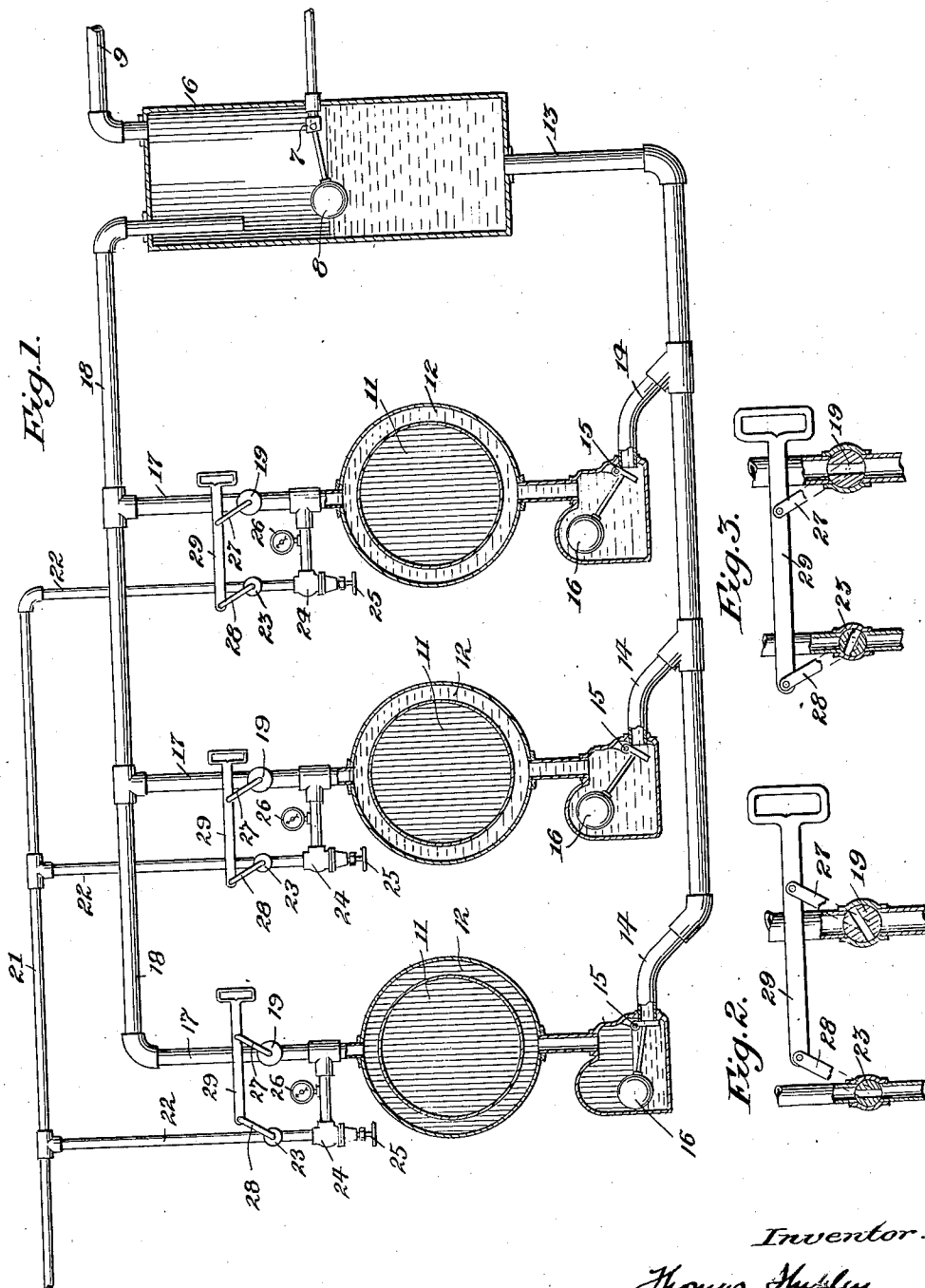


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REFRIGERATION
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UNITED STATES PATENT OFFICE

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REFRIGERATION

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This invention relates to refrigeration, and particularly to means for suspending immediately the refrigerative action of a cooler in which a liquid refrigerant is used by admitting to the cooler gas under pressure in such a way as to displace the refrigerant from the cooler.

In its broad aspects the invention is applicable to any cooler using a liquid cooling medium, but derives peculiar utility as applied to evaporators to which volatile liquid refrigerant is fed. In such a case, if refrigerant gas under a definite pressure be used as the displacing medium, it is possible so to operate the device as to establish and maintain a desired temperature in the evaporator immediately upon the expulsion of the liquid refrigerant.

The use of high pressure gaseous refrigerant to expel liquid refrigerant from the evaporator and thereafter perform a thawing and defrosting function is not new. In such prior device the idea was to condense in the evaporator gaseous refrigerant, the latent heat of vaporization thus made available furnishing the latent heat of fusion necessary for the thawing or defrosting operation. The maintenance of a definite temperature was neither sought nor secured.

The present invention contemplates immediately establishing and maintaining a definite pressure and consequently a definite temperature, usually the temperature existing at the moment of unloading so that the transfer of heat to or from the cooler does not occur during the unloading period. Condensation of gaseous refrigerant in the evaporator is therefore not desired and does not occur in any substantial degree.

A particularly useful application of the inventive concept is to the freezing of ice cream, where after a batch has been cooled to the temperature at which the well known "swell" of the batch commences, the chilling function is suspended to permit the swell to occur under the effect of whipping or beating action of the dasher at a maintained optimum temperature.

The invention will now be described as applied to an ice cream freezing plant having

flooded evaporators, but, as stated, this specific disclosure is intended to be merely illustrative of the preferred embodiment of the invention.

In the drawing,—

Fig. 1 is a diagrammatic view, largely in vertical section, showing the connections for three freezers.

Fig. 2 is a section showing the valves in unloaded position.

Fig. 3 is a similar view showing the valves in freezing position.

In the drawing, 6 is a combined low pressure receiver and suction trap, fed from a high pressure receiver (not shown) through a level maintaining valve 7 controlled by float 8 in receiver 6. The suction connection 9 leads from the top of receiver 6 to the suction of the compressor (not shown). The arrangement so far described is familiar in the art.

Three ice cream freezers are indicated, 11 being the space in which the ice cream is frozen, and the jacket 12 being a flooded evaporator serving to abstract heat from the space 11. A feed pipe 13 leads from the bottom of receiver 6 and has branches 14, one leading to the jacket 12 of each freezer. In each branch 14 is interposed a check valve 15 which opens toward the evaporator 12 and which is normally held open by a float 16.

The float 8 functions to stop flow to receiver 6 at such a level that evaporators 12 are substantially filled. At such times valves 15 are open ready to permit back flow from the corresponding evaporator 12 through branch 14 to pipe 13. When any evaporator has been drained the float 16 of the corresponding valve 15 falls and valve 15 closes tightly against further back flow.

Leading from the tops of the evaporators 12 are corresponding suction branches 17 all connected to suction line 18 which enters receiver 6 from the top. The receiver 6 thus serves as a separator or trap for arresting liquid refrigerant and preventing it from entering suction line 9. Each branch 17 is controlled by a valve 19 shown as a cock, but permissibly of any preferred construction.

A hot gas bleeder 21 leads from the high

pressure gas line between the compressor and condenser (not shown) and has branches 22, each connected to a corresponding evaporator 12 preferably by being connected with branch 17 below valve 19. In each branch 22 there is a stop valve 23 (shown as a cock) and an adjustably loaded back pressure valve 24 of any preferred construction. Such a valve is ordinarily urged open by entering pressure, to which is opposed a spring and some means for adjusting the stress in the spring. The hand wheel 25 represents such an adjustable stressing means. Such a valve is indicated merely as typical of any simple adjustable pressure reducing valve, and no novelty is claimed for the structure of the valve per se.

Gages 26 are connected to show the pressures in corresponding evaporators.

The actuating handles 27 and 28 of valves 19 and 23 are connected by an actuating bar 29 in such manner that the valves are opened in alternation with each other in the two opposite positions (see Figs. 2 and 3).

After the chamber 11 is charged with a batch to be frozen the member 29 is moved to the position of Fig. 3 if not already there. This opens the suction connection after closing the hot gas connection and evaporator 12 then fills with liquid refrigerant which vaporizes, abstracting heat from the cream in chamber 11. (See middle and right hand freezers of Fig. 1).

When the swell commences, member 29 is moved to the right to the position of Fig. 2, closing the suction connection and opening the hot gas connection. Wheel 25 is then so adjusted (unless already so adjusted) as to limit the rise of pressure in evaporator 12, with a consequent establishment of a chosen temperature in the evaporator. With the parts in this condition, the cream in chamber 11 is beaten by the dasher (not shown).

Various changes may obviously be made in the construction and arrangement of the parts, and no necessary limitation to the construction shown is implied.

For example, while the feature of establishing a chosen temperature during the unloaded operation is dependent on the use of an evaporative cooler, the useful effect dependent on the expulsion of the liquid medium from the evaporator may be secured with coolers using other liquid cooling media. Certain claims of the present application are drawn to this broad idea, and are not limited to evaporative coolers.

What is claimed is:—

1. The method of unloading a cooler having an inlet connection and an outlet connection for the circulation of a refrigerating medium through the cooler, which consists in arresting the circulation and admitting gas under pressure to expel the liquid medium from the cooler.

2. The method of unloading a cooler having

an inlet connection and an outlet connection for the circulation of a refrigerating medium, which consists in closing one of said connections, admitting gas under pressure to said cooler to expel said medium through the other of said connections and automatically closing said other connection upon the substantial depletion of the liquid medium in the cooler.

3. The method of unloading a flooded evaporator having a gas suction connection and a liquid connection, which consists in closing the suction connection, admitting hot gas to displace liquid through the liquid connection, and closing the liquid connection in response to substantial depletion of liquid in the evaporator.

4. The method of unloading a flooded evaporator having a suction connection and a liquid connection, which consists in closing the suction connection, admitting hot gas to displace liquid through the liquid connection, controlling the admission of such hot gas to establish within the evaporator a pressure corresponding to the desired temperature in the evaporator during the unloading period, and terminating the outflow of liquid refrigerant in response to the substantial depletion of liquid refrigerant in the evaporator.

5. The combination of a cooler having a supply connection for heat absorbing liquid, a discharge connection and a connection for gas under pressure; a valve adapted to close against outflow through said supply connection; automatic means responsive to liquid level arranged to hold said valve open when liquid is present in said cooler; and valve means controlling said discharge and pressure gas connections.

6. The combination of a flooded evaporator having a liquid refrigerant supply connection, a suction connection and a high pressure gas connection; a valve adapted to close against outflow through said supply connection; automatic means responsive to liquid level arranged to hold said valve open when liquid is present in said evaporator; and valve means controlling said suction and high pressure gas connections.

7. The combination of a flooded evaporator having a liquid refrigerant supply connection, a suction connection and a high pressure gas connection; a valve adapted to close against outflow through said supply connection; a float arranged to hold said valve open when liquid is present in said evaporator; valve means controlling said suction and high pressure gas connections; and manually operable means for opening either of the last-named connections while maintaining the other closed.

8. The combination of a flooded evaporator having a suction connection and a high pressure gas connection; means operable to open either connection while maintaining the other

closed; valve-controlled means for discharging liquid refrigerant from the evaporator when displaced by high pressure gas; and means responsive to the depletion of liquid serving to close the last-named valve against outflow of gas.

9. The combination of a flooded evaporator having a suction connection and a high pressure gas connection; means operable to open either connection while maintaining the other closed; valve-controlled means for discharging liquid refrigerant from the evaporator when displaced by high pressure gas; and a float responsive to the presence of liquid within the evaporator and connected to said valve-controlled means to open the latter for the passage of liquid and close it against the passage of gas.

10. The combination of a flooded evaporator having a high pressure gas connection for expelling liquid refrigerant from the evaporator; and a pressure responsive valve controlling the flow of gas through said connection and serving to limit the pressure thereby established in the evaporator.

11. The combination of a flooded evaporator having a high pressure gas connection for expelling liquid refrigerant from the evaporator; a pressure responsive valve controlling the flow of gas through said connection and serving to limit the pressure thereby established in the evaporator; and manually operable means for adjusting said valve to vary its pressure limiting function.

12. The combination of a flooded evaporator having a high pressure gas connection for expelling liquid refrigerant from the evaporator; a pressure responsive valve controlling the flow of gas through said connection and serving to limit the pressure thereby established in the evaporator; and valve means in the path of the outflow of liquid from the evaporator responsive to the depletion of liquid arranged to close against the outflow of gas.

13. The combination of a flooded evaporator having a high pressure gas connection for expelling liquid refrigerant from the evaporator; a pressure responsive valve controlling the flow of gas through said connection and serving to limit the pressure thereby established in the evaporator; manually operable means for adjusting said valve to vary its pressure limiting function; and valve means in the path of the outflow of liquid from the evaporator responsive to depletion of liquid and arranged to close against the outflow of gas.

14. The combination of a flooded evaporator having a suction connection, a high pressure gas connection and a liquid refrigerant supply connection; means operable to open either the suction connection or the high pressure gas connection while maintaining the other closed; and means serving

to permit the discharge of liquid refrigerant from the evaporator when subjected to the pressure of high pressure gas, and to prevent the passage of high pressure gas through the liquid refrigerant supply connection.

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

THOMAS SHIPLEY.

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