Jan. 23, 1940. C. E. QUINN 2,187,913

REFRIGERATED CONTAINER

Filed Jan. 12, 1939 4 Sheets-Sheet 1

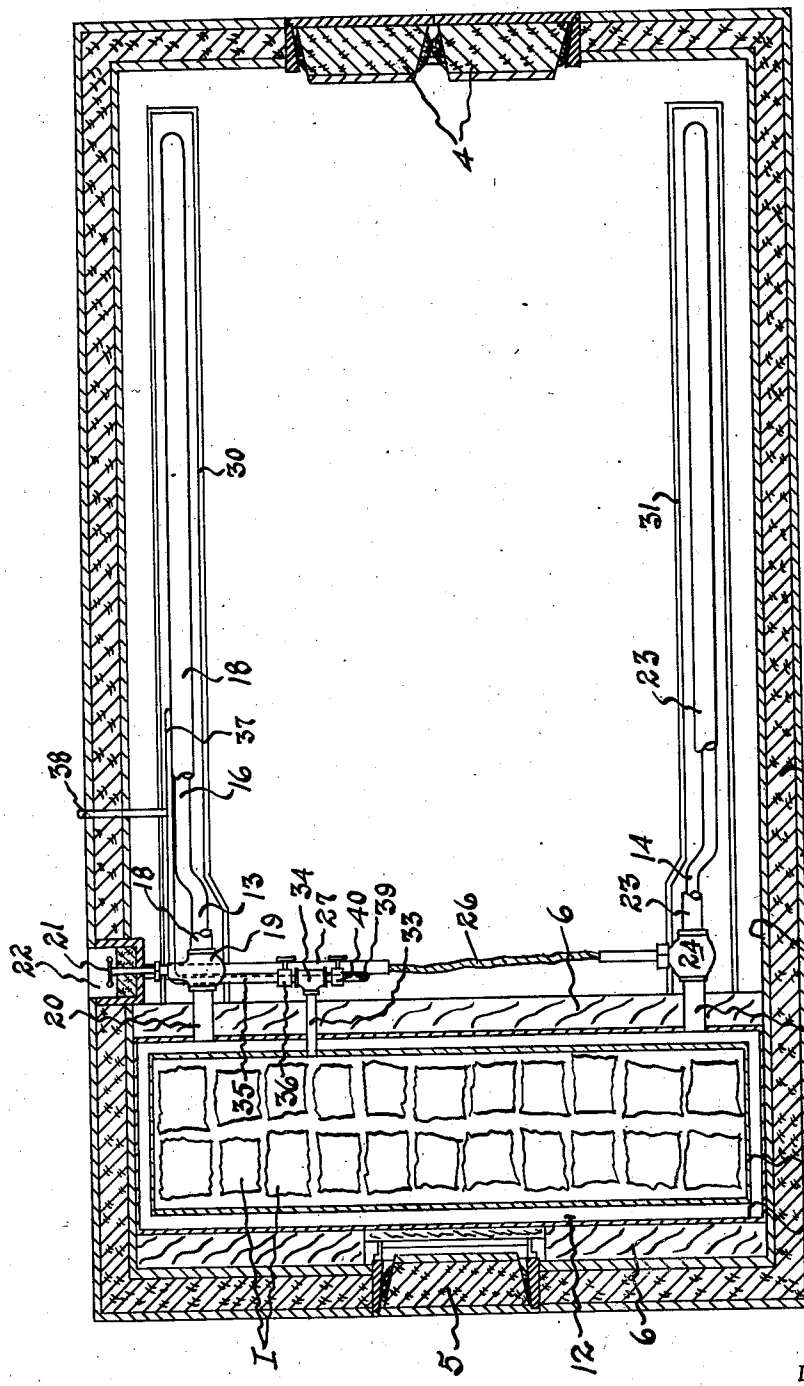


Fig. 1.

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Filed Jan. 12, 1939 4 Sheets-Sheet 2

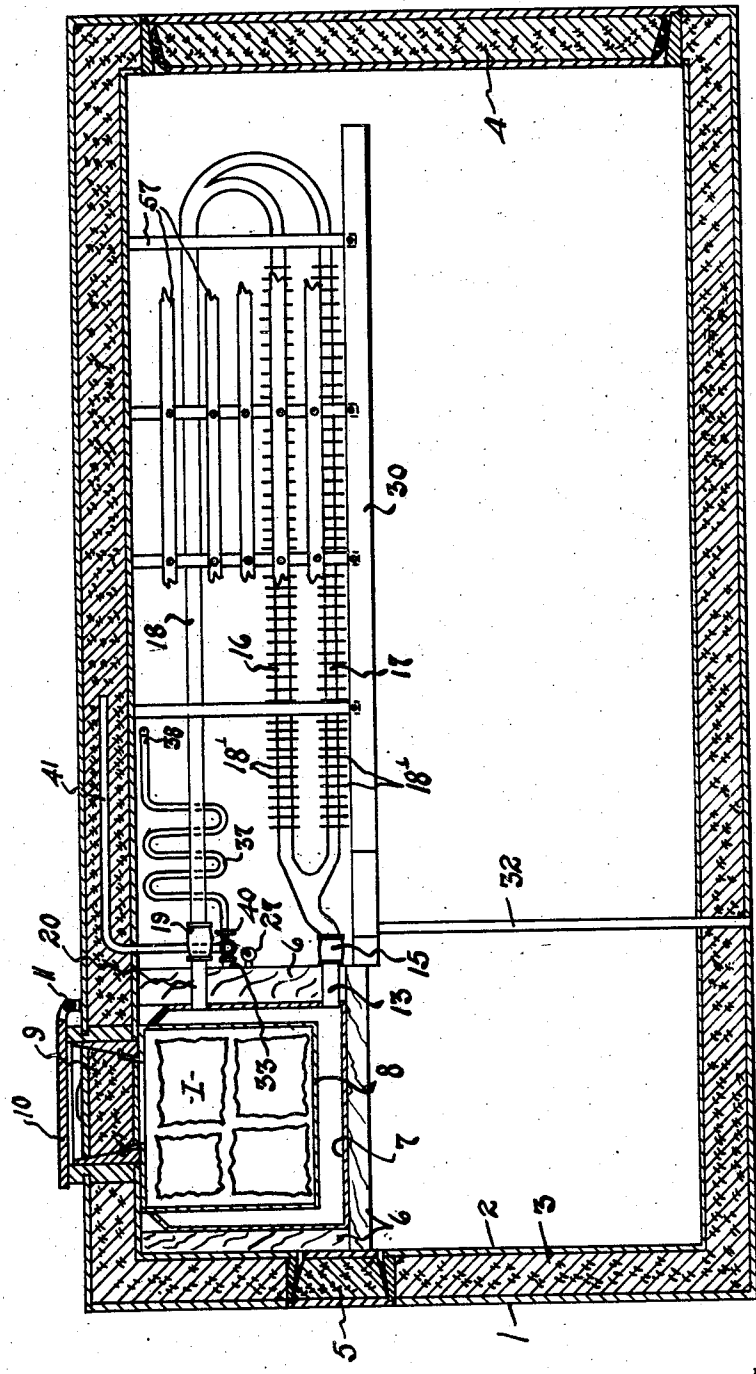


Fig. 2.

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REFRIGERATED CONTAINER

Filed Jan. 12, 1939 4 Sheets-Sheet 3

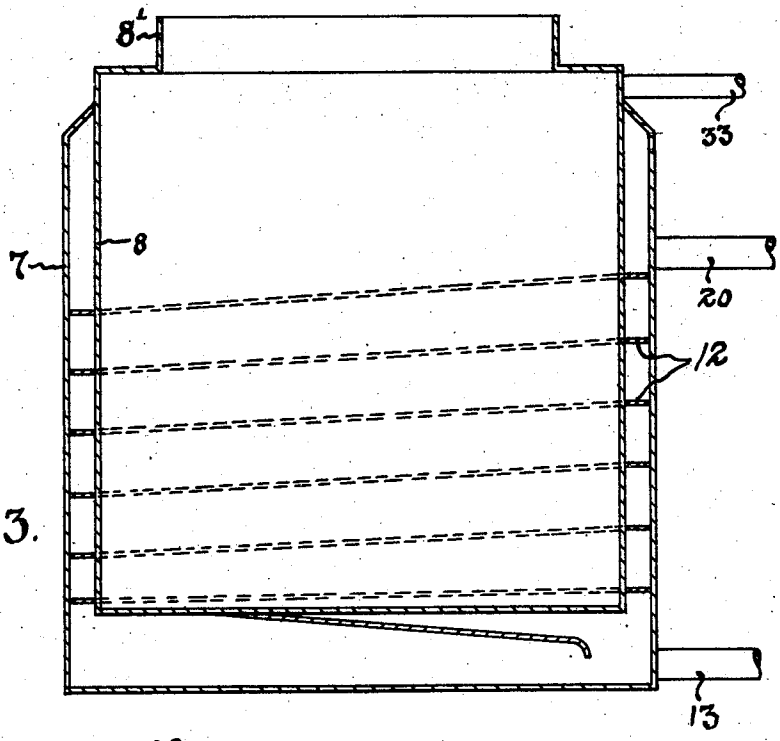


Fig. 3.

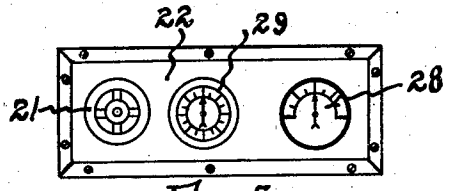


Fig. 5.

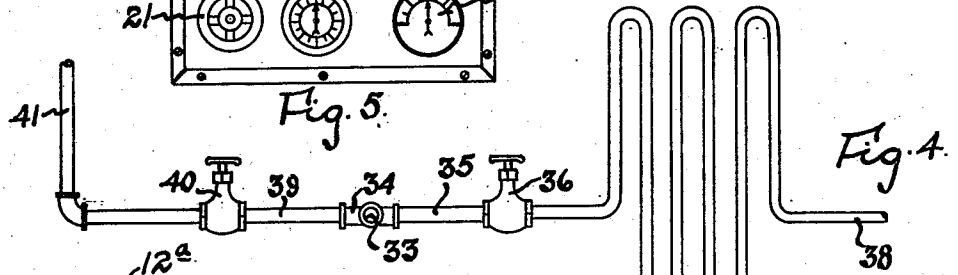


Fig. 4.

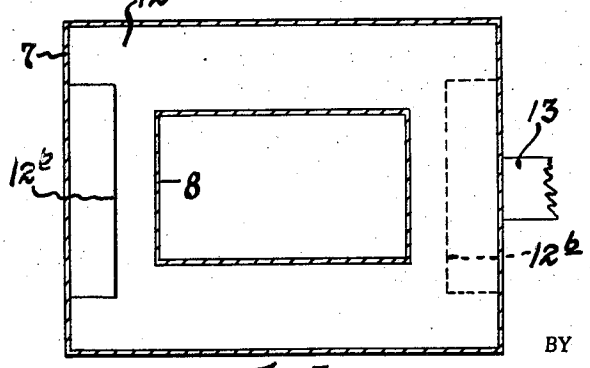


Fig. 7.

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Filed Jan. 12, 1939 4 Sheets-Sheet 4

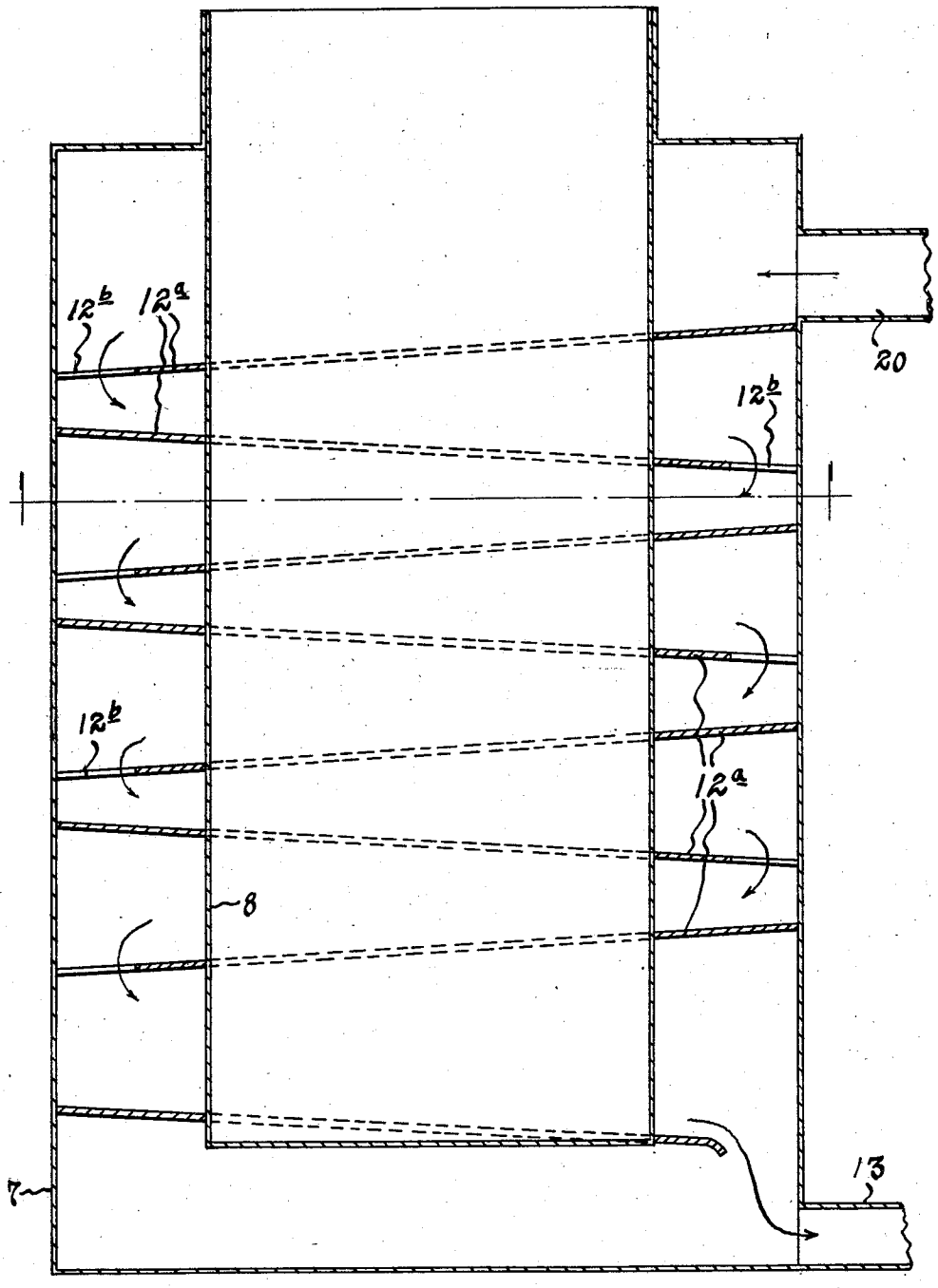


Fig. 6.

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Patented Jan. 23, 1940 2,187,913

UNITED STATES PATENT OFFICE

2,187,913

REFRIGERATED CONTAINER

Clara E. Quinn, St. Petersburg, Fla., assignor to Broquinda, Inc., St. Petersburg, Fla., a corporation of Delaware

Application January 12, 1939, Serial No. 250,476

6 Claims. (Cl. 62—91.5)

This invention relates to improvements in refrigerated containers such as railroad cars, truck bodies, and the so-called L. C. L., or less than carload lot, containers as used on railroads.

An important object of this invention is to provide a complete self-contained unit of this nature.

A further object of the invention is the provision of a refrigerated container of this type particularly adapted to employ solid carbon dioxide as the primary refrigerant although other primary sources of refrigeration can be used.

A still further object of the invention is the provision of a refrigeration system for containers of this type which is capable of automatic operation to maintain desired temperatures therein.

These and many other objects as will appear from the following disclosure are secured by means of the invention herein disclosed in one specific embodiment.

This invention resides substantially in the combination, construction, arrangement and relative location of parts, all in accordance with this disclosure.

In the accompanying drawings,

Figure 1 is a horizontal, cross-sectional view through a L. C. L. container in accordance with this invention;

Figure 2 is a vertical, longitudinal, cross-sectional view therethrough;

Figure 3 is a vertical, transverse, cross-sectional view through the primary and secondary refrigerant container in one suitable form;

Figure 4 is a diagrammatic view of the structure by means of which carbon dioxide gas when solid carbon dioxide is used as the primary refrigerant is employed to take advantage of its refrigerating and insulating properties before it is discharged to the atmosphere;

Figure 5 is a plan view of the control box for the refrigerated container;

Figure 6 is a cross-sectional view similar to that of Figure 3 showing a modification in the construction; and

Figure 7 is a horizontal, cross-sectional view through the structure of Figure 6.

A large volume of perishable products is transmitted on the railways, in trucks and other conveyances by means of sealed containers which have become designated by the abbreviation "L. C. L." These containers are usually packed at the sources of the material, shipped therein, loaded on flat cars or the like, shipped to the nearest distributing point, and then either are unpacked there or unloaded and transported to their ultimate destination. Heretofore no fully satisfactory method of refrigerating containers of this type has been developed wherein the refrigeration system is adapted to and capable of use with such containers. The general purpose of this invention is to provide at the same time as simple a refrigeration system attainable which will be fully self-contained, easily prepared for use, and efficient and dependable for maintaining a desired minimum temperature therein.

In the form of the invention illustrated in the drawings the portable container is more or less diagrammatically illustrated as comprising an outer shell 1 which may be of metal, an inner shell 2 which may be of metal or other suitable material, and an interposed heat insulating lining or shell 3 of any suitable material, such as rock wool, cork in its many forms, and the like. These shells are united into a strong durable container which is provided with one or more openings conveniently closed by doors 4 and 5 through which access to the interior of the container is possible. As illustrated at one end of the container towards the top thereof, there is provided a suitable supporting structure 6 which has been illustrated as a wooden framing. Supported therein is a double wall container of metal comprising an outer shell 7 and an inner shell 8 united to form a closed or sealed space. As illustrated in Figure 3 this combined shell may have an upwardly extending skirt 8' which as illustrated in Figure 2 cooperates with an opening in the top of the container which is closed by means of a removable closure member 9 in turn protected by a cover 10 hingedly mounted at 11. The space between the shells 7 and 8 is divided, as illustrated for example in Figure 3, by means of a helical partition 12 formed of a strip of metal arranged so that the high point of the partition is adjacent the return connections 20 and 25 and its lower terminal end is positioned adjacent the supply connections 13 and 14.

As illustrated in Figure 2, the supply connections 13 and 14 extend to the heat exchange coils through which a liquid secondary refrigerant circulates by thermosyphonic action. There is one of these at each side of the container near the top thereof as will be apparent from Figures 1 and 2. The heat exchange coil for the connection 13 is shown in full detail in Figure 2. It is connected by means of a coupling 15 to the connection and is provided as illustrated with a pair of branches 16 and 17 which extend horizontally along the container to the far end thereof where these branches reunite into a single return line

18 which is connected through a control valve 19 with the return connection 26. As shown in Figure 2 the branches are provided with a series of metal fins 18' which may be in the form of discs in heat conducting relation with the branch pipes which are, of course, of metal, and extending into the space to increase the heat absorption area of those pipes.

As shown in Figure 1, the control handle 21 for the valve 19 extends into a control box 22 mounted on the side of the container at a convenient point for access thereto. The connection 14 in a similar manner is provided with finned branches which unite into the return line 23 connected through the valve 24 to the return connection 25. The valve 24 is operated or controlled by means of a thermostatic device 27 which is connected to the valve by means of a Bourdon wire 26. The valve 24 is one of a number of suitable and well known forms of valves adapted to operation by means of a main transmitting member such as the Bourdon wire 26. The thermostatic device 27 extends to the control box 22 and terminates at the adjustable thermostatic device 28. The pointer of this device may be set at any desired temperature and the valve 24 will be adjusted by the thermostatic device 27 which is exposed to the temperature conditions within the container. The thermostatic device 27 likewise may be any one of a number of well known forms of heat responsive devices suitable for actuating the Bourdon wire. As illustrated in Figure 5, at 29 there is an indicating thermometer which gives a direct reading of the temperature conditions within the container.

Positioned under the heat exchange coils are troughs or gutters 30 and 31 which collect any condensate which drips from the coils and conducts it to waste through a discharge pipe, one of which is shown at 32 in Figure 2. At 33 is a connection from the space within the inner shell 8 which receives the primary refrigerant I. The connection 33 has attached thereto a T 34 provided with the branches 35 and 39, see also Figure 4. In the branch 35 is a hand valve 36, to which is connected a coil 37 positioned in any suitable manner, as indicated in Figures 1 and 2, which coil terminates in a discharge connection 38 to the atmosphere. The branch 39 is likewise provided with a manual control valve 40 and connects to a pipe 41 which extends into the insulation 3 of the container as illustrated in Figure 2. This extension 41 opens into the space between the shells 1 and 2 and may extend to several sides thereof, the illustration in Figure 2 being in illustrative sense. As is clear from Figure 2, the heat exchange coils and the gutters are supported and protected by a suitable grillwork 57 which is preferably made of wood.

The double wall container 7—8 is shown provided with a modified partition wall 12a in Figures 6 and 7. In this case instead of employing a helically formed strip the partition wall consists of a series of plates or sheets 12a alternately inclined in opposite directions and each is provided on its low side with an opening 12b, as is clear from these figures.

In the operation of the apparatus the space between the shells 7 and 8 and the heat exchange coils is filled with any one of a number of suitable and known liquids which may act as secondary refrigerants and which are particularly adapted to thermosyphonic circulation by reason of differences in temperature existing in separated parts thereof. The space within the inner shell 8 is charged with blocks of solid refrigerants, such as water ice, but preferably solid carbon dioxide.

When the system is in operation the valves 24 and 19 are open. Valve 19 may be adjusted manually by means of the handle 21 to some point which will provide one-half or more of the the necessary flow of secondary refrigerant to maintain a desired temperature in the container. The thermostatic control 28 when suitably calibrated can then be set to provide the remainder of the required refrigeration by the proper adjustment of the valve 24. As the surrounding temperature conditions fluctuate, as well as those within the container, the thermostatic device by reason of the adjustment thereof acts to properly control the valve 24 to maintain the desired temperature within the container. An important feature of this invention consists in the fact that the valves 19 and 24 are in the return lines rather than in the supply line. It has been found from experience that this position of the control valves ensures a more uniform temperature condition within the container, that is, the desired temperature is more accurately maintained. With the apparatus thus set the cold secondary refrigerant leaves the space between the shells 7 and 8 from the bottom through the connections 13 and 14, circulates through the heat exchange coils, and returns in its warm condition, having abstracted heat from the main container through the top of this space through the connections 20 and 26. It is discharged onto the helical partition 12 in heat exchange relation with the shell 8 and as it cools it gradually descends in a spiral path to the bottom of the space where it is discharged, as is clear from Figure 3, adjacent the supply lines 13 and 14. At this point it may be noted that in the arrangements of Figures 6 and 7 a similar result occurs except that the secondary refrigerant flows back and forth by running down one partition 12a, falling through the opening 12b onto the next lower partition, and then flowing back to the other side around the inner container 8. Thus it flows back and forth and gradually reaches the bottom of the container 7 adjacent the supply connections 13 and 14. The arrows in Figure 6 clearly show the path of travel of the secondary refrigerant from the time the warm fluid enters through the connection 20 until it leaves through the connection 13.

In the case of solid carbon dioxide as it sublimes the gas generated is conducted through the connection 33 to the branches 35 and 39. The amount of gas which moves through these branches is determined by the setting of the valves 36 and 40, respectively. The gas which goes through branch 35 circulates through the coil 37 to provide additional refrigeration for the space from the gas before it is discharged to waste through the outlet 38. The portion of the gas going through the branch 39 is discharged between the shells 1 and 2 through 41 and serves as a cold blanket around the inner space. In addition, the carbon dioxide gas, having a low specific heat, is a good heat insulator, thereby aiding to insulate the inner space from the outside.

It will be seen by this arrangement that a fully self-contained refrigerating unit is provided for a portable container of the L. C. L. or equivalent types which may, for example, be a removable truck body which efficiently operates

to employ the maximum refrigerating capacity of the original solid carbon dioxide.

Those skilled in the art will readily appreciate that many changes in the details of construction and relative arrangement of the parts may be carried out without departure from the novel subject matter herein disclosed. It is not desired, therefore, to be strictly limited by this disclosure but rather by the claims granted.

What I seek to secure by Letters Patent is:

1. In a portable refrigerating unit, the combination including a heat insulated cabinet, a double wall container supported within said cabinet and adapted to support a solid refrigerant in the inner container, supply and return connections for the space between said containers, a heat exchange coil exposed to the space within the cabinet and connected at its ends to the supply and return connections, a valve in the return connection, thermostatic means mounted in the space and connected to said valve for operating it, and means exterior of said cabinet for adjusting said thermostatic device to maintain a desired temperature within the container, said heat exchange coil being supported near the top of said container along one side thereof and having a plurality of heat conducting fins mounted thereon.

2. In a portable refrigerating unit, the combination including a heat insulated cabinet, a double wall container supported within said cabinet and adapted to support a solid refrigerant in the inner container, supply and return connections for the space between said containers, a heat exchange coil exposed to the space within the cabinet and connected at its ends to the supply and return connections, a valve in the return connection, means exterior of the cabinet for adjusting said valve, and a second coil connected to the inner space of said double wall container mounted in the space in the cabinet and having a discharge to the atmosphere.

3. In a portable refrigerating unit, the combination including a heat insulated cabinet, a double wall container supported within said cabinet and adapted to support a solid refrigerant in the inner container, supply and return connections for the space between said containers, a heat exchange coil exposed to the space within the cabinet and connected at its ends to the supply and return connections, a valve in the return connection, thermostatic means mounted in the space and connected to said valve for operating it, means exterior of said cabinet for adjusting said thermostatic device to maintain a desired temperature within the container, and a second coil connected to the inner space of said double wall container mounted in the space in the cabinet and having a discharge to the atmosphere.

4. A refrigerated L. C. L. container comprising a heat insulated casing, a double wall container supported within said casing comprising a pair of nested shells, the inner shell being adapted to receive a solid refrigerant and the space between said shells a liquid secondary refrigerant, a pair of heat exchange coils connected to said space and arranged along a pair of opposite sides of said cabinet, a valve in the return connection of each of said coils, one of said valves being accessible from the exterior of said cabinet for manual adjustment, a thermostatic operator for the other of said valves mounted in said cabinet, and means for adjusting said thermostatic operator accessible from the exterior of said cabinet.

5. In a portable refrigerating unit, the combination including a heat insulated cabinet, a double wall container supported within said cabinet and adapted to support a solid refrigerant in the inner container, supply and return connections for the space between said containers, a heat exchange coil exposed to the space within the cabinet and connected at its ends to the supply and return connections, a valve in the return connection, said double wall container, supply and return connections and heat exchange coil forming a closed circulatory system for a secondary refrigerant, and means in the space between the double walls of said container for causing the secondary refrigerant to follow a circuitous path in passing from the return to the supply connections.

6. In a portable refrigerating unit, the combination including a heat insulated cabinet, a double wall container supported within said cabinet and adapted to support a solid refrigerant in the inner container, supply and return connections for the space between said containers, a heat exchange coil exposed to the space within the cabinet and connected at its ends to the supply and return connections, a valve in the return connection, said double wall container, supply and return connections and heat exchange coil forming a closed circulatory system for a secondary refrigerant, and partitions mounted in the space between the double walls of said container to cause the secondary refrigerant to flow in contact with the inner of said double walls.

CLARA E. QUINN.