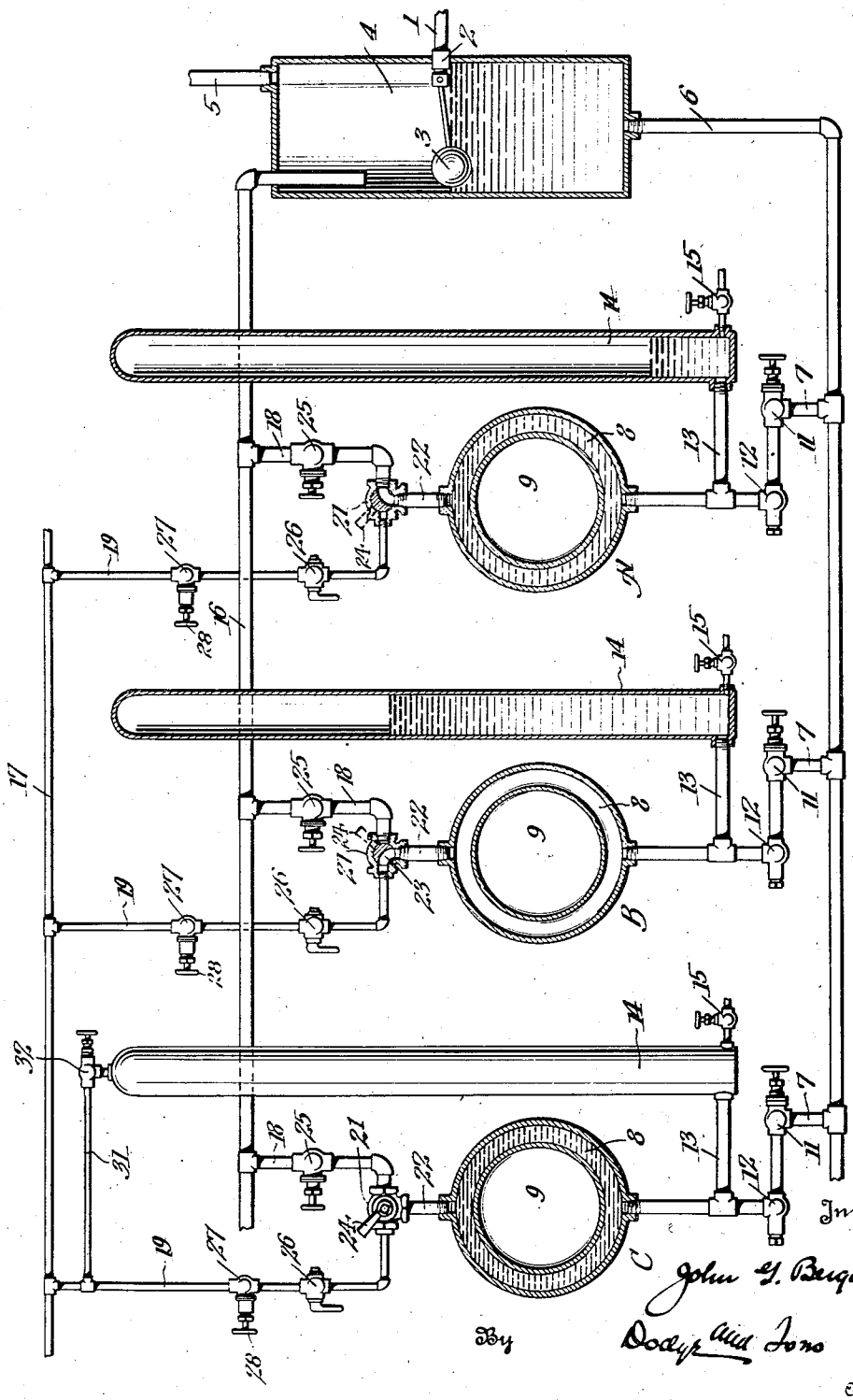
Nov. 12, 1929. J. G. BERGDOLL 1,735,724

REFRIGERATION

Filed Feb. 7, 1928



Patented Nov. 12, 1929 1,735,724

UNITED STATES PATENT OFFICE

JOHN G. BERGDOLL, OF YORK, PENNSYLVANIA, ASSIGNOR TO YORK ICE MACHINERY CORPORATION, OF YORK, PENNSYLVANIA, A CORPORATION OF DELAWARE

REFRIGERATION

Application filed February 7, 1928. Serial No. 252,493.

This invention relates to refrigeration and particularly to means for almost instantly arresting, and as quickly resuming at will the refrigerative action of a direct expansion refrigerator. Certain features of the invention are applicable to indirect (brine circulation) systems to accomplish a similar result.

In the manufacture of ice cream it is important to arrest active refrigeration at the time the so-called "swell" commences, and under commercial conditions the refrigerative action is so intense that this arrest must be virtually instantaneous.

Prior to my invention it has been proposed to effect this result by displacing the liquid refrigerant from the jackets of ice cream freezers by admitting gas under pressure to the top of the jacket. This scheme is particularly useful with direct expansion systems but has been successfully used in slightly modified form with indirect systems.

In the prior art as applied to direct expansion hot gas is taken from the high pressure gas line between the compressor and condenser and is admitted in the evaporator through an adjustably loaded reducing valve at a pressure higher than suction pressure, and so chosen as to correspond to the desired freezer temperature. At the same time the suction connection to the evaporator is closed. The effect is to displace liquid refrigerant from the evaporator, the refrigerant flowing back through the supply line to a reservoir, such as a receiver suction trap. An automatic valve closes to prevent back flow of gaseous refrigerant when the liquid refrigerant has been displaced.

The prior arrangement though entirely operative involved two characteristics subject to improvement: the discharge and return flow was not as rapid as was desired unless unduly large piping be used, and the displacement of liquid into the receiver suction trap raised the liquid level therein and in other freezers unduly, should several freezers be shut down simultaneously.

The present invention offers improvement in these respects and simplifies the structure, by providing adjacent each freezer a local reservoir into which its refrigerant may be rapidly displaced without disturbing effect on other freezers connected to the same line. This greatly accelerates the displacement and also the subsequent return of the refrigerant and does away with the need for any automatic valve closing against gas flow.

Preferred embodiments of the invention are illustrated in the accompanying drawing which is largely diagrammatic and which shows three freezers in vertical transverse section and other parts in vertical axial section with connecting piping and valves chiefly in elevation.

A liquid refrigerant feed line 1 leads from any suitable source of volatile liquid refrigerant such as a high pressure receiver (not shown). This line discharges through a valve 2 controlled by a float 3 into a receiver suction trap 4 in which a constant level of liquid refrigerant is maintained by the action of the float and valve. 5 is a suction line to the compressor. The parts just described are illustrated as one known arrangement for maintaining the desired approximately constant level of liquid refrigerant in the freezers to be described. Any equivalent might be substituted.

Leading from the bottom of trap 4 is the liquid refrigerant supply manifold 6 from which lead branch pipes 7 to the jackets 8 of three identical ice cream freezers differentiated by the letters A, B and C. Any number might be similarly connected. The central cylindrical space 9 of each freezer receives the mixture to be frozen and in practice would contain the usual dasher (not shown). The freezers conform to established practice in their structural details and parts not concerned with the present invention have been omitted from the drawing.

In each branch 7 is a stop valve 11, and a check valve 12 permitting flow toward the jacket 8 and resisting reverse flow. Leading from each branch 7 between its check valve 12 and jacket 8 is a branch pipe 13 which communicates with the lower end of a corresponding closed chamber 14 each of greater volume than the related jacket 8. Each chamber 14 has an oil drain connection controlled by a normally closed valve 15.

Connected with the top of trap 4 is a suction manifold 16. A hot gas manifold 17 leads from the high pressure gas line (not shown) say from a point between the compressor and condenser (not shown). Any suitable source of refrigerant under pressure materially higher than suction pressure might be used.

The manifold 16 communicates by branches 18, and the manifold 17 by branches 19, with two ports of three-way valves 21, each of which has a connection 22 with the jacket 8 of a corresponding freezer. The valves 21 are conventionally shown as having a ported plug 23 and handle 24, but any known arrangement which would connect branches 18 and 19 to connection 22, alternately with each other, might be substituted.

Branch 18 is controlled by a normally open stop valve 25 and branch 19 by a normally open stop cock 26. In the branch 19 there is also an adjustable pressure reducing valve 27. Any suitable valve for reducing the pressure of refrigerant passing the valve might be used. A simple spring-loaded valve is illustrated, the spring loading being adjustable by turning handle 28.

A minor modification is illustrated as to freezer "C" consisting of a branch 31 leading from branch 19 to the top of chamber 14 and controlled by a needle valve 32 which is normally "cracked," i. e., slightly open to bleed high pressure refrigerant with pressure reduction into the top of chamber 14. In a commercial installation all the chambers 14 ordinarily would be connected alike, i. e., they would all have or all omit the branch 31 and valve 32.

In operation valves 15 are closed, valves 11, 25 and 26 are open and valves 27 are set to establish on their outlet sides a pressure corresponding to the temperature it is desired to maintain in the freezers during the "swell" period. During freezing handle 24 is thrown to the left (as shown on freezers A and C). This connects the freezers (the active ones in parallel with each other) in the expansion portion of the refrigerant circuit. Liquid refrigerant fills the jacket 8 to the level established in trap 4 and boiling off through the suction connections 22, 18, 16, 5 produces the desired heat abstraction.

When the "swell" commences and it is therefore necessary to terminate heat abstraction and maintain the "swell" temperature, handle 24 is shifted to its right hand position, as shown on freezer B. This interrupts the suction connection and admits refrigerant in the gaseous state and under higher pressure than suction pressure to the jacket 8. The result is to force liquid refrigerant from jacket 8 back through branch 13 to chamber 14, check valve 12 closing to prevent back-flow to manifold 6. The adjustment of valve 27 assures the maintenance of a suitable pressure and hence a suitable temperature at such times.

To resume heat abstraction (usually with a new batch of cream) the handle 24 is shifted to the left. The pressure in 14 above the liquid refrigerant forces this back into the jacket against the suction pressure, almost instantly, and much more rapidly than flow would occur by gravity flow from trap 4 as in the prior art.

If connection 31 and valve 32 be used its function is merely to maintain a slightly elevated pressure in the top of chamber 14. This is not essential. The leakage of heat to drum 14 and the resulting evaporation of a small amount of liquid refrigerant therein is sufficient to prevent the accumulation of liquid refrigerant in drum 14 during the active refrigerating periods and to generate the necessary expelling pressure.

As has been suggested the invention may be applied in somewhat modified form to indirect systems, i. e., to brine circulation systems. In such case the parts 1 to 5 inclusive would be omitted. Manifold 6 would become the cold brine supply manifold from a brine cooler, manifold 16 would become the brine return manifold leading back to the brine cooler. Manifold 17 would become a compressed gas (usually air) line. Valve 27 would not be needed. In such an arrangement shifting of valve handle 24 would control the displacement of brine from the cooler by compressed air fed from manifold 17, and its return under pressure of air trapped in chamber 14 above the brine. The connection 31 and valve 32 could be used, but in such case the valve 32 would ordinarily be closed and would be opened to accelerate reflux to the freezer jacket.

The drawing is illustrative only and various modifications are obviously possible. For example, the flow precluding function of the check valve 12 is not indispensable. There should be, for best results, such resistance to back flow as will create a bias in favor of flow to the chamber 14, but experience has shown that moderate leakage at a check valve 12 does not defeat operation.

What is claimed is:—

1. The combination of a cooler; a connection for supplying a cooling liquid thereto; a discharge connection leading therefrom; a connection for supplying a liquid displacing gas to said cooler; means for opening either the discharge connection or the displacing gas connection, while maintaining the other closed; a chamber having means for yieldingly resisting the entrance of liquid; means for resisting back flow through said supply connection; and a connection from the lower portion of the cooler to said chamber.

2. The combination of a cooler; a connection for supplying a cooling liquid thereto; a discharge connection leading therefrom; a

connection for supplying a liquid displacing gas to said cooler; means for opening either the discharge connection or the displacing gas connection, while maintaining the other closed; a chamber in which a compressible medium is trapped; a connection from the lower portion of the cooler to said chamber; and means for resisting back flow through said supply connection.

3. The combination of an evaporator cooler; a connection for supplying volatile liquid refrigerant thereto; a suction connection leading therefrom; a connection for supplying gaseous refrigerant thereto at a pressure higher than suction pressure; means for opening either the suction connection or the high pressure gas connection while maintaining the other closed; a chamber containing trapped gaseous refrigerant; a connection from the lower portion of the evaporator to said chamber; and means for resisting back flow through said supply connection.

4. The combination of an evaporator cooler; a connection for supplying volatile liquid refrigerant thereto; a suction connection leading therefrom; a connection for supplying gaseous refrigerant thereto at a pressure higher than suction pressure; means for opening either the suction connection or the high pressure gas connection while maintaining the other closed; a chamber containing trapped gaseous refrigerant; a connection from the lower portion of the evaporator to said chamber; and a check valve in the supply connection.

5. The combination of an evaporator cooler; a connection for supplying volatile liquid refrigerant thereto; a suction connection leading therefrom; a connection for supplying gaseous refrigerant thereto at a pressure higher than suction pressure; means for opening either the suction connection or the high pressure gas connection, while maintaining the other closed; a closed chamber adjacent said cooler; a bleed connection from said high pressure gaseous refrigerant connection to said chamber; a connection from the lower portion of the evaporator to the lower portion of said chamber; and means for resisting back flow through said supply connection.

In testimony whereof I have signed my name to this specification.

JOHN G. BERGDOLL.