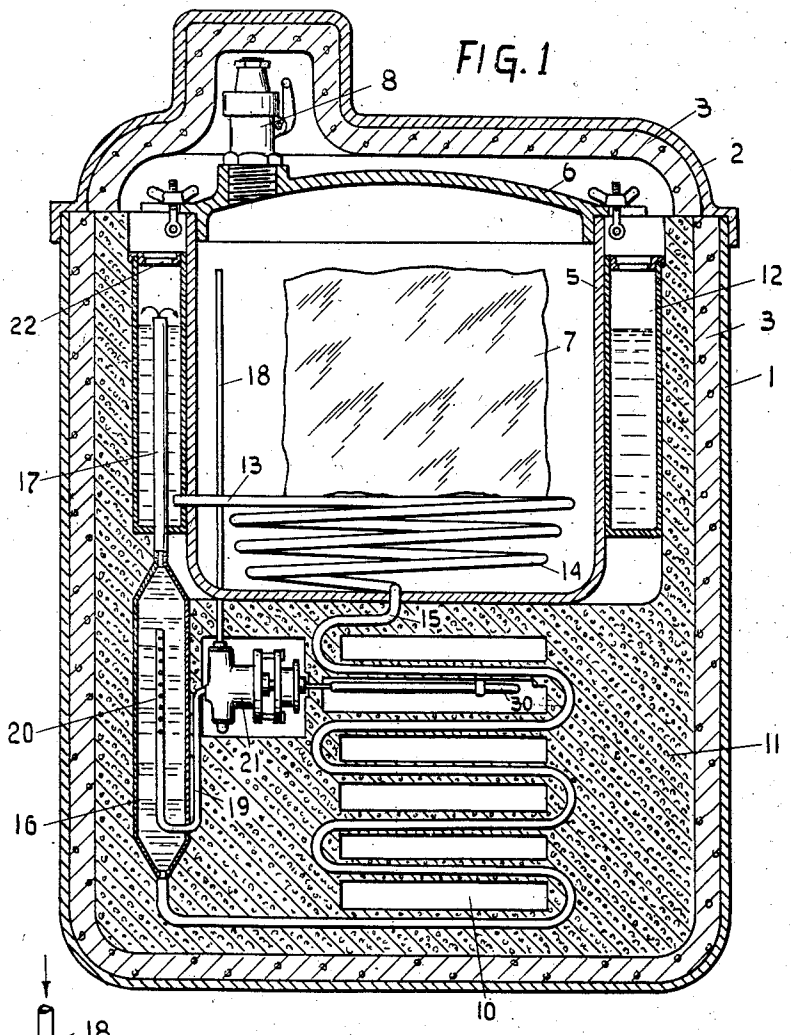
Nov. 15, 1932. L. G. COPEMAN 1,887,580

METHOD AND APPARATUS FOR REFRIGERATION

Filed April 1, 1931

FIG. 1



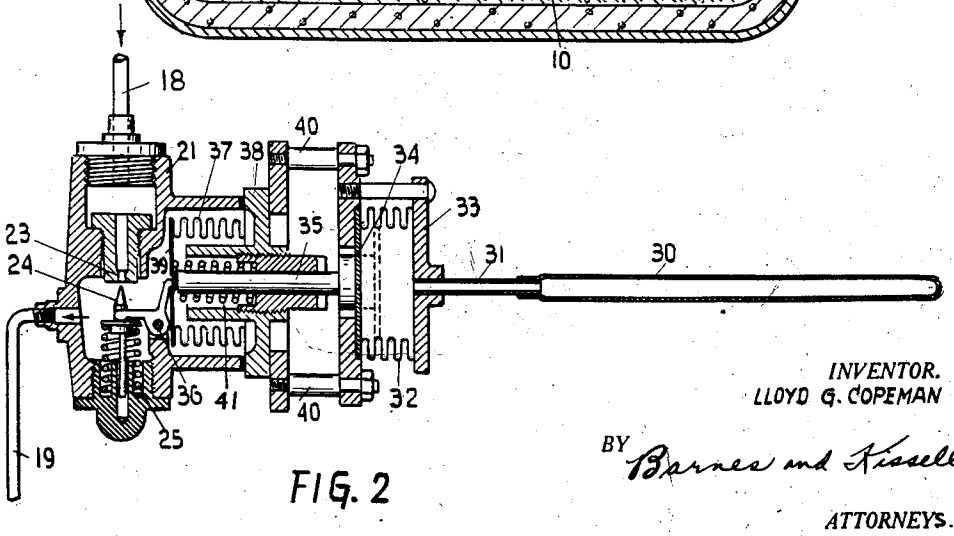


FIG. 2

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UNITED STATES PATENT OFFICE

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METHOD AND APPARATUS FOR REFRIGERATION

Application filed April 1, 1931. Serial No. 526,848.

This invention relates to the art of refrigerating by a substance which evaporates from the solid state to the gaseous state. The invention resides particularly in an arrangement wherein a suitable liquid such as brine or the like is moved in a cyclic path for cooling or refrigerating regions positioned remotely from the cold producing substance and in which movement of the brine in its circulation is effected by the gas power produced by evaporation of the refrigerating substance.

More particularly, the invention is concerned with controlling the refrigeration of some or all of the remote regions by regulating the movement of the brine in its path. In accordance with this object, regulation may advantageously be accomplished by varying the supply of gas which is effective for moving the brine in its path. One way of doing this is exemplified herein as comprising a valve arrangement for controlling the supply of gas for moving the brine in which the valve is governed by the temperature in said remote region or regions. For this purpose a thermostat control may be provided.

In the accompanying drawing:

Fig. 1 is a sectional view taken through a refrigerating device and exemplifying the invention.

Fig. 2 is an enlarged detail in section showing one type of valve and thermostat arrangement which may be employed.

The device shown herein incorporates the general principle of that shown in my copending application #496,845, filed Nov. 20, 1930.

This device as shown comprises an outer casing 1 with a removable cover 2 each insulated as at 3. Within this outer shell there is a receptacle or container 5 with a removable cover 6 adapted to be tightly placed onto the receptacle for containing a block of ice, or in other words, a block of the solid refrigerating substance 7. The substance 6 may be solid CO_2 or other substance which changes directly into gaseous form. A relief valve 8 is provided for exhaust of some of the gases.

Remote regions to be refrigerated are exemplified by compartments or containers 10 which may be incorporated directly in a body of plastically applied stone or the like 11. A suitable brine or liquid which does not freeze under the required temperature is provided and preferably confined in a pipe and the container system. The word brine is used in a broad sense indicating any suitable liquid or refrigerant for the purpose.

Brine may be contained in part in a container or receptacle 12 which may surround the container 5, and connecting into the chamber 12 is a pipe 13 which may have a coil formation 14 within the chamber 5 and then which extends to the remote regions, as at 15. The pipe 15 may be suitably coiled or otherwise shaped to adequately refrigerate the remote regions. The pipe 15 may terminate in a cylinder or the like 16 which is connected by a pipe 17 back into the receptacle 12. Some of the gases in the chamber 5 are utilized for moving the brine in this cyclic path, and for this purpose there may be a tube 18 having its open end disposed in the receptacle 5 and leading into a valve housing 21; out of the valve housing leads another tube 19 which extends into the cylinder 16 and is provided with gas outlet apertures of which there may be a plurality, as shown at 20. It is not necessary herein to recite in detail how the brine is moved as this is amply covered by the above mentioned application; suffice to say that the gas passing through tube 18, tube 19 and discharging into the cylinder through apertures 20 rises through conduit 17 thus causing a brine movement up through the pipe 17 which is discharged from the end of the pipe 17 into the container 12. This results in the movement of the brine through the path provided therefor by the several pipes and containers. The gases may escape through the top of the chamber 12 as by means of one or more apertures 22.

A suitable valve mechanism is provided in the housing 21 for controlling the brine movement, and the valve in turn is advantageously governed by the temperature of the remote regions. Any suitable valve arrange-

ment may be employed and one is shown in Fig. 2. As shown in this figure pipes 18 and 19 connect into the housing 21, and between the connections of pipes 18 and 19 there is a valve arrangement comprising a port 23 and a valve member which may be a needle valve 24. The valve 24 may be backed up by a coil spring or the like 25 which normally tends to urge the valve into the port to close the same. This valve, however, is designed to be opened and closed in accordance with temperature requirements in the remotely refrigerated zone.

For this purpose there may be provided a gas chamber in the form of a feeler or leg 30 which, as shown in Fig. 1, may be positioned in a refrigerated region. This feeler may be positioned wherever desired in such region in order that the temperature of that particular region may be controlled. A tube 31 may connect the feeler into a chamber formed by an expansible and contractable metallic bellows, as at 32, held fixed at one end by a fixture or plate 33 and having a movable diaphragm 34 at the other. Contacting with the diaphragm 34, or secured thereto as may best seem fitting, is a reciprocating element such as rod 35 which acts upon a bell crank 36. This rod 35 extends into the housing 21 and to seal the same a metallic bellows 37 may be provided one end of which may be clamped between the housing and the housing head 38, and the other end provided with a diaphragm 39 positioned between the rod 35 and bell crank 36. A light spring 41 may be employed for exerting an expanding tendency upon the bellows 37. This valve and control unit may be incorporated into a unit structure, as by means of securing the housing 21 and bellows 32 and its associated parts together by means of studs 40.

When the gas confined in feeler 30 and bellows 32 becomes warmed the same expands thus moving the diaphragm 34 from right to left, as Fig. 2 is viewed, pushing the rod 35 in a similar direction, which in turn rocks bell crank 36 and withdraws the valve 24 out of port 23 against the action of spring 25. As shown in Fig. 2 the parts are in valve-opened position with the diaphragm 34 moved to its limit of movement. When the gases in the feeler 30 and bellows 32 cool and contract, spring 25 pushes the valve 24 back into the port 23 to close the same; spring 25 is stronger than spring 41 and accordingly causes a slight collapse of bellows 37 and compression spring 41 and likewise moves the rod 35 from left to right. The diaphragm 34 may take the position as illustrated by the dotted lines of Fig. 2.

In the operation of a refrigerating mechanism of this type first assume that the remote regions to be refrigerated are warmed and are calling for refrigerating action. The gases in the feeler and bellows 32 expand to open the valve 24 whereupon gases enter the cylinder 16 and effect movement of the brine. With this action brine flows from chamber 12 through conduit 13, coil 14 and into pipe 15 thus transferring cold brine in the coils around the regions to be refrigerated exemplified by compartments 10. It will be understood that the brine in chamber 12 and coil 14 are cooled by reason of their close proximity to the solid refrigerating substance 7. When the refrigerated regions are sufficiently cool the gases in the feeler 30 and bellows 32 contract and the valve closes, as above described, thus cutting off the circulation of the brine. Accordingly, it will be noted that the temperature of the remotely positioned refrigerated regions are controlled through the medium of the thermostatic valve which governs the movement of the cold brine. The thermostat and valve may be adjusted as desired to open and close at desired and predetermined temperature ranges in the refrigerated regions.

Some of the gases in chamber 5 may escape through valve 8 and some are used for circulating the brine. In many cases only a relatively small part of the gases are necessary for brine circulation. In some of the claims appended hereto the term "solid CO_2" is used; this is used in a descriptive sense to make the claims definite without being alternative, and it is to be understood that the term "CO_2" is not used in the limiting sense. In other words, where this term is used in the claims it is clearly the intention that such claims cover equivalents of solid CO_2.

I claim:

1. A refrigerating system comprising, a container for solid CO_2, means providing a cyclic path for refrigerant, means utilizing gas power derived from the evaporating CO_2 for circulating the refrigerant in its path, and thermostatically controlled means for governing the flow of refrigerant in its path.

2. A refrigerating system comprising, a container for a block of substance in solid form which changes directly into gaseous form upon evaporation, means providing a cyclic path for refrigerant, means utilizing gas power derived from the evaporating substance for circulating the refrigerant in its path, and thermostatically controlled means for governing the flow of refrigerant in its path.

3. A refrigerating system comprising, a container for solid CO_2, means providing a cyclic path for refrigerant, means utilizing gas power derived from evaporating CO_2 for circulating the refrigerant in its path, and thermostatically controlled means for governing the amount of gas effective upon the circulating means.

4. A refrigerating system comprising, a container for solid CO_2, means providing a cyclic path for refrigerant, means for inject-

ing some of the gas derived from the evaporation of the solid CO_2 into the refrigerant for circulating the refrigerant in its path, and thermostatically controlled means for governing the injection of gas into the refrigerant.

5. A refrigerating system comprising, a container for solid CO_2, means providing a cyclic path for a refrigerant which has parts in close proximity to said container and parts extending to remote regions, means for injecting gas derived from the evaporation of the CO_2 into the refrigerant for circulating the refrigerant in its path, and means thermostatically controlled by the temperature in said remote region for governing the injection of the gas into the refrigerant.

6. A refrigerating system comprising, a container for solid CO_2, means providing a cyclic path for a refrigerant having parts in close proximity to said container and parts extending to a remote region to be refrigerated, means utilizing gas power derived from the evaporation of the CO_2 for circulating the refrigerant in its path, and means thermostatically controlled by the temperature of said remote region for governing the gas effective upon said circulating means.

7. A method of refrigerating which consists in chilling a refrigerant by bringing it into heat exchange relation with a body of solid CO_2, circulating the brine thus chilled in heat exchange relation to a region to be refrigerated, effecting circulation of the brine by the gas power produced in the evaporation of the solid CO_2 and thermostatically controlling the flow of the circulating brine by the temperature in said region.

8. The method of refrigerating with solid CO_2 comprising, providing a cyclic path for a refrigerant with parts of the path in close proximity to the solid CO_2 and parts extending to regions to be refrigerated, circulating the brine in its path by gas power derived from the evaporation of the solid CO_2, and thermostatically controlling the gas effective for circulating the brine from the temperature of the refrigerated region for governing the flow of refrigerant in its path.

9. The method of refrigerating with solid CO_2 which comprises chilling brine by bringing it into heat exchange relation with the solid CO_2, providing a cyclic path for the brine leading to regions to be refrigerated, injecting gas derived by evaporation of the solid CO_2 or the like into the brine for circulating the brine in its path, and thermostatically controlling the gas injected into the brine by the temperature in the regions to be refrigerated for governing the flow of the refrigerant in its path.

In testimony whereof I affix my signature.

LLOYD G. COPEMAN.