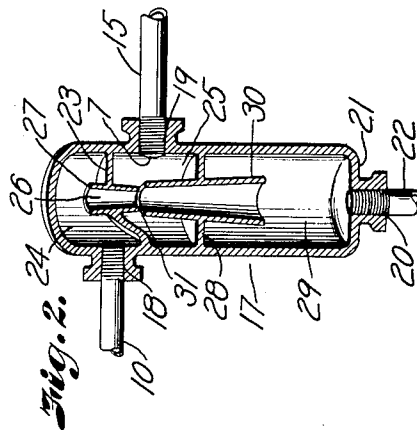
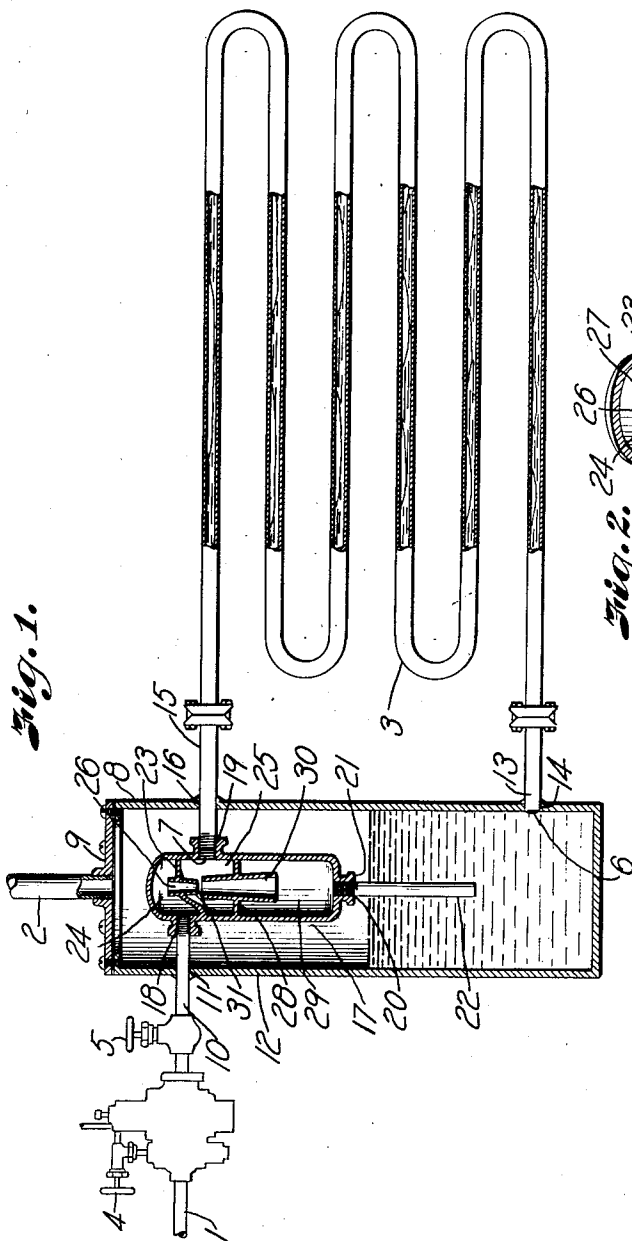


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J. F. HOFFMAN
REFRIGERATION SYSTEM
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REFRIGERATION SYSTEM

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My invention relates to refrigerating systems wherein a low boiling point liquid is evaporated to produce the cooling effect and more particularly to methods and means for
5 controlling flow of refrigerant through the evaporating chamber or coil, the principal object of the invention being to increase the extent of contact of liquid refrigerant with the walls of the coil and thus increase the
10 conduction of heat between the coil and the refrigerant.

In apparatus of the character described, refrigerant moves relatively slowly through the coil and bubbles due to evaporation under
15 the effects of heat transmission are trapped in the liquid and tend to displace liquid from contact with the coil whereby the cooling effect is diminished at the areas defined by the bubbles due to the fact that vapors conduct
20 heat less readily than liquid.

The bubbles referred to are relatively small in the lower branches of the coil where the refrigerant is coldest and increase in size toward the warmer portions of the coil adjacent the outlet thereof.

Further objects of my invention therefore are to withdraw evaporated refrigerant as rapidly as possible from the column of liquid refrigerant in the coil of a refrigerating system, and particularly to induce accelerated
30 flow of refrigerant in the coil whereby the vapors will be withdrawn and the retention of bubbles by the liquid will be minimized so that a larger proportion of the coil will
35 be contacted by liquid refrigerant and the cooling effect of the system will be enhanced.

A further object of the invention is to employ incoming refrigerant from the supply line for inducing the circulation and flow
40 of refrigerant in the coil, to mingle incoming cold refrigerant with warmer outgoing refrigerant, and to adapt the flow control means for use with supply and return lines and other ordinary elements of refrigerating
45 system.

In accomplishing these and other objects of the invention, I have provided improved details of structure, the preferred forms of which are illustrated in the accompanying
50 drawings, wherein:

Fig. 1 is a side elevation of a portion of a refrigerating system including a coil and my device interposed therein shown in central vertical section, the walls of the coils being partly broken away to disclose gas bubbles in the liquid refrigerant within the coil.

Fig. 2 is an enlarged central vertical section of the casing located in the shell of my device as shown in Fig. 1, and adjacent portions of conduits connected to the casing.

Referring in detail to the drawings:

1 designates a supply line, 2 a return and 3 a coil comprising elements of a refrigerating system which may be of ordinary construction connected to compressors, condensers and similar apparatus not shown, and the use of which is well known. Control valves 4 and 5 are provided on the supply line for controlling flow of liquid refrigerant toward the coil.

In ordinary practice the supply line would be connected directly to the inlet end 6 of the coil and the outlet end 7 of the coil would be connected directly to the return.

For my purpose however, I interpose a shell 8 between the outlet and inlet ends of the coil to receive used refrigerant for recirculating a portion thereof, and provide for injecting the supply refrigerant into a stream of used refrigerant for inducing flow thereof in the coil, as will be particularly described. In a preferred form, the return is inserted in the top 9 of the shell, the supply line discharge pipe 10 in an opening 11 of the side wall 12 of the shell adjacent the top thereof, a coil inlet pipe 13 in an opening 14 in the side wall of the shell adjacent the bottom thereof, and a coil outlet pipe 15 in an opening 16 of the wall spaced vertically from the opening 11 and preferably slightly lower than said opening. The shell is thus supported by the inlet and outlet pipes.

The pipes 10 and 15 project into the shell and their threaded ends or discharge mouths are preferably spaced horizontally to receive a chambered member or casing 17 having threaded openings 18 and 19 into which the threaded ends of the pipes are inserted for securely and firmly supporting the casing in

spaced relation with the upper and lower ends of the shell.

An opening 20 in the bottom 21 of the casing receives a depending pipe 22 having its lower end spaced from the bottom of the shell.

Refrigerant received by the casing from the supply line and the coil and passing through the casing is thus conducted into the lower portion of the shell and into the body of liquid refrigerant therein, the level of which is maintained above the opening 14 so that liquid may move to the coil.

A partition 23 is located in the casing between the supply line opening 11 and the coil opening 19 to form a chamber 24 at the upper end of the casing communicating with the supply line, and a used refrigerant receiving chamber 25 communicating with the coil, the partition having a central opening 26 for passage of refrigerant from the supply line into the chamber 25 and therethrough toward the lower end of the shell.

Restricting the flow of supply line refrigerant through the partition 23 and effecting an injector and a spray action is a downwardly directed tapering nozzle 27 forming the opening 26, the outlet end of the nozzle being above the axis of the horizontally positioned coil discharge pipe 15 whereby the injected stream passes across the path of the stream from the coil.

A second partition 28 is located below the coil discharge pipe to form the lower wall of the chamber 25 and the upper wall of a third chamber 29 comprising the lower portion of the casing. A second nozzle 30 tapering oppositely to the first named nozzle 27 is mounted in the partition 28 concentrically with the first named nozzle and having its upper end spaced slightly from the lower end of the first named nozzle. A relatively narrow space 31 is thus provided between the two nozzles whereby the current of incoming liquid refrigerant moving under pressure and restrictedly from the nozzle 27 will draw into the nozzle 30 refrigerant delivered to the chamber 25 by the coil discharge pipe 15, and the intermingled streams of refrigerant will move through the lower chamber 29 and depending pipe 22 into the body of liquid in the lower portion of the shell.

The pipe 22 and outlet 14 of the shell are so related and the operation of the apparatus may be so adjusted that the liquid level is constantly above the lower end of the pipe 22.

Products of evaporation occupying the upper portion of the shell tend to move through the return toward the compressor. The intermingling of relatively warm refrigerant discharged from the coil with incoming refrigerant at lower temperature will tend to equalize the temperatures of the two streams.

The injector effect of the downwardly dis-

charged stream of supply line refrigerant tends to induce flow of refrigerant from the coil and lift the liquid therein, and thus withdraw vapors from the coil whereby the number and size of gas bubbles is reduced.

A larger proportion of the inner surface of the coil is therefore contacted by liquid refrigerant and hence a maximum conducting effect is provided for.

The flow of liquid refrigerant into the casing is controlled by the valves conformably to the work required of the refrigerant in the coil and the rate of movement of the vapors from the shell, so that sufficient refrigerant will be discharged through the injector nozzle to lift the refrigerant in the coil and eliminate bubbles and maintain a desired level of liquid in the shell.

The liquid body will have a relatively high level when the operation of the apparatus is suspended and refrigerant is not being delivered under pressure, and the body of liquid constitutes a reservoir having a static head sufficient to supply the coil when operations are resumed.

The liquid level will fall when circulation is set up, and the coil will be substantially flooded, the supply being governed by the valves correspondingly to the volume of departing vaporous refrigerant so that the coil will be substantially flooded at all times and refrigerant will move with relative rapidity therethrough, and portions of the refrigerant will be recirculated.

What I claim and desire to secure by Letters Patent is:

1. In a refrigerating system of the character described including a supply line for liquid refrigerant under pressure, an evaporating chamber member, an inlet pipe, an outlet pipe, and a return line for evaporated refrigerant, a reservoir comprising a shell having communication at the top thereof with the return line, said inlet pipe being connected with the bottom portion of the shell, a casing located in the shell having an opening at its lower end, means supporting the casing adjacent the upper end of the shell including a discharge tube on the supply line and a discharge tube on said outlet pipe projecting into the shell and the casing in vertically spaced relation, partitions dividing the casing into a plurality of chambers communicating respectively with the supply line, said outlet pipe, and the shell, and tapering concentric nozzles in the partitions for passage of liquid refrigerant from the supply line through the second chamber for inducing flow of gaseous refrigerant from the evaporating chamber for passage with said liquid refrigerant through the third chamber into the reservoir for movement of liquid refrigerant by gravity into the evaporating chamber member and movement of vaporous refrigerant into the return line.

2. In liquid refrigerant evaporating apparatus including a supply line for liquid refrigerant under pressure, a return line for products of evaporation, and a coil having an inlet end and an outlet end, a shell having outlets at top and bottom for communication respectively with the return line, and the inlet end of said coil, a casing in the shell having outlet communication with the shell, the supply line and the outlet end of the coil projecting horizontally into the shell and the casing and adapted to discharge streams into the casing in vertically spaced relation, and a partition in the shell between the paths of said streams having a tapering opening forming a nozzle for restricted discharge of liquid refrigerant through the partition across the path of refrigerant moving into the casing from the coil. 70
- In testimony whereof I affix my signature.
JOHN F. HOFFMAN. 75
3. In apparatus of the character described including supply and return lines, a coil, and a liquid-containing shell having outlets to the return line and coil, a casing in the shell, a pipe communicating with the casing and having an outlet end normally submerged in liquid in the shell, and pipes connected with the supply line and coil and extending into the shell for delivering refrigerant from the supply line and coil to the casing. 80
4. In apparatus of the character described including a shell having vapor and liquid outlets, and an evaporator, a casing having spaced partitions forming chambers, and provided with spaced aligned nozzles, a pipe providing communication between the casing and the shell, an outlet pipe from the evaporator having a discharge end located in the casing for delivering refrigerant to one of said chambers, and a pipe connected to the supply line and having a discharge end connected to the casing for delivering refrigerant to another of said chambers for movement through the nozzles. 85
5. In liquid refrigerant evaporating apparatus, including a supply line for liquid refrigerant under pressure, a return line for products of evaporation, and a coil having an inlet end and an outlet end, a shell having outlets at top and bottom for communication respectively with the return line and the inlet end of said coil, a casing having outlet communication with the shell, the supply line and the outlet end of the coil being adapted to discharge streams into the casing in vertically spaced relation, and a partition in the shell between the paths of said streams having a tapering opening forming a nozzle for restricted discharge of liquid refrigerant through the partition across the path of refrigerant moving into the casing from the coil. 90
6. In apparatus of the character described including supply and return lines, and a coil having an inlet and an outlet, means including a liquid-containing shell having outlets 95
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