Nov. 5, 1935. G. VARNEY 2,019,551

REFRIGERATING SYSTEM

Filed June 16, 1931

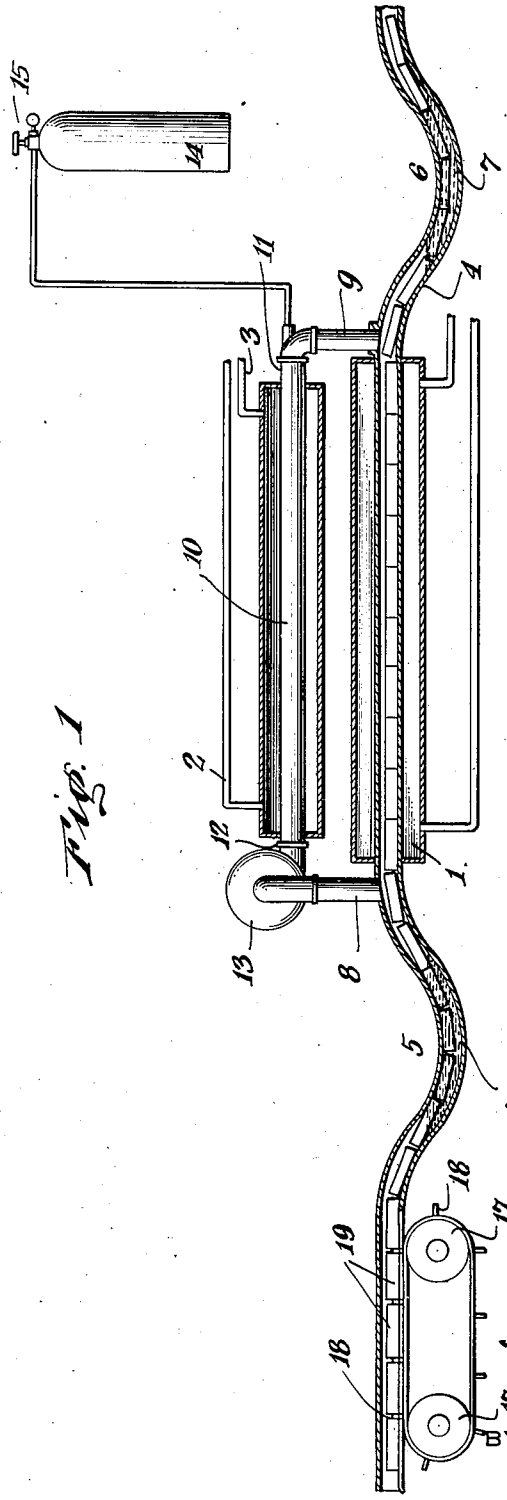

Fig. 1

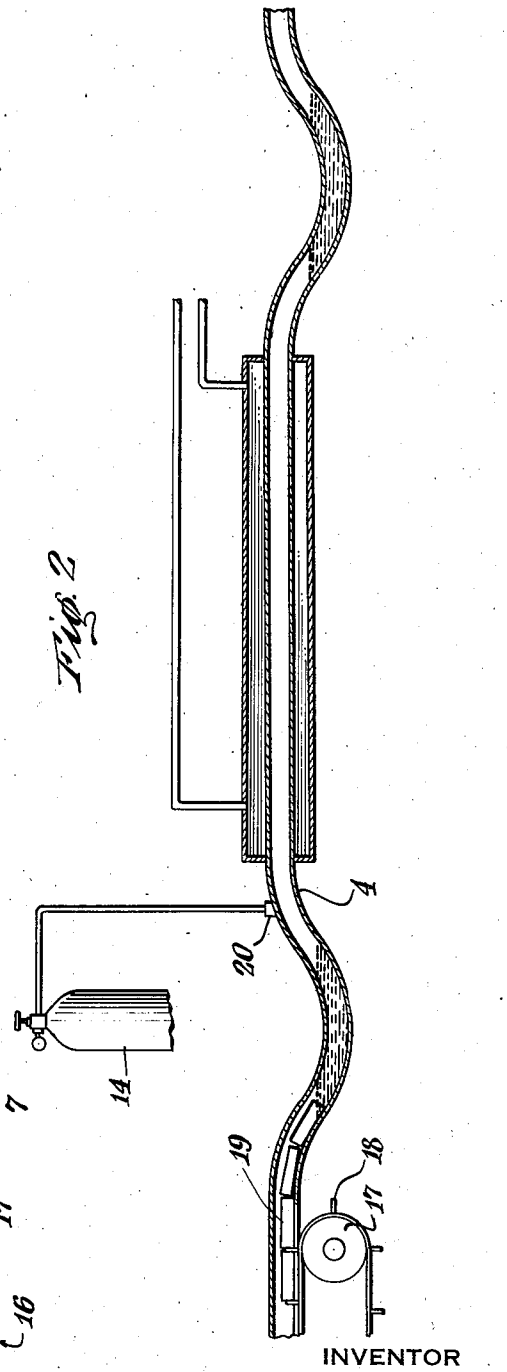

Fig. 2

INVENTOR

Gordon Varney

BY HIS ATTORNEY

Ernest E. Harmon

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REFRIGERATING SYSTEM

Gordon Varney, Bradenton, Fla.

Application June 16, 1931, Serial No. 544,802

7 Claims. (Cl. 62—114)

This invention relates in general to the art of refrigeration, and more particularly to that phase of refrigeration relating to chilling and freezing of perishable commodities, and is most specifically directed to that phase of refrigeration designed to produce such freezing with sufficient rapidity to prevent the breaking down of cellular structures or the segregation of the component parts of such commodities. This invention is an improvement in certain respects, and for certain results, over my co-pending application, Serial Number 542,503, on Refrigeration systems, filed June 7th, 1931.

I am aware that the problem of quick freezing is not a new one and that others have endeavored, in various ways, to accomplish the results desired. However, I have devised a method of and a means for providing for such a quick cooling which I believe to be novel and a distinct improvement over any method of which I am, at present, aware.

It is the prime object of my invention to provide a means for and a method of rapid chilling and/or freezing of perishable commodities, the rapidity of action of refrigeration being sufficient to prevent disintegration or deterioration of the commodity in consideration.

It is a further object of this invention to provide, in a refrigeration system, means for insuring a more intimate and efficient heat exchange between the refrigerant and the article to be refrigerated.

It is a further object of my invention to utilize in my refrigeration chamber, as a medium of heat exchange, a gas of relatively high heat conductivity.

A further object of my invention is to provide special means for refrigerating such a gas.

With the above in mind, it is a further object of my invention to provide a quick refrigeration system which can be economically operated with a minimum of apparatus and refrigerants and which will, by its very nature, insure rapid and sure refrigeration.

Further objects of this invention will be found in the accompanying specification and claims and will be disclosed in the accompanying drawing, in which:

Figure I is a central vertical section taken on the longitudinal axis of my device, the whole being shown largely diagrammatically.

Figure II is a view, similar to that of Figure I, of a modification of my device.

Referring now to the drawing, it will be seen that the apparatus which I have illustrated may be comprised, as follows:

At 1, I have disclosed a refrigeration chamber utilizing an ammonia expansion system of refrigeration, though my apparatus is in no wise limited to such refrigeration means as any other means of refrigeration may be used.

At 2 is shown, diagrammatically, an ammonia gas inlet 2 and outlet 3. Within the refrigeration chamber 1 there is a heat conduction tube 4 which will be so designed as to be of approximately the same configuration and cross-sectional area as that of the articles to be refrigerated. This tube 4 extends throughout the length of the chamber 1 and has two depressed portions 5 and 6 which are filled with a liquid 7, such as mercury, brine, prestone, or the like, which acts as a gas seal to the tube 4. Immediately adjacent the ends of the chamber 1 the tube 4 is provided with an outlet tube 8 and an inlet tube 9 to permit of passage of a refrigerating gas from the tube 4 to and through a gas refrigerating chamber 10. The chamber 10 is provided with inlet and outlet 11 and 12 to a suitable refrigerating system and a blower 13 is provided to insure circulation through the tube 10. The outlet tube 9 is tapped to permit of induction from a pressure cylinder 14 containing the gas of relatively high heat conductivity to be utilized, the gas preferably being inert, the inlet from said cylinder being controlled by a regulatable pressure valve 15.

At 16, as a schematic means for providing progressive refrigeration of a plurality of articles, I have shown a pair of wheels 17 provided with pawls 18 for insuring the successive progress of a plurality of articles 19 through the chamber 4.

In Figure 2, I have shown a variation of my device in which the heat conductive gas is not separately cooled but the cylinder 14 is tapped directly into the tube 4 at 20, a point above the liquid seal.

Having described my apparatus, it will be seen that the same operates, as follows:

The articles 19 to be refrigerated are successively passed through the refrigerating tube 4 by means of the wheels 17 and the pawls 18. The size and shape of the tube 4 is designed so as to approximate closely the size and shape of the packages to be refrigerated and thus to provide for an initial relatively close thermal contact. To further aid the heat transfer I have provided means for introducing a gas of relatively high heat conductivity to completely fill the space between the inner walls of the refrigerating chamber 4 and the articles to be refrigerated.

Any inactive gas having high heat conductivity may be utilized. However, I have considered using helium or hydrogen as being inactive and at the same time highly heat conductive. The liquid seals prevent the heat conductive gases from escaping to or having contact with the atmosphere and the apparatus shown in Figure I shows an additional refrigeration means for separately cooling this gas. Marked advantages of the use of such an inactive gas as I have suggested are their high heat conductivity, the prevention of oxidization, and especially the prevention of frosting with the heat insulation incident thereto.

In referring to hydrogen as a medium of heat exchange I am well aware of the fact that it is an active gas under ordinary conditions. However, I have found hydrogen to be inactive under the refrigerating conditions imposed upon it in the manner above described and I therefore make reference to it as an inactive gas. Furthermore, in my alternate reference to helium and hydrogen as a medium of heat exchange I do not wish to limit my invention to use of either but to any gas which may have the properties of high heat conductivity or of inactivity under refrigerating conditions.

Having thus described my invention, I claim:

1. As a refrigeration apparatus, a refrigerating chamber, a heat conduction tube extending through said chamber, said tube having a cross-sectional area and a configuration approximating that of the article to be refrigerated to provide for intimate heat exchange between its walls and the said article, and a refrigerated gas of relatively high heat conductivity filling the space between said walls and said article, means for refrigerating said tube, and separate means for refrigerating said gas.

2. As a refrigeration apparatus, a refrigerating chamber, a heat conduction tube extending through said chamber, said tube having a cross-sectional area and a configuration approximating that of the article to be refrigerated to provide for intimate heat exchange between its walls and the said article, and a refrigerated gas of relatively high heat conductivity filling the space between said walls and said article, means for refrigerating said tube, separate means for refrigerating said gas, and means for enclosing said gas in a gas-tight seal.

3. As a refrigeration apparatus, a refrigerating chamber, a heat conduction tube extending through said chamber, said tube having a cross sectional area and a configuration approximating that of the article to be refrigerated to provide for intimate heat exchange between its walls and the said article, and a refrigerated inert gas of high heat conductivity filling the void between the walls and said article, means for refrigerating said tube, and separate means for refrigerating said gas.

4. As a refrigeration apparatus, a refrigerating chamber, a heat conduction tube extending through said chamber, said tube having a cross sectional area and a configuration approximating that of the article to be refrigerated to provide for intimate heat exchange between its walls and the said article, and a refrigerated inert gas of high heat conductivity filling the void between the walls and said article, means for refrigerating said tube, and separate means for refrigerating said gas, and means for enclosing said gas in a gas tight seal.

5. As a refrigeration apparatus, a refrigeration chamber, a heat conduction tube extending through said chamber and refrigerated on all sides throughout that portion of its length included within said chamber, and a gas of high heat conductivity filling the space between inner walls of said tube and the articles to be refrigerated, and a means separate from said refrigerating chamber for refrigerating said gas.

6. As a refrigeration apparatus, a refrigerating chamber, a heat conduction tube extending through said chamber, said tube having a cross-sectional area and a configuration approximating that of the article to be refrigerated to provide for intimate heat exchange between its walls and the said article, and a refrigerated gas of relatively high heat conductivity filling the space between said walls and said article, means for refrigerating said tube, and means for refrigerating said gas.

7. As a refrigeration apparatus, a refrigerating chamber, a heat conduction tube extending through said chamber, said tube having a cross-sectional area and a configuration approximating that of the article to be refrigerated to provide for intimate heat exchange between its walls and the said article, and a refrigerated gas of relatively high heat conductivity filling the space between said walls and said article, means for refrigerating said tube, means for refrigerating said gas, and means for enclosing said gas in a gas-tight seal.

GORDON VARNEY.