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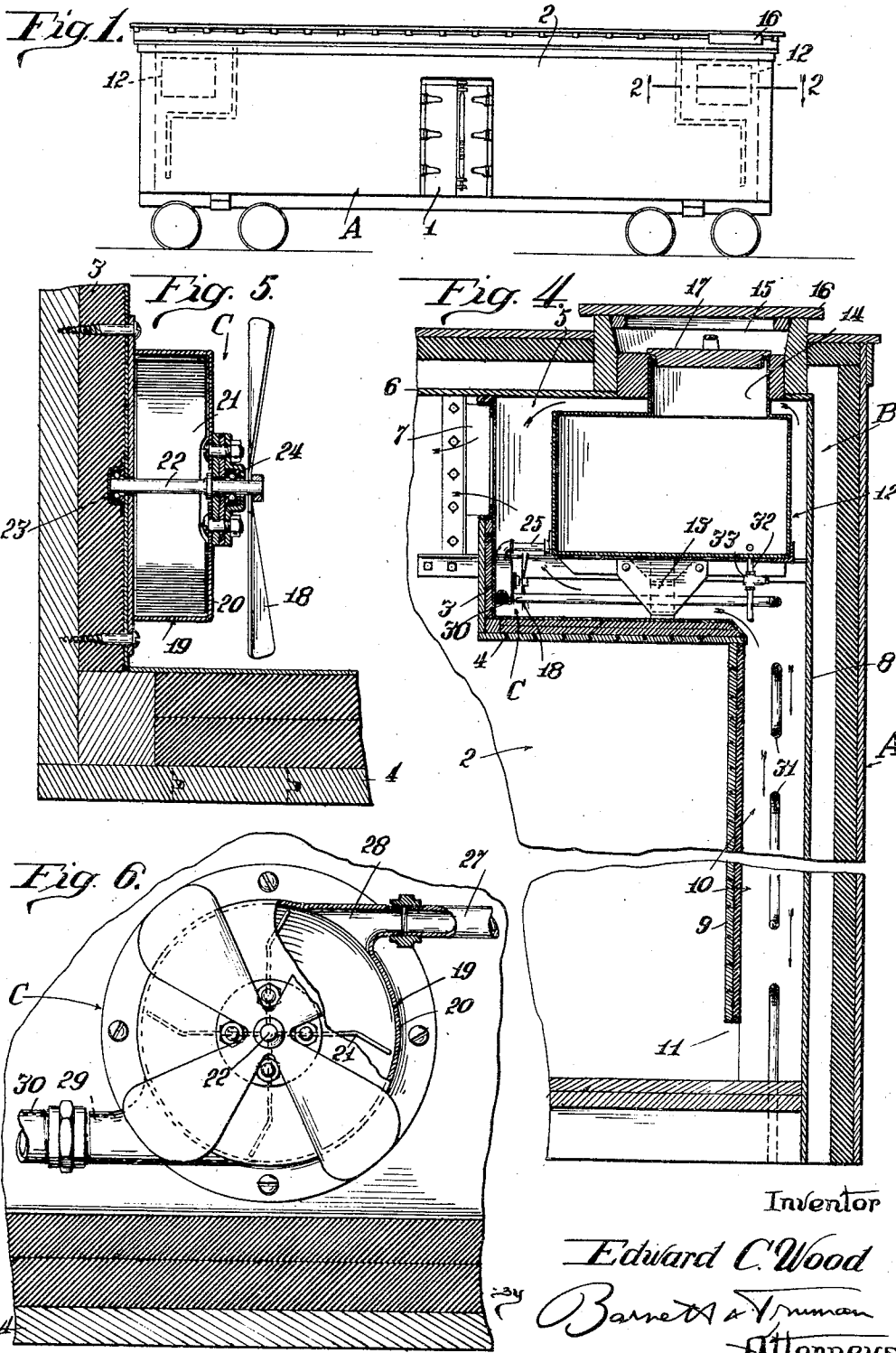
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REFRIGERATING APPARATUS FOR RAILWAY CARS

Filed Jan. 18, 1932

2 Sheets-Sheet. 1



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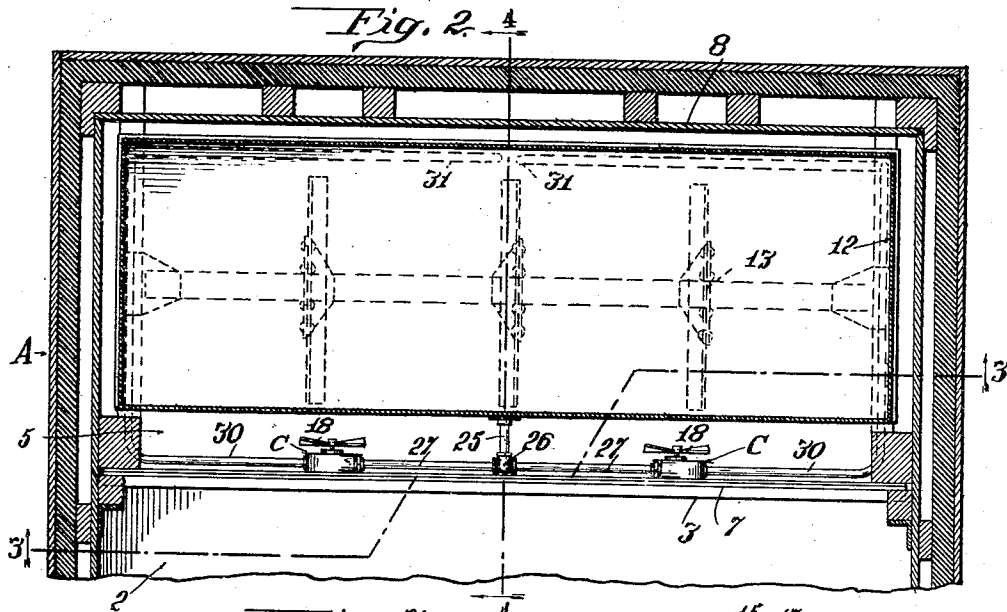
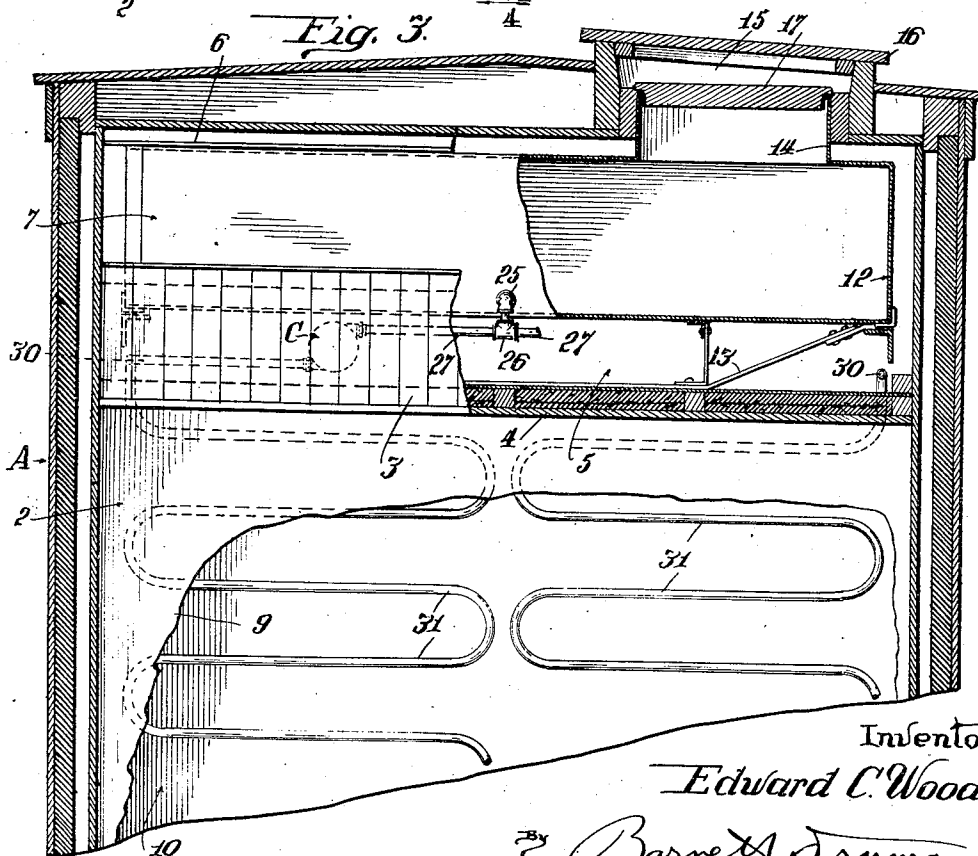
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2 Sheets-Sheet, 2



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UNITED STATES PATENT OFFICE

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REFRIGERATING APPARATUS FOR RAILWAY CARS

Application filed January 18, 1932. Serial No. 587,215.

This invention relates to certain new and useful improvements in a refrigerating apparatus for railway cars, and more particularly to an apparatus adapted to utilize solidified carbon dioxide as a refrigerant, and to enforce a positive circulation of the air within the car by means of the fluid pressure developed as the refrigerant absorbs heat and vaporizes.

As is now well known, solidified carbon dioxide has an extremely low temperature, and when a sufficient quantity of heat is absorbed thereby it passes directly into the gaseous state. A very large quantity of gas is evolved in comparison with the original volume of the solid carbon dioxide. It will be apparent that if the refrigerant is confined within a gas-tight container, considerable fluid pressure will be developed within this container as the refrigerant vaporizes. Also, carbon dioxide gas is a very effective insulator, and as a blanket of this gas is formed around the solid refrigerant (and also about the goods within the compartment to be refrigerated, if the gas is permitted to escape into this compartment) the rate of vaporization of the refrigerant is considerably reduced. However, if the gas is permitted to escape, and the rate of vaporization consequently increased, more heat is absorbed from the car and the goods therein so that a much lower temperature may be maintained, if this is desirable.

According to the present invention, the gas under pressure evolved in the refrigerant-holding container is utilized to drive a fan or blower before the gas is discharged to the outer air, this fan or equivalent apparatus being used to enforce a positive circulation of the air within the car in contact with the refrigerant-container so that the refrigerating process is expedited and made more effective.

The principal object of the present invention is to provide an improved process and apparatus for positively enforcing the circulation of air within the refrigerating chamber by means of the gas pressure developed as solidified carbon dioxide or equivalent refrigerant vaporizes.

Another object is to provide means for utilizing the vaporized carbon dioxide as a refrigerating medium.

Another object is to provide an improved form of refrigerating apparatus for use in a railway car.

Other objects and advantages of this invention will be more apparent from the following detailed description of one approved form of apparatus embodying the principles of this invention.

In the accompanying drawings:

Fig. 1 is a diagrammatic side elevation of a refrigerator car, the general location of the refrigerating apparatus in the two ends of the car being indicated in dotted lines.

Fig. 2 is an enlarged horizontal section through the refrigerating apparatus at one end of the car, the view being taken substantially on the line 2—2 of Fig. 1.

Fig. 3 is a vertical section, taken substantially on the line 3—3 of Fig. 2.

Fig. 4 is a partial longitudinal vertical section taken substantially on the line 4—4 of Fig. 2.

Fig. 5 is a central vertical section through one of the air-circulating mechanisms.

Fig. 6 is a front elevation, partially broken away, of the apparatus shown in Fig. 5.

The refrigerator car A may be of the usual type provided with suitably insulated walls, and usually having side doors 1 in the side walls intermediate the length thereof. In each end of the car is positioned one of the improved refrigerating assemblies, herein after described, these two refrigerating apparatuses indicated at B being substantial duplicates of one another so that only one need be described. In each upper end portion of the car, a portion of the main car compartment 2 is cut off by means of transverse vertical partition 3 and horizontal partition 4 so as to form a refrigerating chamber 5. The vertical partition 3 terminates short of the roof 6 so as to form an inlet passage 7 through which air flows in from the upper portion of compartment 2. The horizontal partition 4 terminates short of the end wall 8 of the car, and a transverse vertical partition 9 extends down from the end of par-

tition 4, in spaced relation to end wall 8, so as to form an air passage 10 having an outlet 11 into the main compartment 2 beneath the bottom of partition 9.

5 The metal container 12 in which the refrigerant is confined, is supported within chamber 5 in any suitable manner as by means of the brackets indicated generally at 13. Preferably the container 12 is so positioned in chamber 5 that air can circulate
10 freely around all sides, ends, top and bottom of the container thus providing a maximum cooling surface. The container 12 is closed except for an inlet passage 14 which extends
15 upward into the hatchway 15 opening through the roof of the car. This hatchway is provided with a removable hatch cover 16, and a closure plug 17 is provided for the inlet passage 14, this plug being adapted
20 to maintain a gas tight fit and be provided with suitable fasteners (not here shown) so as to hold the plug in position against the gas pressure developed within the closed container 12.

25 It will now be apparent that the relatively warm air in main car compartment 2 adjacent the roof 6 will flow into chamber 5 through inlet passage 7, thence flow through chamber 5 in contact with the refrigerant
30 container 12, thence downwardly through passage 10 and back into the lower portion of compartment 2 through outlet 11. In order to positively enforce and speed up this
35 air circulation, one or more blowing devices indicated generally at C are positioned at suitable locations within the chamber 5 or the passage 10. Each of these mechanisms C
40 comprises a suitable rotary fan 18 and a fluid-pressure motor 19, here shown as comprising a closed casing 20 in which is mounted a rotary impeller 21 carried by shaft 22 which is journaled in anti-friction bearings
45 23 and 24, the fan 18 being secured to one outer end of shaft 22.

In the installation here shown by way of example, a conduit or pipe 25 leads from container 12 to a T-connection 26 from which
50 branch pipes 27 lead to the respective inlet ports 28 of the two fluid motors. From the outlet 29 of each motor, a pipe 30 may lead directly or indirectly to the air outside the car. In the installation here shown a refrigerating pipe coil 31 (one for each device C)
55 is positioned within air passage 10, the discharge pipe 30 connecting with the upper end of this coil and the lower end discharging to the outer air.

60 In operation, the comparatively warm air flowing through chamber 5 is cooled by contact with container 12, the heat absorbed from this air vaporizing a portion of the refrigerant thus building up the pressure of the
65 gaseous carbon dioxide confined in chamber

12. This gas under pressure flows out through conduit 25 into the motor housing 19 causing the impeller 21 to rotate and drive the fan 18, which in turn enforces the circulation of air through chamber 5 and passage
70 10. The gas is discharged from the motor housing through conduit 30 and thence flows to the outer air. Since this gas is at a very low temperature, it may be passed through a coil such as 31 and abstract additional heat
75 from the air flow through passage 10. If desired, the refrigerating coil 31 may be omitted and discharge pipe 30 extended directly from motor 19 to the outer air. In some instances it may be found desirable to
80 discharge the carbon dioxide gas inside the car instead of dissipating it to the outer air, although the construction hereinabove described is preferred.

85 While two fan mechanisms have been shown in the present example, it will be understood that one or more such fans may be provided, depending on the requirements of the circulation system and the available fluid
90 pressure that is developed in container 12.

If necessary, an auxiliary discharge pipe such as indicated at 32 and provided with a safety valve 33 may lead from the container 12 in order to avoid the building up of any
95 excessive pressure in the container. This pipe may discharge directly to the outer air or may discharge through a refrigerating coil such as 31. If preferred, an auxiliary connection may be made directly from container
100 12 to refrigerating coils such as 31, and provided with suitable valves, so that the carbon dioxide gas may be utilized for refrigerating purposes without operating the blower mechanisms C. It is to be understood that
105 all such variations come within the scope of the invention as hereinabove set forth and covered by the claims which follow.

I claim:

1. In a refrigerating apparatus, a compartment to be refrigerated, a closed container
110 in the compartment for confining solidified carbon dioxide, a fan for circulating air within the compartment in contact with the container, a fluid-pressure motor for driving
115 the fan, a conduit for carbon dioxide gas leading from the container to the motor, and a cooling coil within the compartment having its inlet connected with the outlet of the motor, and its discharge end leading outside
120 of the compartment.

2. In a refrigerating apparatus, a compartment to be refrigerated, a closed container positioned in the upper portion of the compartment, said container adapted to confine
125 a quantity of solidified carbon dioxide, a circulating passage having an inlet in the upper portion of the compartment, an enlarged upper portion surrounding the container and an extension leading down to an outlet in
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the lower portion of the compartment, a fan within the passage for enforcing a downward circulation of the air therethrough, a fluid-pressure motor for driving the fan, a pressure pipe leading from the container to the inlet of the motor, and a discharge pipe leading from the motor to the air outside the compartment.

3. In a refrigerating apparatus, a compartment to be refrigerated, a closed container positioned in the upper portion of the compartment, said container adapted to confine a quantity of solidified carbon dioxide, a circulating passage around the container having an inlet in the upper portion of the compartment and an outlet in the lower portion of the compartment, a fan within the passage for enforcing a downward circulation of the air therethrough, a fluid-pressure motor for driving the fan, a pressure pipe leading from the container to the inlet of the motor, a refrigerating coil positioned

in the passage and having its inlet connected with the outlet of the motor, and its discharge end leading outside of the compartment.

4. In a refrigerator car, a container positioned in one upper end portion of the car, said container adapted to confine a quantity of solidified carbon dioxide, an air-circulating passage built around the container and having an inlet opening adjacent the roof of the car and an outlet adjacent the floor, a fan positioned in the passage for positively enforcing a downward circulation therethrough, a fluid-pressure motor for driving the fan, a pipe for gaseous carbon dioxide leading from the container to the inlet of the motor, and a cooling coil positioned in the passage and having its inlet end connected with the outlet of the motor and its discharge end leading outside of the car.

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