

Feb. 26, 1929.

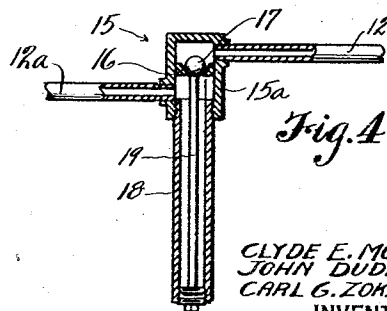
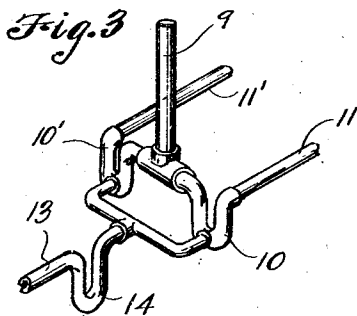
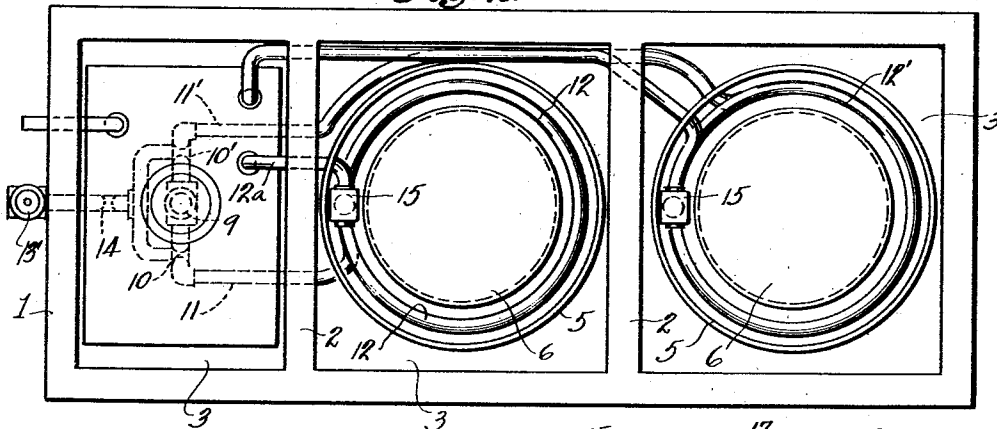
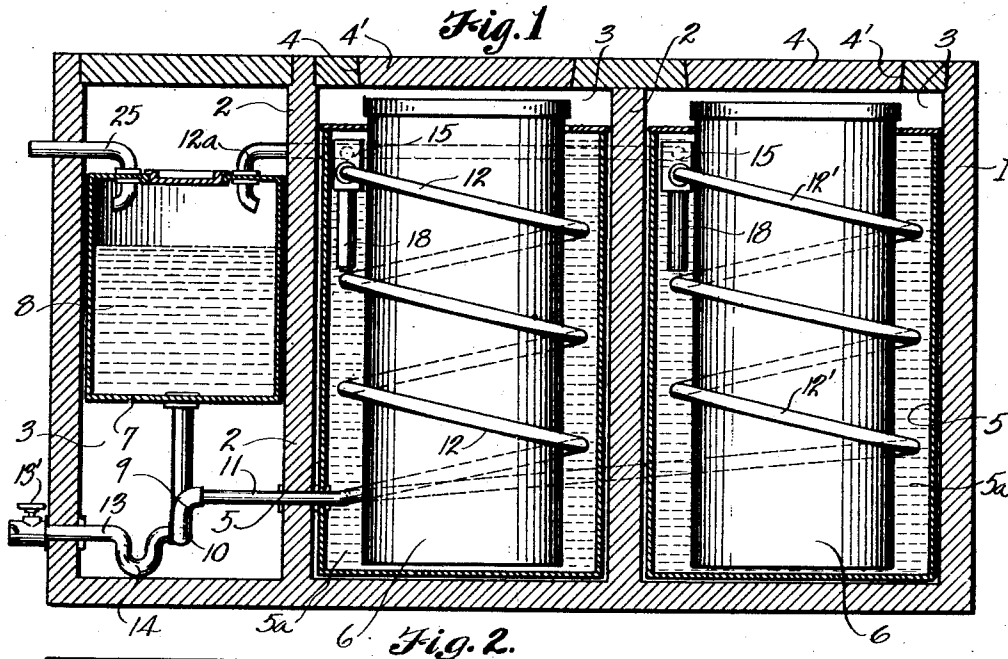
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REFRIGERATING APPARATUS

Filed Sept. 17, 1927

3 Sheets-Sheet 1



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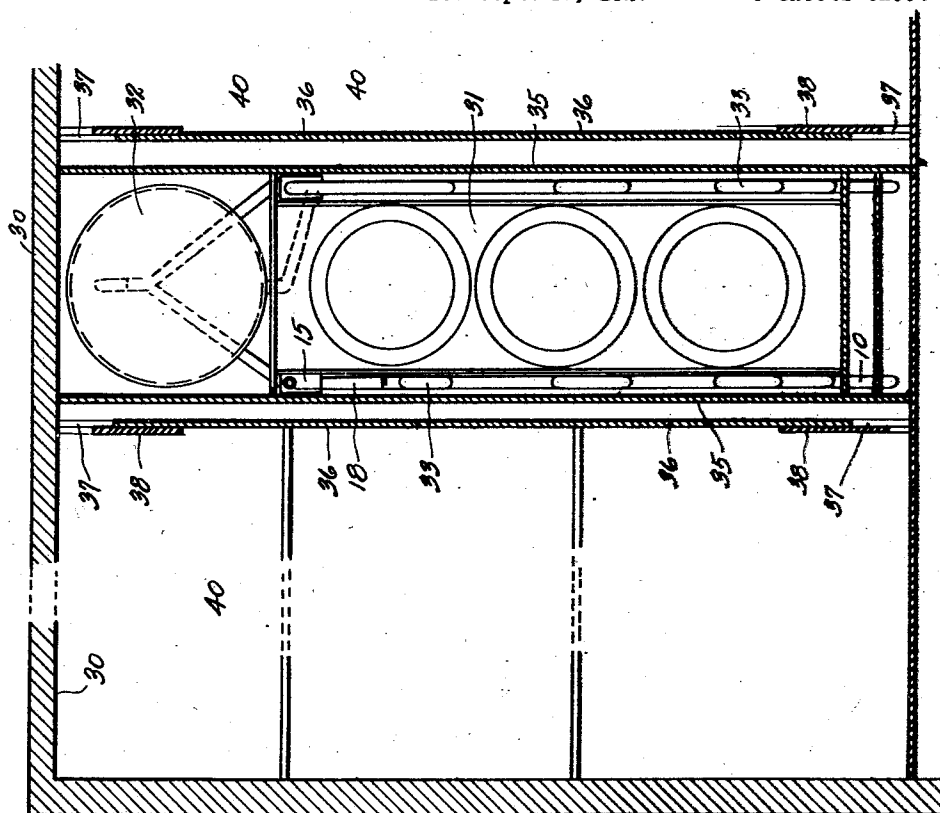


Fig. 6

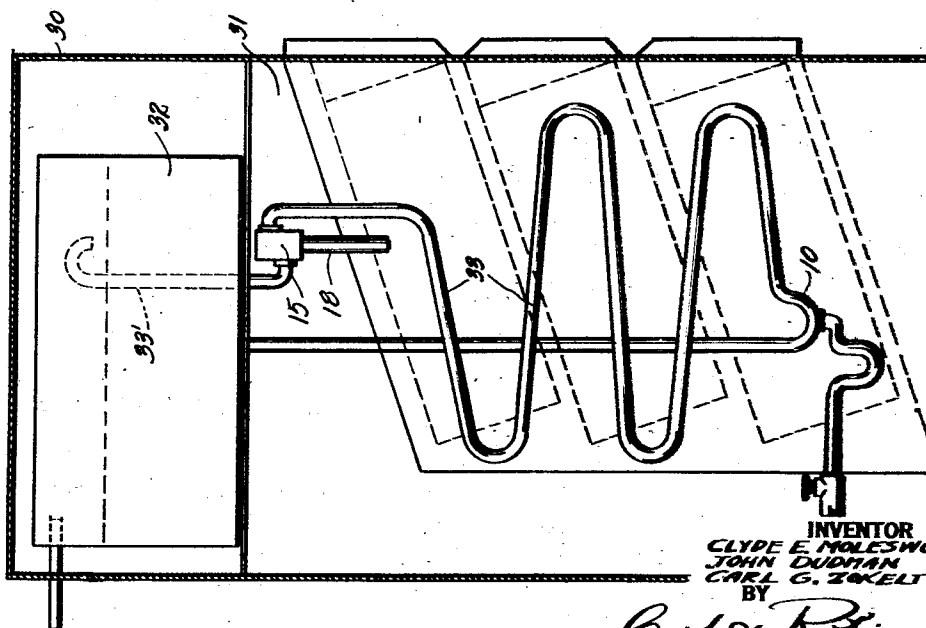


Fig. 5

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Fig. 7

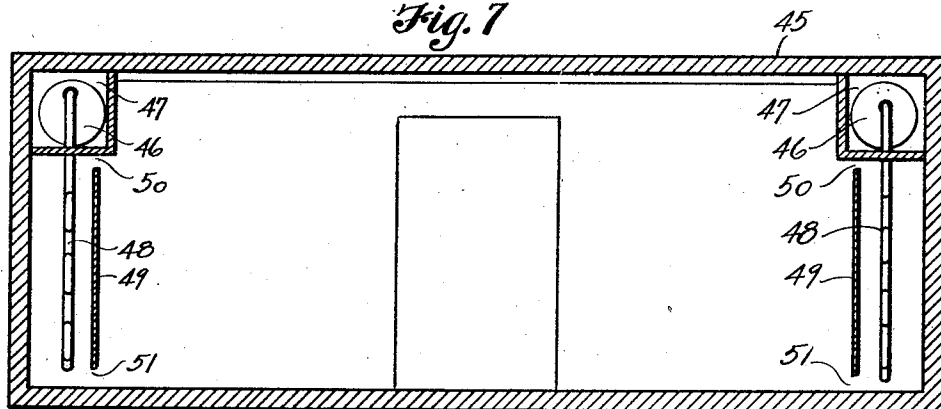
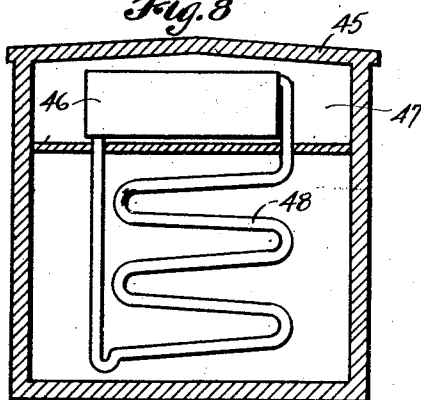


Fig. 8



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UNITED STATES PATENT OFFICE.

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REFRIGERATING APPARATUS.

Application filed September 17, 1927. Serial No. 220,157.

This invention relates to refrigerating systems and more particularly to improvements in refrigerating apparatus of that character utilizing liquefied gases, such as anhydrous ammonia, or other pre-cooled liquid, as the refrigerant; it being the principal object of the present invention to provide a refrigerating system which employs no mechanically operating devices such as pumps, compressors, motors, or the like, which is very desirable for and may be economically used in mercantile places for ice cream cabinets, show cases, etc., and which also, in a modified form, may be used with great success in refrigerator cars and cold storage plants.

More specifically stated, the object of the present invention resides in the provision of a refrigerating system comprising an insulated container for a liquid refrigerant, an expansion coil located within the chamber to be cooled and into which the refrigerant may flow by gravity from the container and a temperature controlled valve mechanism which operates automatically to control the admittance of the refrigerant into that portion of the coil that lies within the refrigerating area.

Other objects of the invention reside in the various details of construction and particularly in the combination of parts and in the mode of operation of the system as will hereinafter be described and pointed out in the claims terminating the specification.

In accomplishing the objects of the invention, we have provided the improved details of construction, the preferred forms of which are illustrated in the accompanying drawings, wherein—

Figure 1 is a vertical section of a refrigerator constructed in accordance with details of the present invention.

Figure 2 is a plan view of the same.

Figure 3 is a perspective view of a part of the piping system of the system, showing the "goose neck" traps.

Figure 4 is a detailed, sectional view of the control valve mechanism.

Figure 5 is a sectional view of an alternative type of construction for show case refrigeration.

Figure 6 is a front view, partly in section, of the same.

Figure 7 is a sectional view of a refrigerator car equipped with a refrigerating system embodied by this invention.

Figure 8 is a cross sectional view of the same.

In the following specification, we have described in detail the system in its arrangement for the cooling of ice cream packers, but it is to be understood that it has been shown in this particular form only for the purpose of explanation, since it is just as well adapted for other uses illustrated, such as for show case cooling in the ordinary mercantile establishments, or for railway car refrigeration in which instance the disposition of the coils and size of cooling compartments would be made to suit the particular use.

The feature of this invention, briefly stated, resides in providing gravity fed expansion coils with an automatic, temperature controlled means whereby the coil may be closed when a certain predetermined reduction of temperature has been attained in the cooling chamber, so that the gas produced from the refrigerant incident to absorption of heat from air or brine about the coil will act to push back the liquid from the coil and thus prevent any further reduction of temperature; then, when the temperature again rises, due to the holding back of the refrigerant, the valve opens to free the gas for displacement by the refrigerant so that the desired reduction of temperature may be maintained.

Referring more in detail to the several views of the drawings, particularly to Figures 1, 2 and 3—

1 designates the refrigerator body to be interiorly cooled which, as here shown, is of rectangular form and is divided transversely by partition walls 2, of suitable insulating material, into a plurality of compartments 3 to which access may be had through top openings 4 to which covers 4' are fitted. Within these compartments are tanks 5 for holding a suitable brine, designated at 5^a, and disposed within these tanks are the ice cream cans, or containers, 6.

While the construction of the box, or housing, 1 has not been illustrated in detail in the present drawings, it is to be understood that its walls would be constructed in the conventional manner, or any suitable manner, and of such materials that it will be non-conductive to heat or cold and inside temperatures will be unaffected by outside temperatures.

In the construction here shown, the housing 1 has a compartment, provided at one end

by means of a transverse wall 2, within the upper part of which a tank, or receptacle, 7 is suspended; this tank being closed and is adapted to contain a volatile, or pre-cooled, liquid or a liquefied gas, designated at 8, as the refrigerant. Leading from the base of the tank there is a downwardly directed pipe 9 which extends to near the base of the compartment where it is fitted with two "goose neck" traps 10—10' which connect, respectively, with pipes 11—11' leading to the lower end of expansion coils 12—12' located in the brine tanks and about the containers 6. Each of these coils, as shown, is spirally formed and, at its upper end, leads back into the refrigerant container 7 through the top wall of the latter, but each coil is equipped at a point just before it leaves its respective compartment with a thermostatically operated valve mechanism, as designated at 15, whereby the escape of gas from the coil is controlled as a means of regulating the admittance of the liquid refrigerant to the coil.

Connected with the two traps, is a filling and drain pipe 13 leading to the side of the housing where it has a valved connection 13' for attachment to a filling hose. This pipe is also equipped with a goose neck trap 14 as a means of preventing the filling pipe from remaining flooded.

One form of valve 15 used and its control means is shown in Figure 4, wherein 15^a designates a valve housing provided interiorly with a valve seat 16 on which a ball valve 17 is seated. The end of the expansion coil 12 connects with the housing above the valve and a continuation of the coil, designated at 12^a, leads from the housing below the valve seat and opens into the top of container 7. Extending downwardly from the valve housing is a tube 18 and mounted coaxially therein, by a fixed, adjustable connection at its lower end, is a rod 19 which engages with the ball valve. In this construction, the rod 19 is very sensitive to temperature changes and expands and contracts in accordance with these changes, while the tube 18 is of a material not affected to any appreciable extent. The extent of the rod 19 is so adjusted that so long as the temperature in the compartment which the valve controls is above a certain predetermined degree, it retains the ball valve unseated, to thereby permit escape of gas from the expansion coil back into the container 7, but, when the temperature is reduced below that degree desired, the rod 19, due to contraction, seats the ball valve 17 to stop the outlet of gas. This results in the displacement of or pushing back of the liquid refrigerant from the coil into the container 7 so that no further lowering of temperature will result. When the temperature again rises, due to the holding back of the refrigerant, the valve is opened and the refrigerant again enters the coils. Thus, the valve 15,

by the control of the passage of gas there-through, automatically regulates the temperature in the compartment 3. By providing a valve mechanism 15 for each compartment, different temperatures may be maintained.

The container 7 is also provided at the top with a vent pipe 25 for the venting of gas. This pipe may lead into a gas retaining device (not shown) if so desired, and it is preferred that the ends of the pipes 25 and 12^a within the container 7 be bent away from each other as shown.

Assuming the device to be so constructed, its operation is as follows:

First, the tank 7 is filled to a suitable height through pipe 13 with a liquid refrigerant. This passes, by gravity flow, through the pipe 9, goose neck traps 10—10', pipes 11—11' and into the coils 12—12'. Heat absorbed from the coils and compartments 3 results in slowly transforming the liquid refrigerant in the coils into a gas, which bubbles up through the coils and passes through the regulating valves 15 and pipes 12^a to the tank 7. As the temperature in a compartment is lowered to a predetermined degree, the valve 15 in that compartment automatically closes, as previously described, to prevent a continuation of flow of gas and this closing results in pushing back the liquid refrigerant from the coils as far as the trap 10 so that the temperature will not go lower. When the temperature rises, due to this pushing back of the refrigerant, the valve again opens to permit the gas to escape and the liquid refrigerant to re-enter the coils. The valve device thus controls the temperature automatically.

Referring now to the device of Figures 5 and 6, we have, in these figures, illustrated an alternative construction operating on practically the same principle as that above described but in a slightly different type of cabinet. In this construction, the refrigerating cabinet is shown in connection with show cases which are designed to be kept cool by circulation of air in contact with the cooled walls of the refrigerated area. In this construction, 30 designates what may be a show case construction provided at a point, preferably midway between its ends, with a refrigerating compartment 31 wherein, at the top, a refrigerant containing tank 32 is located and which is connected with pipe coils 33 to supply the latter with refrigerant by gravity flow in the same manner as described in connection with the device of Figures 1 and 2. These coils are supplied with liquid by connection at their lower ends and, at their upper ends, they have connections 33' that lead back into the supply tank. They are also equipped with traps 10 and automatically operated valve mechanisms 15, as previously described, for the purpose of regulat-

ing the temperature in the refrigerated area.

Mounted slightly in spaced relation to the side walls 35 of the refrigerated area, are walls 36 provided at upper and lower edges with openings 37 over which slides 38 are adjustably mounted as a means of controlling the area of the passages. The air within the show case compartments 40, at opposite sides of the refrigerated area, is kept cool by circulation through the spaces between walls 35 and 36, and its degree is controlled by the adjustment of the slides so as to regulate the rate of circulation.

In Figures 7 and 8, we have illustrated an adaptation of the present system to railway car refrigeration. In these views, 45 designates what may be a refrigerator car equipped with storage tanks 46 for liquid refrigerant in insulated compartments 47 at its ends, and expansion coil 48 into which the refrigerant is fed by gravity flow; this system operating on the same principle as that just described in the show case construction. Partition walls 49 separate the area close to the coils from main part of the car and openings 50—51 at the top and lower edges of these partitions permit of a circulation of air through the refrigerated areas and interior of the car.

Having thus described our invention, what we claim as new and desire to secure by Letters-Patent, is:

1. In a refrigerating system, a source of liquid refrigerant, an expansion coil into which said refrigerant may flow by gravity, and means for controlling the escape of gas from the coil as a means for controlling the admittance of refrigerant thereto.

2. In a refrigerating system of the character described, a source of liquid refrigerant, an expansion coil for receiving the refrigerant and a temperature controlled means for controlling the escape of gas from the coil as a means for controlling the admittance of the refrigerant to the coil.

3. In a refrigerating system of the character described, a refrigerating chamber, a source of liquid refrigerant, an expansion coil within said chamber connected with the source of refrigerant by gravity flow to receive the refrigerant, a valve at the outlet of the coil for controlling the escape of gas therefrom and temperature controlled means for opening and closing the valve.

4. In a refrigerating system of the character described, a housing providing a refrigerating chamber, a vented container for a liquid refrigerant, an expansion coil within the chamber connected at one end to the container so as to be fed with refrigerant there-

from by gravity flow and opening at its other end into the container above the level of refrigerant and means for controlling the passage of gas from the coil as a means of controlling the feeding of refrigerant thereto.

5. In a refrigerating system of the character described, a refrigerating cabinet divided to form separate, insulated compartments, a vented refrigerant container in one of said compartments, an expansion coil in another of said compartments connected at its lower end to receive refrigerant from the container by gravity flow and leading at its upper end back into the top of the container, a valve mechanism disposed in the coil adjacent its upper end for controlling the flow of gas from the coil and a thermostatically operated mechanism connected to open and close the valve.

6. In a refrigerating system, a refrigerating chamber, a source of liquid refrigerant, an expansion coil in the chamber having a pipe connection at its lower end with the source of refrigerant to receive the refrigerant by gravity flow, means in the upper end of the coil for controlling the passage of gas therefrom as a means of controlling the inflow of refrigerant, and a trap in the connection between the source of supply and coil for limiting the back flow of gas.

7. In a refrigerating system, a refrigerating chamber, a source of liquid refrigerant, an expansion coil in the chamber having a pipe connection at its lower end with the source of refrigerant to receive the refrigerant by gravity flow, a valve in the coil near its upper end, temperature controlled means for opening and for closing the valve, and a trap in the connection between the coil and source of supply for limiting the back flow of gas in the coil.

8. In a refrigerating system, a refrigerating chamber, a source of liquid refrigerant, an expansion coil in the chamber having a pipe connection at its lower end with the source of refrigerant, to receive the refrigerant by gravity flow; means in the upper end of the coil for controlling the passage of gas therefrom as a means of controlling the inflow of refrigerant, and a trap in the connection between the source of supply and coil for limiting the back flow of gas, and a filling and draining pipe connected with the said trap; said filling pipe having a trap adjacent its point of connection.

Signed at Seattle, Washington, this 1st day of September, 1927.

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