Jan. 3, 1939. J. H. MARANTETTE 2,142,569

TEMPERATURE CONTROL FOR REFRIGERATORS

Filed Nov. 6, 1937 2 Sheets-Sheet 1

Fig. 1

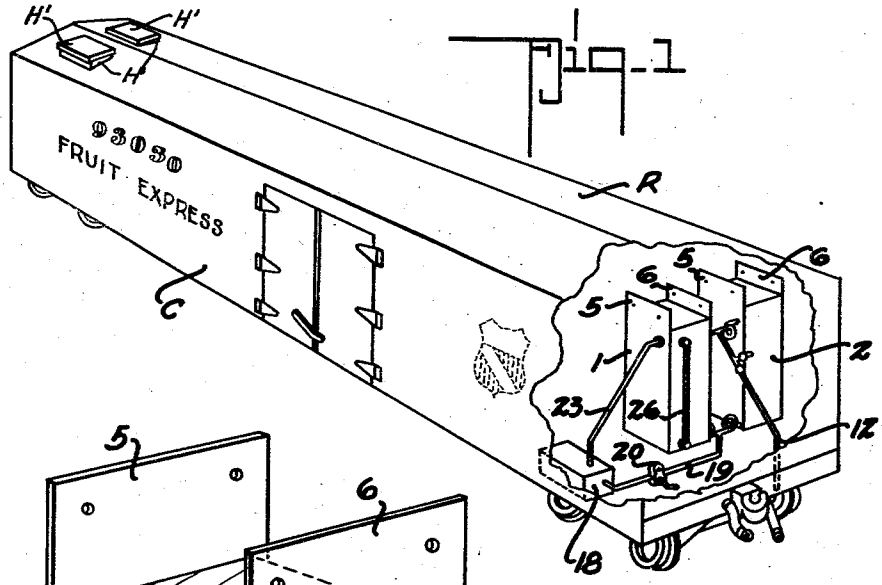
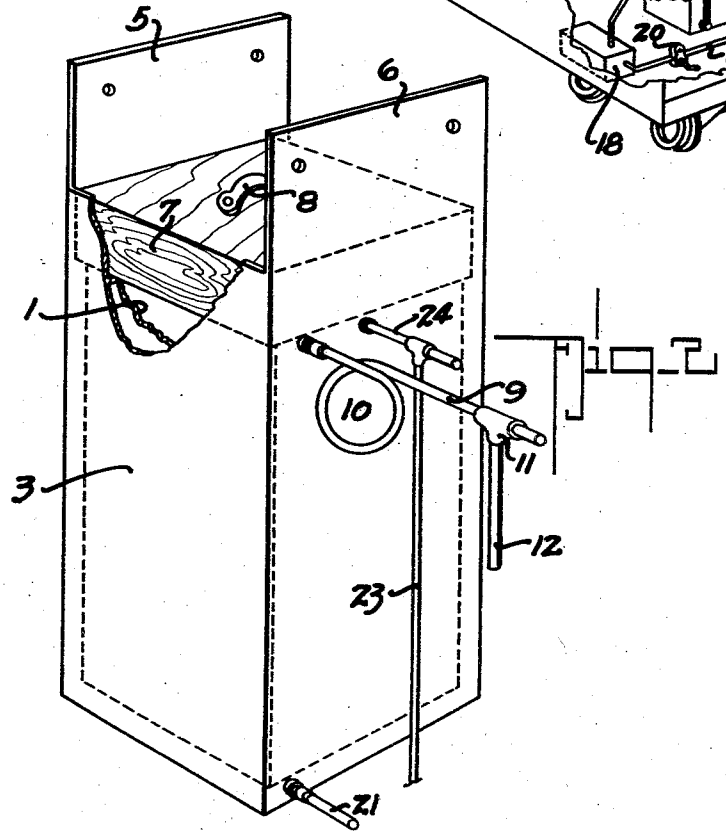


Fig. 2



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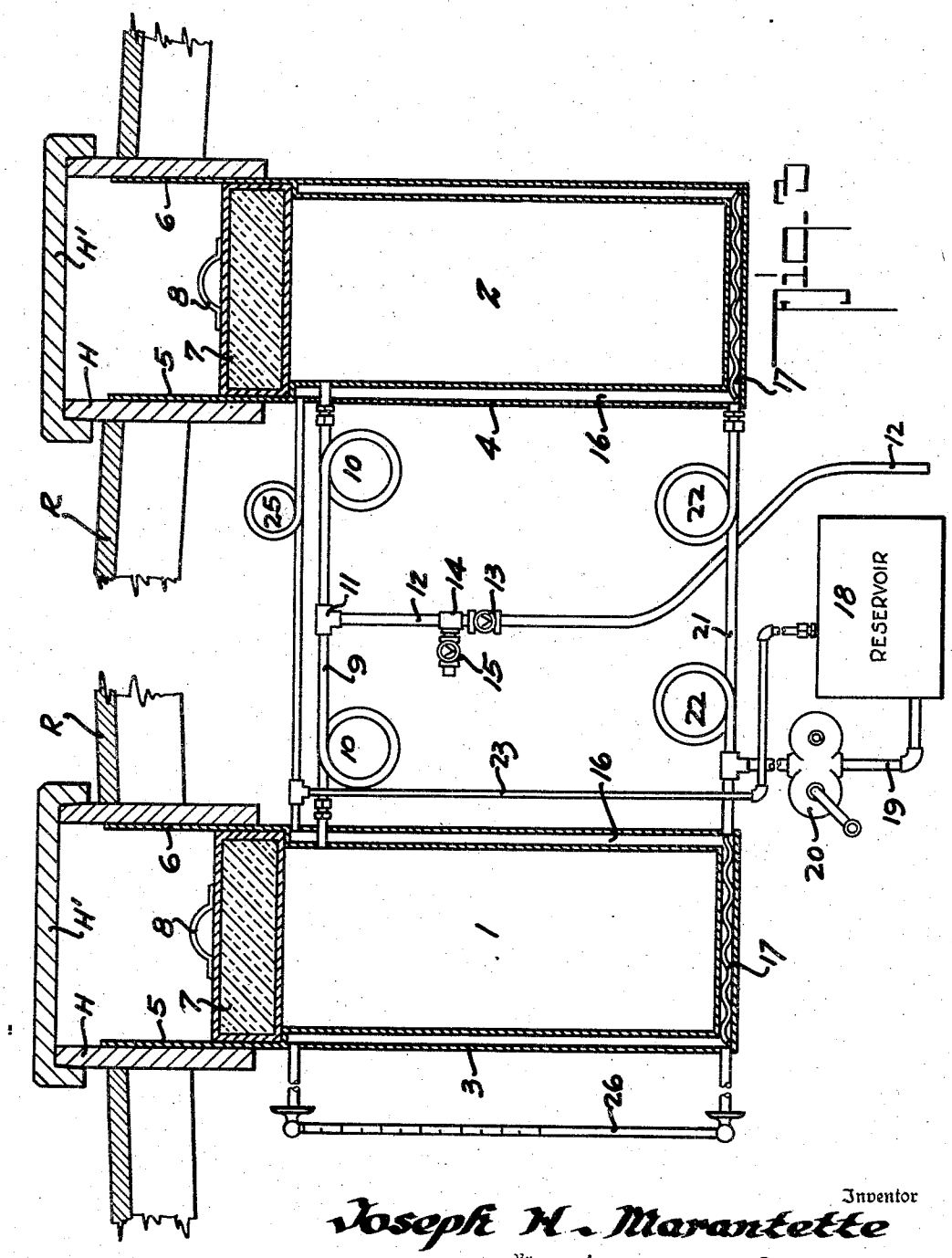
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TEMPERATURE CONTROL FOR REFRIGERATORS

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TEMPERATURE CONTROL FOR REFRIGERATORS

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5 Claims. (Cl. 62—91.5)

The invention contemplates the use with a refrigerating apparatus or appliance, of an exterior jacket utilizing a fluid as a non-conductor or insulator against transmission of heat, and also employing a fluid-conductor for displacing the non-conductor, and thus controlling or regulating the effect of the refrigerator on the temperature of the surrounding atmosphere. In carrying out my invention, according to one mode, I preferably employ air as the non-conducting fluid or insulator in the jacket, and oil as a liquid conductor to displace the air and occupy the vacated space in the jacket, and the air and oil are each confined to a separate closed circuit in combination with a common reservoir.

As a preferred refrigerating medium I employ solidified gas or solid carbon dioxide which is supplied to two ice tanks, as here illustrated, although it will be understood that this number may be varied. The two tanks are connected together, and the gas evaporating from the solids in the tanks after the performance of its refrigerating functions may be disposed of by drainage.

Under some conditions, as for instance when it is desired to fumigate directly the interior of the refrigerator car with the fluid-gas, the latter may be released to the interior of the car before passing out to the atmosphere.

In the exemplification of the invention in the accompanying drawings, the duplex refrigerator apparatus is suspended from the hatchways of a refrigerator car, with the storage reservoir located below the floor of the car, and as will be apparent, this compact arrangement of the apparatus requires a small space within the car, as compared with similar apparatus or appliances employing natural ice as a refrigerant. Due to the convenient arrangement of the parts and the compactness of the apparatus, re-icing, when required, may readily be accomplished from the roof of the car after removal of the hatch-covers and removal of the covers for the ice tanks.

The invention thus briefly outlined consists in certain novel combinations and arrangements of parts as will hereinafter be more fully set forth and claimed. In the accompanying drawings I have illustrated one complete example of the invention embodied in a refrigerator car, but it will be understood that various changes and alterations may be made in this exemplifying structure, within the scope of my appended claims, without departing from the principles of my invention.

Figure 1 is a conventional refrigerator car, partly broken away at one end to indicate the installation of the refrigerating apparatus contained within the car.

Figure 2 is a perspective view of one of the jacketed ice-tanks, partly broken away for convenience of illustration.

Figure 3 is a sectional view transversely of the roof of a railway refrigerator car, showing the refrigerating apparatus suspended from the two hatchways in the roof, with the duplex ice-tanks in vertical section, to disclose the interior construction.

In order that the general arrangement of the refrigerator car installation or equipment may readily be understood, I have shown a conventional refrigerator car C with hatchways H, H, in the roof R of the car, one at each side of the longitudinal center of the car, and the hatchways are closed by hatch-covers H', H'. The refrigerating equipment may be located in one end of the car or both ends of the car may be equipped with the refrigerating apparatus, and the latter is suspended or supported from the walls of the hatchways, the duplex equipment when used extending transversely of the interior of the end of the car.

One or more of the tanks may be suspended from a hatch or hatches, and the tanks are readily accessible from the roof of the car when the hatch cover H' is removed.

The two ice tanks 1 and 2 are preferably of rectangular shape and they are adapted to receive their supplies of cakes of solidified gas or solid carbon dioxide, and each tank is provided with an exterior jacket, as 3 and 4, the tanks and jackets being fashioned of suitable material. Each tank at its upper end is provided with a pair of attaching flanges 5 and 6, spaced to fit up into the hatches, and by bolts or screws these attaching flanges are fastened to the walls of the hatches.

The upper, open ends of the ice-tanks are closed by composite sealing plugs 7 having handles 8, and these heat-insulated plugs or closures are readily accessible through the hatches from the roof of the car for re-icing the tanks, after the hatch covers H' have been removed.

The ice tanks are thus closed to the atmosphere, but a gas-pipe 9, communicating with the respective upper ends of the ice-tanks, connects the tanks and receives the evaporated gas from the tanks, the pipe being provided with a pair of coils or bends 10, 10, to compensate for expansion and to equalize the fluid gases, as the

solids evaporate in the tanks. Between the equalizing coils 10, 10 a T-coupling 11 is provided, and an outlet pipe 12 is connected to the coupling to lead or drain the fluid gas from the apparatus. A cut-off valve 13 is interposed in the outlet pipe 12 to control passage of fluid-gases through the outlet pipe, and this valve may be entirely closed when it is desired or necessary, to fumigate the interior of the car directly with the fluid gas.

For this purpose the outlet pipe is provided with a connection or coupling 14 located between the cut-off valve 13 and the connecting pipe 9, and a control valve 15 is connected with the coupling. To introduce the fluid gas to the interior of the car, the cut-off valve 13 is closed, and the valve 15 is opened as desired to discharge the fluid gas into the car.

For usual refrigerating purposes, without direct contact from the fluid gas, the valve 15 is closed, and the valve 13 is open, so that the fluid gas may pass through the outlet pipe 12 to the atmosphere.

The insulating jackets 3 and 4 are spaced from the inner ice-tanks 1 and 2 to provide oil spaces 16, and a false bottom 17 is provided between the bottoms of the ice tanks and the jackets, this false bottom, as indicated in Figure 3 being fashioned of corrugated strips, in order to provide open spaces between the bottom of the ice tank and the bottom of the jacket. An open space is thus provided around the four sides of the ice tank and beneath its bottom, and this space is enclosed by the jacket and is adapted to contain either air as a fluid non-conductor or insulator, or oil as a conductor, or the upper portion of the jacket may contain air while the lower portion contains oil. The upper, air-contained portion of the jacket being a poor conductor, performs the functions of an insulator to prevent or retard the evaporation of the solid carbon dioxide into fluid gas, while the lower oil-contained portion of the jacket, being a good conductor provides on its exterior surface the required refrigerating area for contact with the air in the refrigerator car. In other words, that portion of the jacket containing oil transmits heat more readily than that portion of the jacket which contains air, and it will be apparent that the temperature of the air in the interior of the car may be controlled, varied, or regulated, by controlling the quantity of oil forced into the jacket for the purpose of displacing a volume of air from the upper portion of the jacket.

The oil for the jacket is supplied from a reservoir 18 that is preferably located below the ice tanks or even under the car, and oil is supplied to the bottoms of the tanks, or rather to the bottoms of the jackets surrounding the tanks, through the oil pipes 19, by means of a conveniently located hand pump 20, here illustrated as a gear-pump. The pump pipe 19 is connected to a cross pipe, or copper tubing 21, that communicates with the bottoms of the two jackets 3 and 4, and one or more expansion coils or bends 22, 22, may be interposed in the cross pipe to equalize the volume of oil pumped to the communicating jackets. To supply the required quantity of oil to the jackets, the hand-pump is operated to lift the oil from the reservoir to the predetermined level in the jackets, and the jackets may be drained of oil if required, by reversing the pump, or by a gravity return flow to the reservoir.

The reservoir 18, in addition to its supply of oil, also provides a supply of air for a closed air circuit that includes the upper portions of the two jackets, and the air pipe 23 from the reservoir. This pipe is connected with a cross pipe 24 that communicates with the upper ends of the two jackets, and a distributing or equalizing coil or bend 25 is provided in this cross pipe, as indicated.

Thus the refrigerating apparatus is provided with two separate fluid circuits having a common reservoir, and as the oil is forced by the pump from the reservoir to the two jackets, a quantity of air from the upper ends of the two jackets is forced back into the reservoir. As the air is displaced and the oil level correspondingly rises, the level is indicated by an oil gauge 26 mounted on one of the ice tanks and communicating at its upper and lower ends with the upper and lower ends of the jacket of the tank.

For a slow evaporation of the solidified gas in the ice tanks and a minimum refrigerating effect from the jackets on the interior of the car, a comparatively small quantity of oil is forced into the jackets to provide a good conductor of small area, and the level of the oil is indicated by the gauge.

For a quicker evaporation of the solidified gas in the ice tank, and a maximum refrigerating effect from the jackets on the air within the interior of the car, a larger quantity of oil is pumped into the jackets to displace the air and thus reduce the insulating portion of the jackets.

While the specification heretofore has dealt with the use of air as a non-conductor and oil as a conducting medium, I have found that gases other than air may be used with facility and among these carbon dioxide (CO_2) gas and for a conducting medium I have found that mineral oil is entirely suitable although alcohol, Prestone, or other forms of anti-freeze solutions are adaptable.

At the present time I prefer mineral oil and carbon dioxide gas, in which the carbon dioxide gas is introduced with the oil at approximately sixty pounds pressure. This insures a maximum temperature control with a minimum volume of oil and gas since the space between the tank and the jacket may be limited to approximately one-half inch, whereas with alcohol the same results will require three-inch spaced walls and Prestone three and one-half inch spaced walls.

Refrigerating cars thus equipped have been shipped long distances with an extremely low percentage of loss or waste of the refrigerant, and thermal indicators and recorders have registered a uniformity in the predetermined temperature desired for the interior of the cars.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a refrigerating system, the combination with spaced refrigerant chambers each having an enclosing jacket, of an air circuit including a cross-pipe having expansion coils and communicating with said jackets, an oil circuit including a cross-pipe having expansion coils therein and communicating with said jackets, a common reservoir for said two circuits, and a pump in the oil circuit.

2. In a refrigerating system for railway cars, the combination with a pair of refrigerating tanks containing solidified gas, and insulating jackets for said tanks, of means for varying the insulated area of said jackets, an evaporated gas

outlet-pipe communicating with said tanks, and a vent-pipe connected with said pipe.

3. In a refrigerating system for railway cars, the combination with a pair of refrigerating tanks containing solidified-gas, and insulating jackets for said tanks, of means for varying the insulated area of said jackets, an evaporated gas outlet-pipe communicating with said tanks, a vent-pipe connected with the said pipe and a cut-off valve in the vent pipe, and an auxiliary valve-connection located between the cut-off valve and said tanks.

4. In a refrigerating system, the combination with a tank containing solidified gas and a closure therefor, and an evaporated gas outlet-pipe connected with the tank, of a closed jacket encasing said tank and spaced from its walls, temperature control means for said tank including means for introducing a lighter non-conducting fluid to the upper portion of the jacket, means for introducing a heavier conducting fluid to lower portion of the jacket, and a gauge for indicating the levels of said fluids in the jacket.

5. In a refrigerating system, the combination with a tank containing solidified gas, a closure therefor, and an evaporated gas outlet-pipe connected with the tank, of a closed jacket encasing said tank and spaced from its walls, temperature control means for said tank including means for introducing alternately a non-conducting fluid and a conducting fluid to the tank from a common reservoir, the lighter non-conducting fluid entering the upper portion of the jacket, and the heavier conducting fluid entering the lower portion of the jacket, and a gauge for indicating the fluid levels in the jacket.

JOSEPH H. MARANTETTE.