy enough to withstand the rough usage to which containers are subjected in service. The base of the container

is preferably supported on a rectangular framework of channel bars 6 with intermediate longitudinally disposed Z-bars 6a. At the top of the container near one end thereof there is a hatch 7, normally closed by a cover 8 and rendered gas tight by a plug 9, through which the refrigerant medium may be charged into the container.

While the particular form of insulation used for the lining 3 of the outer casing 2 may be varied, I prefer to employ a material known commercially as "dry zero" for the sides, ends and roof of the container, as well as for the body of the hatch plug 9. At the base of the container, as indicated at 3a, I prefer to employ celotex or balsa wood. At each side of the container, near that end which is opposite to the filling hatch 7, double doors 10 are provided, the doors being divided horizontally, and their sections being hinged near the center of the containers. The doors 10 are carefully fitted and sealed at their edges in the manner of refrigerator doors, and they are divided into separate sections so that only one section need be opened at a time when access to a part of the container is desired.

The inner shell 4 which encloses the lading space for the articles to be refrigerated extends continuously around the container except for the space at one end of the container beneath the roof which is occupied by the bunker for the refrigerant comprehensively designated at 11. Within that portion of the gas circulating passage which leads downward from the bunker 11 to the base of the container, there are baffles 12 inclined outwardly, as shown in full lines at the left hand of Fig. III, joining the ends of vertical channel beams 13. The baffles 12 and channel beams 13 thus form separate ducts 5a diverging downward toward the base of the container. Within that portion of the gas circulating passage which extends horizontally across the base of the container, there are horizontally disposed channel beams 14 forming a like number of ducts 5b beneath the lading to be refrigerated. As shown at the right hand of Fig. III, the portion of the gas circulating passage which extends upward along the end wall opposite to the bunker 11 has therein additional channel beams 15 which form separate ducts 5c converging toward the top of the container. At the top of the container there is a single duct 5d leading to the top of the bunker 11.

The refrigerant space within the bunker 11 is isolated from the lading space of the container by a thick wall 16 of insulating material, such as balsa wood, which extends downward from the top of the container and then outward to

ward the end thereof, joining the ends of the inner metal shell 4. Within the bunker 11 there is an inner compartment for the accommodation of the solid carbon dioxide A including a foraminous base member 17, preferably in the form of a wire screen of large mesh, and a vertical balsa wood partition 18, the latter being relatively thin to afford partial insulation. The insulating wall 16 of the bunker 11 is sheathed with metal strips 19 and spaced from the bottom of the inner refrigerant compartment by parallel channels 20. The metal parts of the bunker are all preferably constructed of aluminum.

It will be observed that the inner compartment for the solid carbon dioxide is located directly beneath the filling hatch 7 and is bounded on the top and at one end by the insulating lining 3 of the outer casing 2. At the sides the inner compartment is bounded by the bunker wall 16. At the inner end, the inner compartment is bounded by the partition 18 which extends completely across the bunker 11. The partition 18 and the wire screen 17 form with the bunker wall 16 a vertical gas passage 21 and a horizontal passage 22, constituting a continuation of the gas passage 5 which surrounds the lading. Warm gas from the duct 5d thus enters the vertical passage 21 and passes downward, separated from the solid carbon dioxide A by the vertical partition 18. It then flows transversely through the passage 22 beneath the screen 17 where it is exposed to the bottom surface of the solid carbon dioxide. Beneath the passage 22 the bunker wall 16 slopes downwardly and outwardly, causing the passage 22 to increase in cross sectional area toward the outer casing 2, thus assisting the downward flow of cold gas towards the ducts 5a.

It will be especially noted that only the bottom surface of the solid carbon dioxide A is exposed to the gas circulating passage. Accordingly, sublimation of the solid carbon dioxide tends to reduce the volume of the solid refrigerant by successive layers taken off the bottom thereof, and there is an exposed bottom surface of substantially uniform area regardless of the volume of the solid carbon dioxide. Hence uniform refrigeration is provided irrespective of whether the bunker 9 has been freshly charged or is almost empty.

At the top of the container leading upward from the gas duct 5d through the casing 2 and its insulating lining 3, there is a vent 23 which permits the surplus carbon dioxide gas which is generated to pass off, thus maintaining a uniform pressure in the bunker 9 and the gas circulating passage 5. Near the intake to the vertical passage 21 of the bunker, a valve or damper 24 is provided, this valve or damper being controlled through links 25 by a thermostat 26 mounted on the bunker wall 16. Temperatures are controlled by proportionment of the flow of carbon dioxide gas effected by operation of the valve or damper 24, either thermostatically or by manual setting of its position. The proper setting of the thermostat 26 or of the valve or damper 24, where the control is manual, may be determined from tests as to the requirements for maintaining any desired temperature in the lading space of the container, depending upon the nature of the produce to be carried therein.

At the base of the container wooden slats 27 are preferably employed for supporting the lading. In order to compensate for loss of moisture which may occur through absorption by escaped carbon dioxide gas, a humidifier 28 is installed

near the floor of the container. The humidifier 28 includes a cotton wick blanket 29 suspended from a bracket 30 and having its lower end submerged in a water pan 31.

In operation, the circulation of gas in the above described container is as follows: The gas circulating passage 5 acts as a radiator, absorbing heat from the relatively warm air within the lading space of the container and raising the temperature of the gas in the passage 5. As the bunker 11 is located immediately over the vertical ducts 5a, the cold gas generated therein, being heavier than the warm gas, will fall forcing the warm gas across the bottom of the container through the ducts 5b upward through the vertical ducts 5c. The warm gas continues in its flow across the top of the container through the duct 5d into the vertical passage 21 of the bunker 11 where it is chilled by the solid carbon dioxide A inasmuch as the vertical partition 18 affords only partial insulation. The chilling of the gas admitted to the vertical passage 21 assists in circulation. It then flows downward and across the lower exposed surface of the solid carbon dioxide where it is cooled. As before stated the heat transfer between the carbon dioxide gas and the solid carbon dioxide is rendered substantially uniform by the exposure of a constant area at the bottom surface to the gas circulating in the passage 22.

From the above description it will be apparent that the container of my invention is designed to effect uniform and efficient refrigeration of the lading. Moreover, while I have described one particular example of my invention with reference to a specific form of container, it will be apparent that various changes may be made in the details and arrangement of the constituent elements of the container, without departing from the spirit of the invention as defined in the annexed claims.

Having thus described my invention, I claim:

1. In a railway refrigerator container, an outer casing lined with insulating material, an inner shell enclosing the lading to be refrigerated and defining with said outer casing a narrow passage for the circulation of gas, a top bunker for solid carbon dioxide including walls of insulating material attached to said inner shell and isolating the refrigerant space from the lading space, an inner compartment within said bunker including a foraminous base member for supporting the solid carbon dioxide and a vertical partition of insulating material, said foraminous member and partition forming with the bunker walls a continuation of the gas circulating passage aforesaid.

2. In a railway refrigerator container, an outer casing lined with insulating material, an inner shell enclosing the lading to be refrigerated and defining with said outer casing a narrow passage for the circulation of gas, a top bunker for solid carbon dioxide including walls of insulating material attached to said inner shell and isolating the refrigerant space from the lading space, an inner compartment within said bunker including a foraminous base member for supporting the solid carbon dioxide and a vertical partition of insulating material, said foraminous member and partition forming with the bunker walls a continuation of the gas circulating passage aforesaid leading downward from the top of the container and then across beneath said foraminous member and there increasing in cross sectional area toward one end of the outer casing.

3. In a railway refrigerator container, an outer casing lined with insulating material, an inner shell enclosing the lading to be refrigerated and defining with said outer casing a narrow pas-	including a foraminous base member for supporting the solid carbon dioxide, a vertical partition of insulating material, said foraminous member and partition forming with the bunker walls a continuation of the gas circulating pas-	80
5 sage for the circulation of gas, a top bunker for solid carbon dioxide including walls of insulating material attached to said inner shell and isolating the refrigerant space from the lading space, an inner compartment within said bunker	sage aforesaid, and a door in the side of the outer casing at the end opposite to said bunker.	
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