Nov. 21, 1939. W. F. DIETRICHSON 2,180,510

REFRIGERATOR CAR

Filed Sept. 15, 1937 3 Sheets-Sheet 1

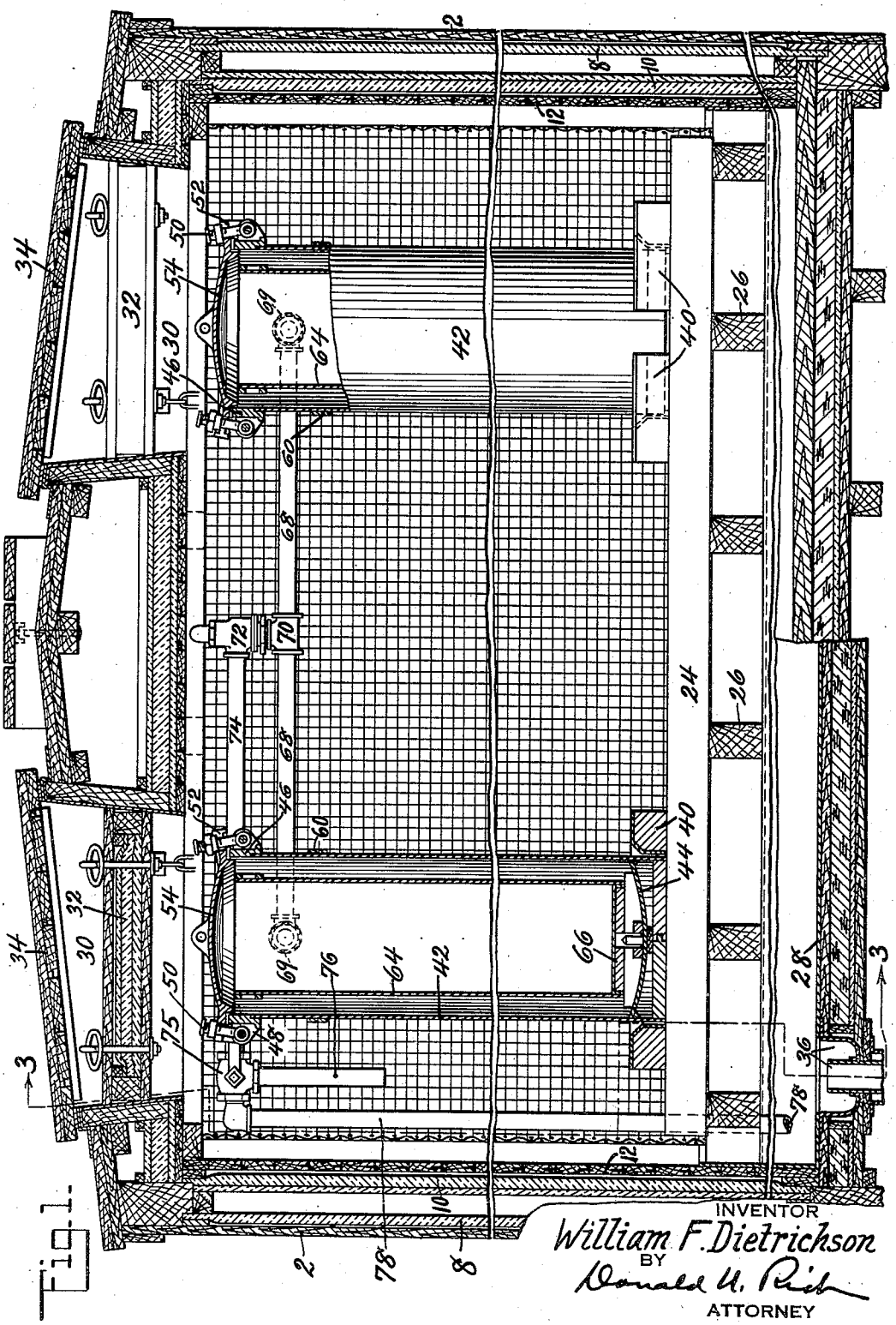


Fig. 1.

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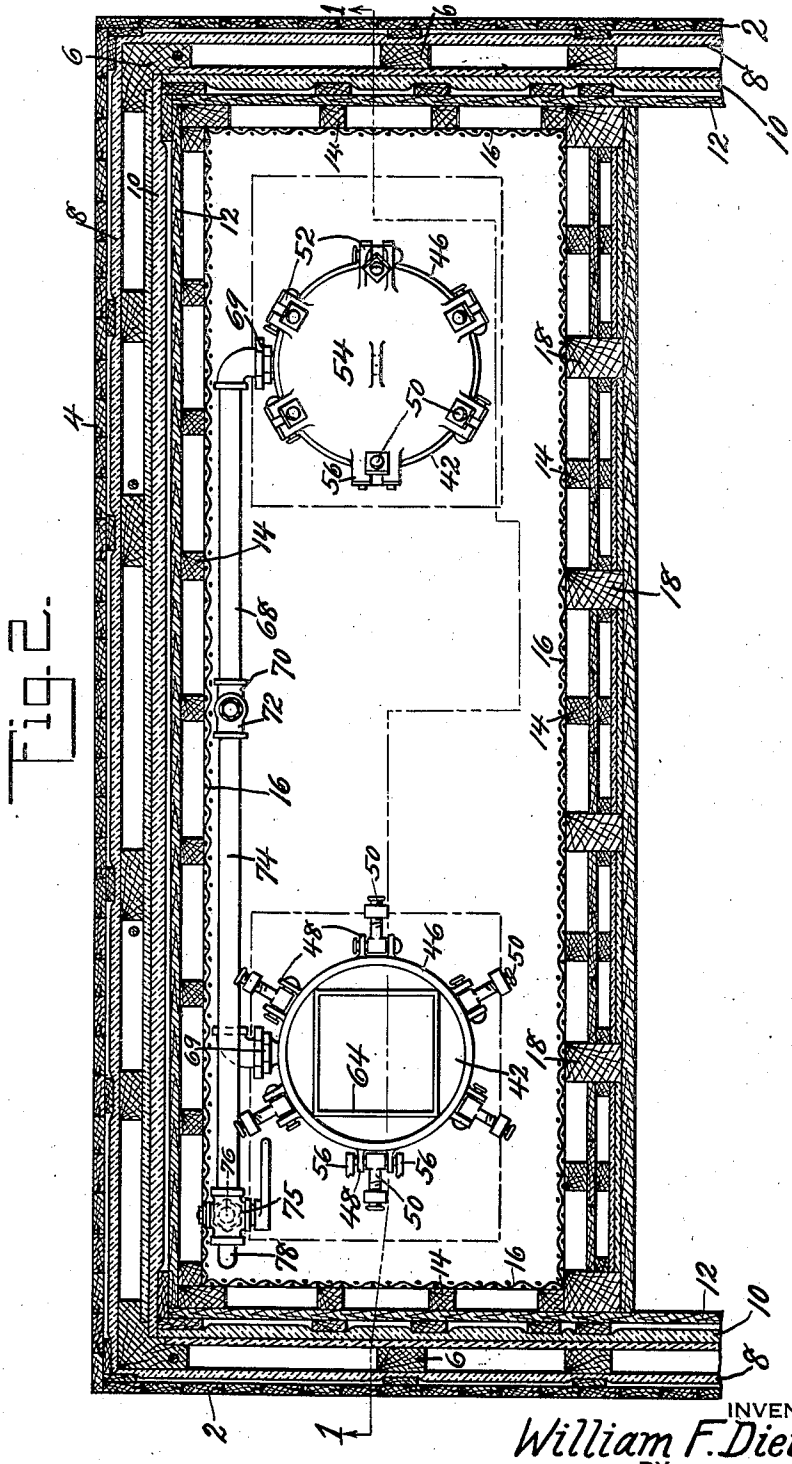


Fig. 2.

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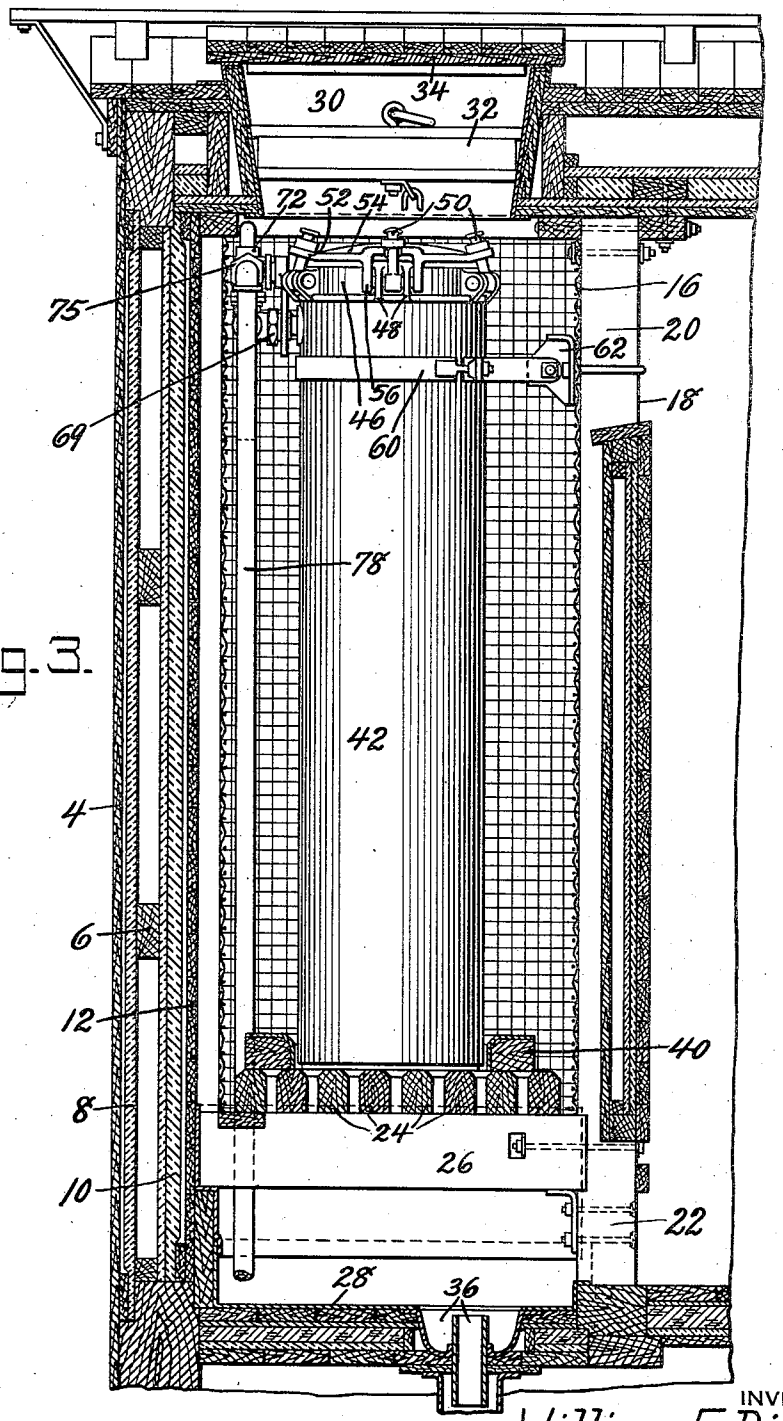


Fig. 3.

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REFRIGERATOR CAR

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Application September 15, 1937, Serial No. 163,952

13 Claims. (Cl. 62—91.5)

This invention relates to refrigerator cars in general and in particular to refrigerator cars convertible for use either with solid carbon dioxide, water ice or a combination of the two.

In the past cars have been built using water ice as a source of refrigerant and also cars have been built designed specially for solid CO_2 rendering them wholly unsuitable for use with water ice as a refrigerant. Recently it has been proposed to increase the cooling of ordinary water ice refrigerator cars by the addition of a container placed in the roof zone or elsewhere in the car interior which container carried solid carbon dioxide. With the refrigerator cars modified as indicated above a large amount of lading was injured due to the intense cold adjacent the carbon dioxide container and its use has now been practically abandoned. The main reason for the abandonment of the use of carbon dioxide in refrigerator cars was the fact that temperatures could not be carefully controlled and the containers occupied a large amount of valuable lading space. It is an object, therefore, of the present invention to provide sealed containers for solid carbon dioxide, the temperature of which may be regulated by control of the pressure maintained within the container.

A further object of the invention is the provision of a refrigerator car which may be cooled either by water ice alone, solid carbon dioxide alone or a suitable combination of the two.

A still further object of the invention is the provision of a refrigerator car using a combination of water ice and solid carbon dioxide with regulating means permitting the control of the rate of consumption of the solid carbon dioxide, thus controlling the ratio of carbon dioxide to water ice consumed in cooling the car.

A yet further object of the invention is the provision of apparatus for the utilization of solid carbon dioxide which apparatus may be readily installed or removed from existing refrigerator cars without any radical modification of the car structure that would affect its use as a regular water ice car or decrease the lading capacity.

These and other objects of the invention will be apparent to persons skilled in the art from a study of the following description and accompanying drawings, in which:

Figure 1 is a sectional view taken substantially on line 1—1 of Fig. 2 with a portion of one container broken away to clearly disclose the similarity of container construction;

Fig. 2 is a sectional view taken substantially through the upper portion of the ice bunker and showing in line and dash outline the relative location of the hatch openings, and

Fig. 3 is a sectional view taken substantially on line 3—3 of Fig. 1.

Referring now to the drawings in detail, it will be seen that the refrigerator car used for illustrative purposes is of conventional design having the wood side walls 2 and end walls 4 insulated from the car framing 6 by insulating blanket 8. Upon the inner side of the framing customary insulating layers 10 are provided and protected by inner wood lining 12, thus forming the usual type of refrigerator car. In order to provide baskets or bunkers for the reception of refrigerant small wood spacing strips 14 are secured to the lining at each end of the car and these have nailed or otherwise secured thereto the wire netting 16. The customary bulkhead is provided by securing posts 18 to the floor and roof structure of the car, which posts have the short lining attached thereto on one side and carry the full length wire netting upon the other side, thus forming upper and lower air circulating openings 20 and 22 respectively. The usual ice grate 24 is supported in the lower portion of the bunker upon longitudinally extending supports 26 secured to the bulkhead posts and car end structure above the metallic drip pan 28. The bunker so formed is adapted to be filled with refrigerant through hatch openings 30 normally closed by plug 32 and cover 34 with the drainage from the refrigerant escaping from the drip pan through trap 36.

Suitable blocking 40 is secured to the ice grates and is adapted to receive the lower ends of metallic containers 42 of such a size as to be readily lowered through the hatch openings. Each of the containers is cylindrical in form and is provided at its lower end with a head 44 welded in position and at its upper end with a ring 46 welded in position and provided with outstanding lugs 48 adapted to pivotally mount clamping bolts 50. These clamping bolts engage outstanding ears 52 formed on the periphery of lid 54 adapted to engage the ring to provide a pressure seal. If desired the seal may be formed by ground surfaces but is preferably formed by means of gaskets as is customary with pressure vessels. One of the pivotal mounts for the locking bolts is extended in order to provide a pivot for the hinge 56 formed by portions depending from one of the lid ears as is clearly shown in Fig. 3. The upper end of each container after being lowered into the bunker is suitably anchored to the bulkhead by means of bands 60 extending around the

container and secured to anchoring brackets 62 fastened to the bulkhead posts (Fig. 3).

Each container is provided with an inner box 64 which is substantially square and has the corners engaging the inner surface of the container, thus spacing the box walls from the container sides and providing spaces in which the cold carbon dioxide gas may circulate. The inner boxes are substantially the same size as the commercial cubes of compressed carbon dioxide and the only point at which the carbon dioxide gas may escape from the inner box is at the upper end since the lower end is completely closed by box floor 66 resting upon the lower pressure head of the container. In order that the pressure in the containers may be maintained at a constant equal amount pipes 68 are connected thereto by means of unions 69 and these pipes are connected together by a T connection 70 which carries a pressure relief valve 72 adjustable to open at any desired pressure. The outlet of the pressure relief valve is connected to pipe 74 at one end, the other end being connected to a three-way valve 75 located adjacent one of the hatch openings. One of the outlets of the three-way valve has connected thereto a short discharge pipe 76 which will discharge within the car, while the other outlet has connected thereto a pipe 78 extending downwardly through the floor of the car to discharge gas outside of the car. It will thus be seen that the two containers are connected together thus maintaining an equal pressure in each container and that this pressure may be maintained at any desired point by adjustment of the pressure relief valve. It will also be seen that the gaseous discharge from the pressure relief valve may be directed either into or out of the car dependent upon the setting of the three-way valve 75.

From the preceding description it will be apparent that the only necessary modification of an existing bunker is the provision of bottom bracing blocks 40, upper anchor brackets 62 and exterior discharge pipe 78. With the bunker thus modified the containers may be lowered into the bunker through the hatch openings, anchored in place and the piping with the pressure relief valve and three-way valve connected to the containers and to the exterior discharge pipe. In order to remove the containers, it is only necessary to loosen the unions 69 and release the upper anchor from the anchor bracket 62, after which the containers may be lifted bodily through the hatch openings.

The operation of the bunker and the air circulation therethrough without the containers in place, is identical with that of the customary ice bunker now in use in refrigerator cars and after installation of the containers the air circulation remains unchanged and the only difference is that the solid carbon dioxide within the containers will maintain a lower temperature than that usually obtainable with ice alone. In charging the bunker with the containers in position, it is necessary first to fill the inner box with solid carbon dioxide, after which the sealing lids are clamped in place and the bunker filled with ice in the customary manner. After the bunker is fully charged with solid carbon dioxide and water ice and the pressure relief valve properly set, it will be found that the low temperature carbon dioxide gas flowing down along the walls of the inner box and up along the walls of the sealed container will cool the ice and air immediately adjacent the container to a point far below that possible with ordinary meltage of water ice. As the carbon dioxide gas absorbs heat units from the ice and air adjacent the container its temperature will rise, thus increasing the pressure to a point where the pressure relief valve opens permitting discharge of the relatively warm carbon dioxide gas from the top portion of each container. It will be obvious that by modifying the pressure at which the pressure relief valve opens the rate of consumption of the carbon dioxide may be controlled and in this way control the entire temperature of the car as well as the ratio of consumed carbon dioxide to water ice.

While the invention has been described more or less in detail with specific reference to one form thereof, it is obvious that various modifications and rearrangements of parts may be accomplished and all such modifications and rearrangements of parts are contemplated as fall within the scope of the following claims.

What is claimed is:

1. In a roofed refrigerated railway car the combination of an ice bunker for water ice, hatch openings in the car roof through which the bunker may be charged with water ice, an ice grate in the lower portion of the bunker, and containers supported upon the ice grate beneath the hatch openings for removal therethrough and for the pressure storage of solid carbon dioxide, the top of said containers being spaced from the lower edges of the hatch openings in order to permit charging of the ice bunker with water ice through the hatch opening.

2. In a roofed refrigerated railway car the combination of a bunker holding water ice, a hatch opening in the car roof at either end of the bunker and through which the bunker may be charged with refrigerant, an ice grate in the lower portion of the bunker, a container supported upon the ice grate beneath each hatch opening, said containers being closed for the pressure storage of solid carbon dioxide, a pressure relief valve, and means connecting each container to the pressure relief valve whereby a predetermined equal pressure may be maintained in the containers.

3. In a roofed refrigerated railway car the combination of an ice bunker for the reception of water ice, a hatch opening in the car roof at either end of the bunker and through which the bunker may be charged with refrigerant, an ice grate in the lower portion of the bunker, a container supported upon the ice grate beneath each hatch opening, said containers being closed for the pressure storage of solid carbon dioxide, a pressure relief valve, and means connecting each container to the pressure relief valve whereby a predetermined equal pressure may be maintained in the containers, said pressure relief valve being connected to directional means for selectively discharging carbon dioxide gas either into or out of the car.

4. In a roofed refrigerated railway car the combination of an ice bunker for the reception of water ice, a hatch opening in the car roof at either end of the bunker and through which the bunker may be charged, a container supported within the bunker beneath each hatch opening, said containers being closed for the pressure storage of solid carbon dioxide, a pressure relief valve, means connecting each container to the pressure relief valve whereby a predetermined equal pressure may be maintained in the containers, a directional valve connected to the pressure relief valve and having two outlets, and

outlet means connecting one outlet to the car exterior and the other outlet to the car interior, said directional valve being operable from the hatch opening for preselection of the outlet means.

5. In a refrigerated railway car, a bunker holding water ice, a container arranged in said bunker and closed for pressure storage of solid carbon dioxide, and pressure relief means connected with the container and so formed as to be operative in response to predetermined pressure within the container to discharge carbon dioxide gas into the interior of the car.

6. In a refrigerated railway car, a bunker holding water ice, a container arranged in said bunker and closed for pressure storage of solid carbon dioxide, pressure relief means connected with the container and so formed as to be operative in response to predetermined pressure within the container to vent gas from the latter, and means connected with the pressure relief means so formed as to discharge carbon dioxide gas selectively into the interior of the car or outside the car.

7. In a refrigerated railway car, a bunker holding water ice, a solid carbon dioxide holding container arranged in the bunker, and means for venting carbon dioxide gas from the container into thermal contact with the water ice whereby to prolong the refrigerating effect of said water ice.

8. In a refrigerated railway car, a bunker holding water ice, a solid carbon dioxide holding container arranged in the bunker and in thermal contact with the water ice in the latter, and means including a pressure relief valve for venting carbon dioxide gas from the container into thermal contact with the water ice whereby to prolong the refrigerating effect of said water ice.

9. In a refrigerated railway car, a bunker holding water ice, a solid carbon dioxide holding container arranged in the bunker in thermal contact with the water ice, a pressure relief valve connected with the container for maintaining a predetermined pressure within the latter, and means for selectively directing gas from the said valve into thermal contact with the water ice to prolong the refrigerating effect of the water ice or for directing said gas out of the car.

10. In a refrigerated railway car, a bunker holding water ice in such a manner as to be in thermal contact with the air currents in the car, a solid carbon dioxide holding container arranged in the bunker in thermal contact with said water ice, and an adjustable pressure relief means connected with the container for maintaining a plurality of predetermined pressures within the latter.

11. In a refrigerated railway car, a bunker holding water ice, and means for prolonging the refrigerating effect of the water ice comprising solid carbon dioxide holding means arranged in the bunker in thermal contact with the water ice, said holding means being formed to provide an inner container in which the solid carbon dioxide is received and an outer container surrounding said inner container and receiving gas from the latter whereby to retard sublimation of said solid carbon dioxide and absorb heat units from the water ice.

12. In a refrigeration system, a closed container holding a low temperature refrigerant, a bunker in which said container is arranged, said bunker holding a relatively higher temperature refrigerant in thermal contact with said container, and pressure relief means connected to the container for maintaining a substantially predetermined superatmospheric pressure therein.

13. In a refrigeration system, a closed container holding a low temperature refrigerant, a bunker holding a relatively higher temperature refrigerant and in which said container is arranged in thermal contact with said higher temperature refrigerant, said higher temperature refrigerant being also in thermal contact with air currents, and pressure relief means connected to the container for maintaining a substantially constant pressure therein, said pressure relief means being adjustable whereby to control the rate of consumption of said low temperature refrigerant.

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