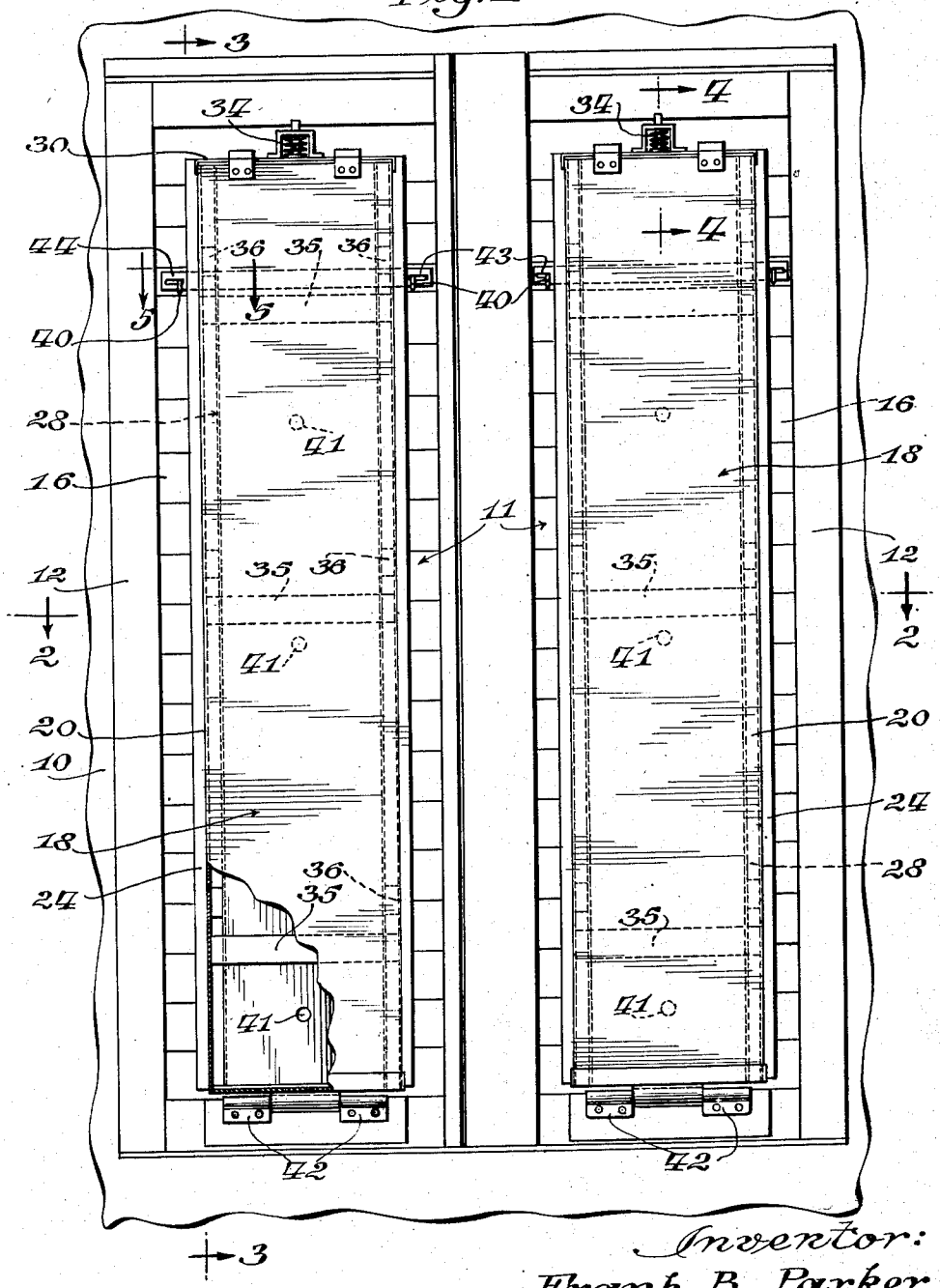
Jan. 30, 1940. F. B. PARKER 2,188,372

REFRIGERATION

Filed Nov. 5, 1937 2 Sheets-Sheet 1

Fig. 1



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REFRIGERATION

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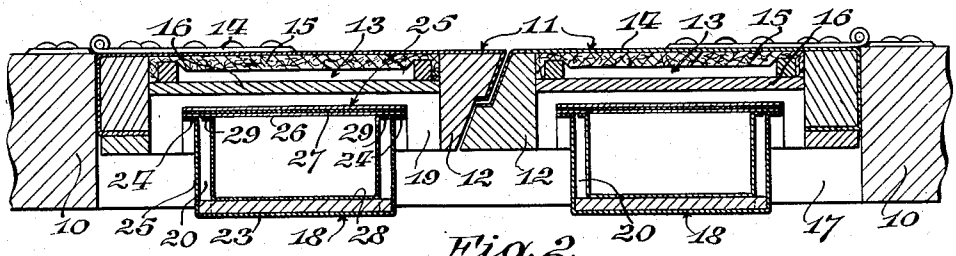


Fig. 2

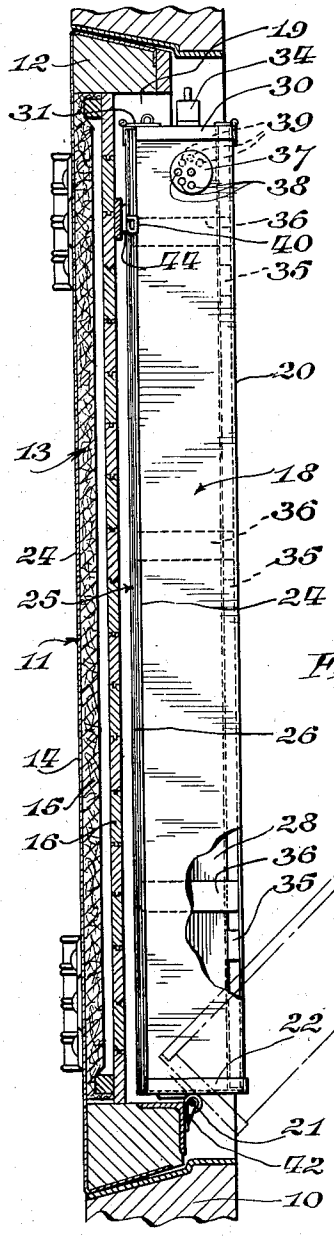


Fig. 3

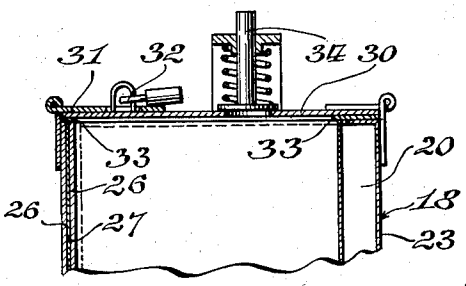


Fig. 4

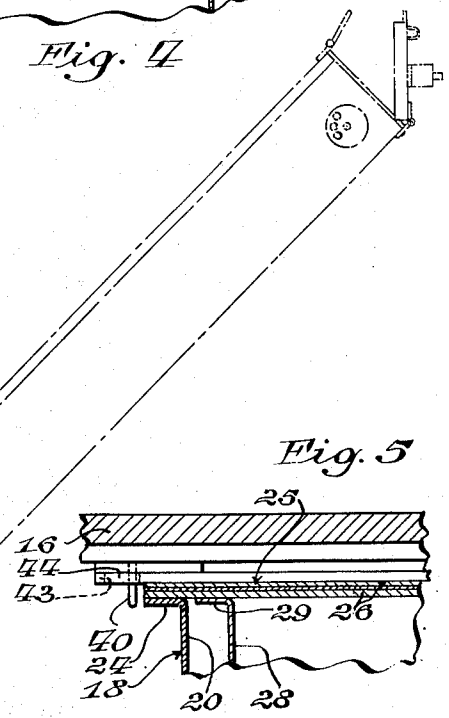


Fig. 5

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Patented Jan. 30, 1940 2,188,372

UNITED STATES PATENT OFFICE

2,188,372

REFRIGERATION

Frank B. Parker, Chicago, Ill.

Application November 5, 1937, Serial No. 172,943

6 Claims. (Cl. 62—91.5)

This invention relates to refrigerators and particularly to refrigerators for freight cars, trucks and other vehicles, although my improved refrigerator may be applied to other chambers in which materials are to be chilled.

One of the objects of the invention is to provide an improved refrigerator which can be readily replenished with refrigerant at any time without disturbing the contents of the storage space.

A further object of the invention is to provide an improved refrigerator which is adapted for the economical and effective employment of solid carbon dioxide for refrigeration.

Other objects, advantages and capabilities of the invention will appear from the following description of a preferred embodiment thereof, taken in conjunction with the accompanying drawings, in which:

Figure 1 is an elevational view of the doors of a refrigerator car, equipped with a pair of my improved refrigerators, the view being taken from the inside of the car;

Fig. 2 is a horizontal sectional view therethrough, taken on the line 2—2 of Fig. 1;

Fig. 3 is a vertical sectional view, taken on the line 3—3 of Fig. 1;

Fig. 4 is a sectional detail, taken on the line 4—4 of Fig. 1, and

Fig. 5 is a sectional detail view, taken on the line 5—5 of Fig. 1.

Referring to the drawings, the reference numeral 10 designates the side of a refrigerator car, which is provided with a pair of doors 11, 11. Each of these doors comprises a peripheral framework 12 and a well insulated exterior panel 13. The panel 13 may comprise an outer wall 14 of metal which extends partly around the ends of the door, as best seen in Fig. 2, a layer 15 of highly effective insulating material, and an inner wooden wall or partition 16.

As best seen in Fig. 2, each door 11 extends only part way into the doorway 17 of the car. My improved refrigerator 18 is mounted partly within the space 19 within the door 11, that is, the space on the inner side of the panel 13 which is surrounded by the frame 12 of the door. The refrigerator 18 also extends inwardly into the doorway on the inner side of the door 11, but it preferably does not project inwardly beyond the doorway to any considerable extent. Consequently, the car can be loaded completely, leaving only the doorway 17 unoccupied and the doors 11 may be closed and locked in the usual manner and the car will be chilled for a considerable time by the evaporation of the refrigerant.

My improved refrigerator 18 comprises an outer tank 20 which is vertically elongated and arranged so that it fits into the door frame 12 in the manner described, leaving a clearance all around it, as best seen in Figs. 2 and 3. The tank 20 is pivotally mounted by a pivot rod 21 and pivot supports 42 carried on the lower horizontal member of the door frame. The tanks can be dismounted by merely pulling out the rods 21. This pivotal mounting enables the tank 20 to be swung away from the door, in the manner shown in dot and dash lines in Fig. 3, to a horizontal or near horizontal position for charging the refrigerator with refrigerant. This charging is most conveniently done when the door is opened and, consequently, it can be effected at any time after the car is fully loaded.

The tank 20 comprises a base 22 and a principal wall 23 of metal. This wall 23 is preferably of channel section and is provided with flanges 24. The channel 23 is closed by a composite wall 25 which may suitably comprise two metal plates 26 which are separated by a suitable heat insulator 27. The edges of the plates 26 and the insulating material 27 overlie the flanges 24 and the tank 20 is completely assembled by securing these elements to the flanges and to the base 22.

A second tank 28, which is adapted to contain the refrigerant, is located within the tank 20. The tank 28 is also of channel form and it is provided with flanges 29 which are secured to the innermost plate 26 by welding or other suitable means. The tank 28 extends the whole way from the base 22 to the top of the tank 20. As is best seen in Fig. 2, the inner refrigerant tank 28 is closed on its outer side by the insulated wall 25. Its other three sides are located in spaced relation to the corresponding three walls of the tank 20.

The intermediate space is normally occupied by carbon dioxide gas which is cold and which is a poor conductor of heat. It will readily be understood that the rate of evaporation of the refrigerant within the tank 28 is maintained relatively slow owing to the fact that this evaporation requires external heat which is supplied to it relatively slowly through the insulated wall 25 and through the carbon dioxide gas space between the tanks 28 and 20.

The upper ends of the two tanks are closed by a cover 30 which is hinged to the outer tank 20. A hasp 31 enables a lock 32 to be applied to prevent pilfering. The cover 30 is provided with a sealing gasket 33 of rubber or other suitable ma-

terial so that both tanks 20 and 28 may be tightly closed at their upper ends. The cover 30 is provided with a spring-pressed safety valve 34, which is located in a part of the cover 30 above the refrigerant tank 28.

The two tanks 20 and 28 are maintained in spaced relation by means of battens or baffles 35 and 36. The baffles 35 are located between the two inner walls of the tanks 20 and 28 and are located in horizontal direction, as best seen in Fig. 1. The baffles 36 are located between the end or side walls of the tanks 20 and 28, as is also shown in Fig. 1. The baffles 35 and 36 are located in spaced relation so that gases may be displaced upwardly out of the space between the tanks as the refrigerant vaporizes.

Near the upper end and preferably in one of the side walls an evaporation control member 37 is provided. This evaporation control member may suitably comprise a disc with a plurality of openings 38 therein. This disc can be located in a plurality of positions so as to bring any number of the openings 38 into register with any number of corresponding openings 39 formed in the wall of the tank 18. Latches 40, pivotally carried by the door 11, are adapted to be passed through the horizontal slots 43 of bars 44 welded or otherwise secured to the outer side of the wall 25, to maintain the refrigerators in their normal vertical position. The inner wall of the tank 28 is provided with a plurality of small openings 41, these openings being preferably located below each batten 35.

The operation is as follows. The doors 11 are opened, which renders the refrigerators completely accessible nothwithstanding that the car is filled to the doorway. The latches 40 are released and the refrigerators are swung downwardly by their pivots 21 into a substantially horizontal position which enables the tanks 28 to be filled with solid carbon dioxide. The closure 30 is then closed, the evaporation control disc 37 is set at an appropriate position, the refrigerator is swung about its pivot 21 into vertical position, and the latches 40 are then moved to secure it in that position. The doors 11 are then closed and locked in the usual manner.

Heat penetrates, relatively slowly, through the wall 25 and through the gas space between the tanks 20 and 28. Consequently, the carbon dioxide evaporates at a reasonable rate. The gas produced escapes from the tank 28 through the opening 41, and, being colder and of greater density than the gas between the tanks 20 and 28, it flows downwardly towards the bottom of the tank, moving between the baffles 36 and 35 in its downward path. Relatively warmer gas moves upwardly in the opposite direction and in this way a continuous counterflow of gas is maintained between the two tanks in the normal operation of the refrigerator. By the time the upwardly moving gas reaches the upper end of the tank 20, it is considerably warmer than its temperature of production owing to the fact that the gas when produced is very cold, about —110 degrees F., and, consequently, it absorbs a considerable amount of heat through the channel-shaped wall of the tank 18 during its upward passage.

This absorption of heat through the wall of the tank 20 serves to cool the air within the car and to cause convection currents in such air. The intermediate chilling effect of the solid carbon dioxide is thus tempered by causing the cold gas produced to pass over a large heating surface, that is, a surface by which the gas is heated, that surface being the channel wall of the tank 20, and by the convection movements of the air within the car which prevents any of that air from being excessively chilled. These convection currents distribute the chilling effect of the solid carbon dioxide in highly tempered degree throughout the whole space within the car.

The position of the disc 37 controls to some extent the rate of evaporation of and the chilling exercised by the solid carbon dioxide. This disc may be so located that it offers a substantial impediment to the escape of gas from the tank 20. Consequently, there may be a certain increase of pressure within the tank 20 and within the tank 28 which, in turn, opposes the evaporation or sublimation of the solid carbon dioxide. The safety valve 34 prevents this pressure from becoming excessive. The carbon dioxide which escapes through the openings 39 and 38 which are in registry, is an effective chilling agent although its temperature has been raised or tempered to an extent which prevents it from effecting any excessive local chilling of a part of the cargo. The gas which escapes through these openings moves downwardly along the tank 20 and joins the convection currents previously referred to.

Although the invention has been disclosed in connection with the specific details of a preferred embodiment thereof, it must be understood that such details are not intended to be limitative of the invention except in so far as set forth in the accompanying claims.

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

1. In combination, a storage compartment including a door, a refrigerator housing pivotally mounted on the inner side of said door, and a refrigerant container within said housing and having a wall in spaced relation to the wall of the housing, closure means for said housing and container, said container having openings for the escape of refrigerant gas into the space between said walls, and said housing having an opening at its upper end for the escape of refrigerant gas.

2. In combination, a storage compartment including a door, a refrigerator housing pivotally mounted on the inner side of said door, a refrigerant container within said housing and having a wall in spaced relation to the wall of the housing, closure means for said housing and container, said container having openings for the escape of refrigerant gas into the space between said walls, and said housing having an opening at its upper end for the escape of refrigerant gas, and adjustable means for controlling the escape of gas from said housing.

3. A refrigerator comprising a tank comprising a channel of heat conductive material, a base closing one end of said channel, and an insulated wall closing said channel, a refrigerant container within said tank comprising a channel within and in spaced relation to the first said channel and secured to the insulated wall, the inner channel having an opening whereby refrigerant gas may escape from the refrigerant container into the space between the channels, and means for closing the tank, said tank having an opening for the escape of refrigerant gas.

4. A refrigerator comprising a tank comprising a channel of heat conductive material, a

base closing one end of said channel, and an insulated wall closing said channel, a refrigerant container within said tank comprising a channel within and in spaced relation to the first said channel and secured to the insulated wall, the inner channel having an opening whereby refrigerant gas may escape from the refrigerant container into the space between the channels, baffle means in spaced relation within said space, and means for closing the tank, said tank having an opening for the escape of refrigerant gas.

5. A refrigerator comprising a tank comprising a channel of heat conductive material, a base closing one end of said channel, and an insulated wall closing said channel, a refrigerant container within said tank comprising a channel within and in spaced relation to the first said channel and secured to the insulated wall, the inner channel having a vertical series of openings whereby refrigerant gas may escape from the refrigerant container into the space between the channels, baffle means in spaced relation within said space, and means for closing the tank, said tank having an opening for the escape of refrigerant gas.

6. A refrigerator comprising a tank comprising a channel of heat conductive material, a base closing one end of said channel, and an insulated wall closing said channel, a refrigerant container within said tank comprising a channel within and in spaced relation to the first said channel and secured to the insulated wall, the inner channel having an opening whereby refrigerant gas may escape from the refrigerant container into the space between the channels, means for closing the tank, said tank having a plurality of openings for the escape of gas, and a perforated disc mounted on said tank whereby any desired number of said openings may be closed.

FRANK B. PARKER.