

May 27, 1930.

F. D. PELTIER

1,760,168

REFRIGERATION

Filed Feb. 26, 1927

5 Sheets-Sheet 1

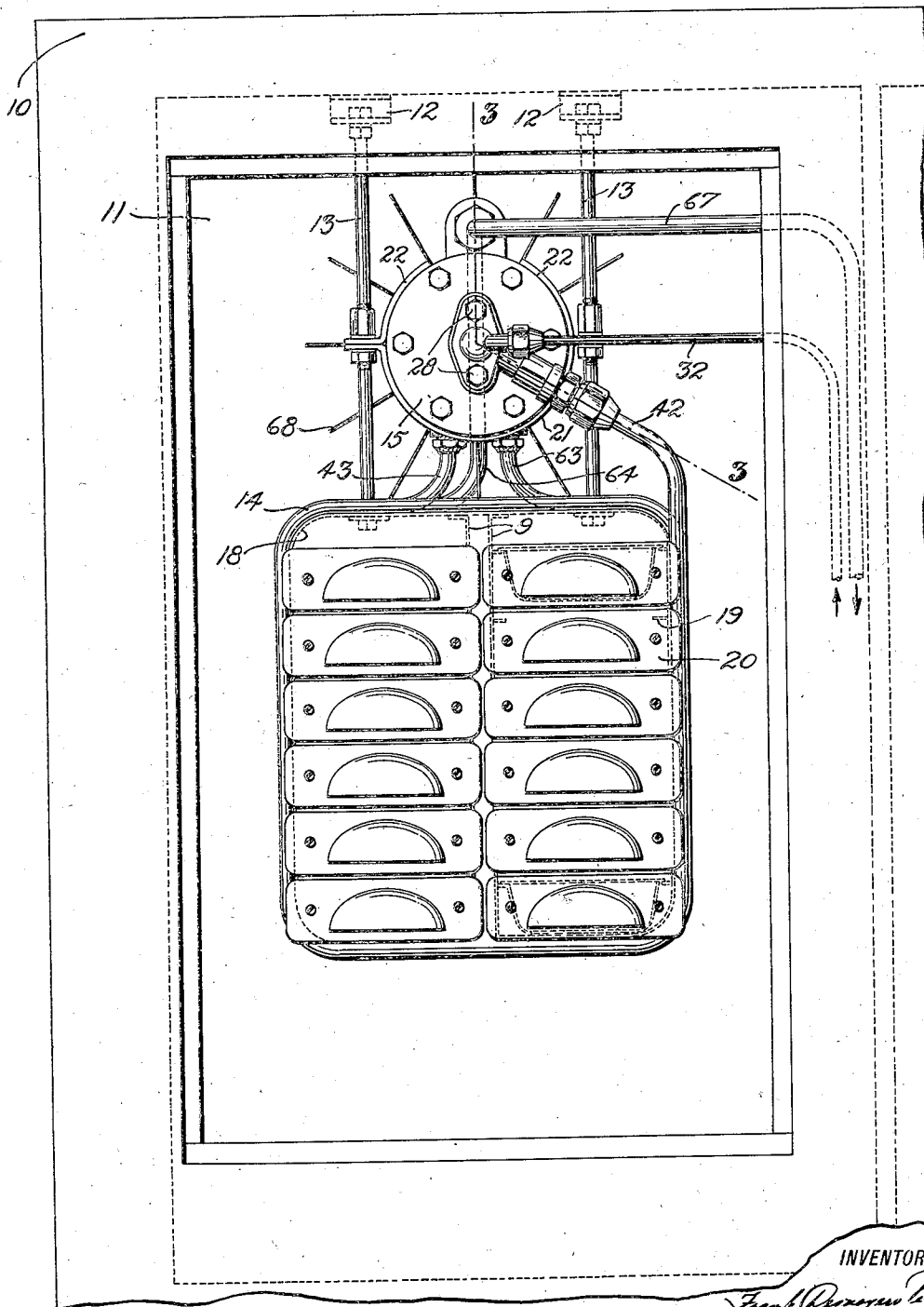


Fig. 1.

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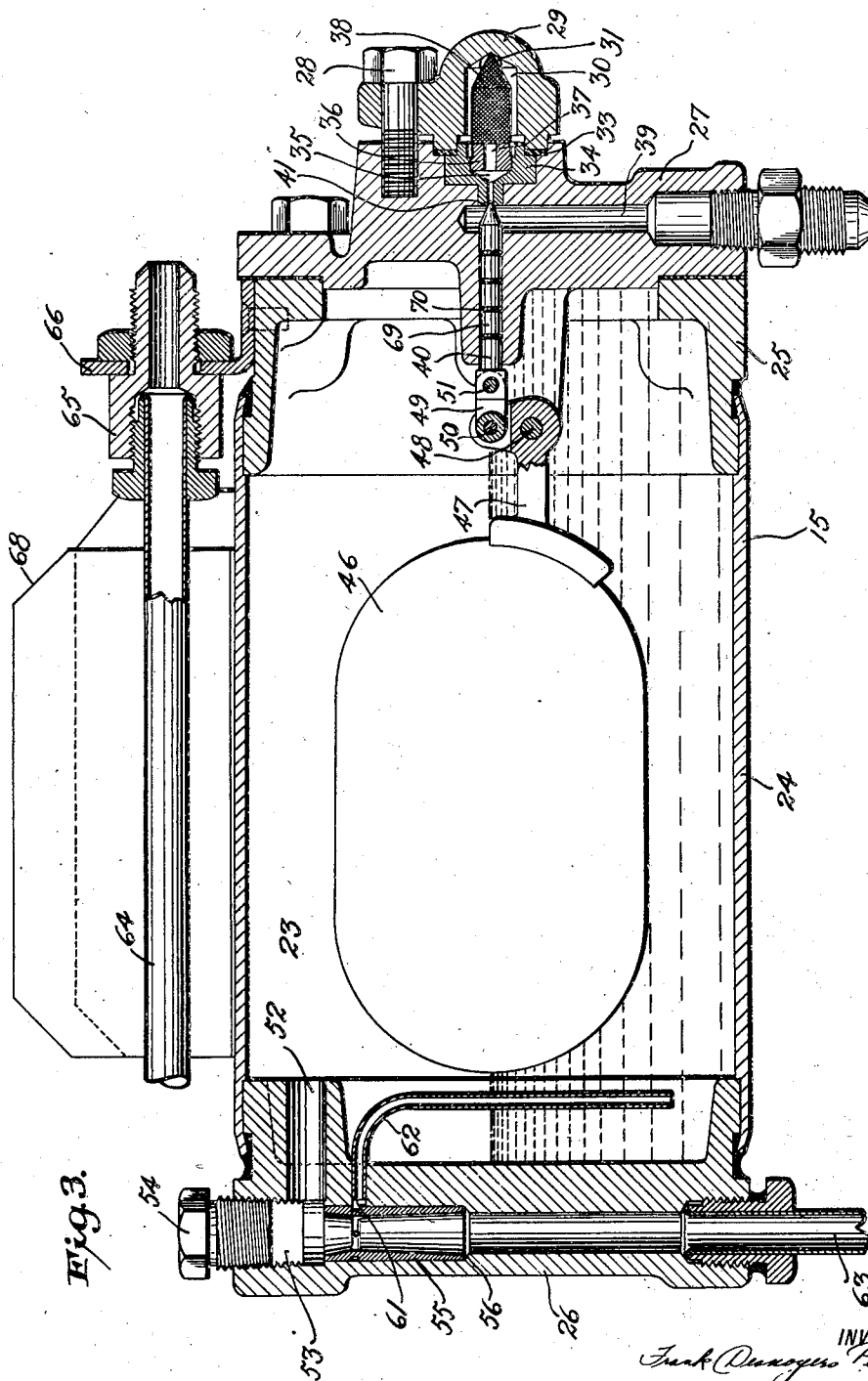


Fig. 3.

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Fig. 4.

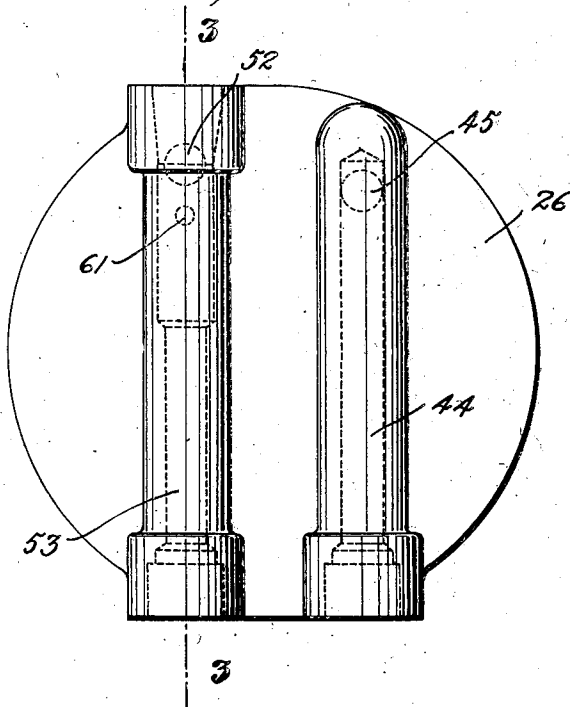


Fig. 5.

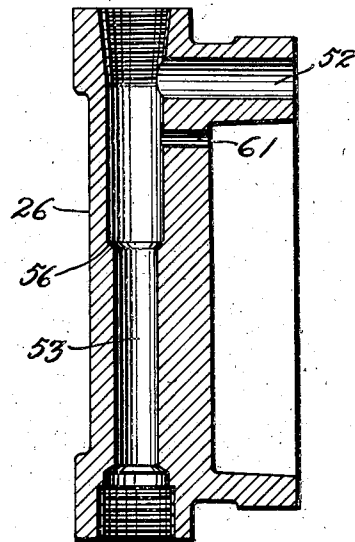
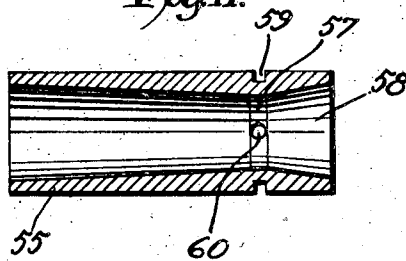


Fig. 10.



Fig. 11.



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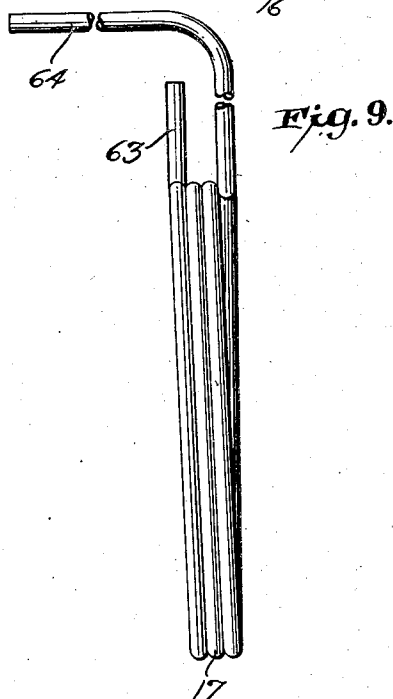
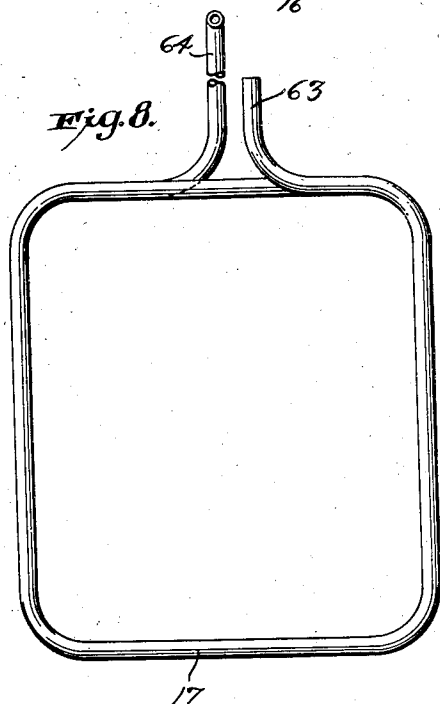
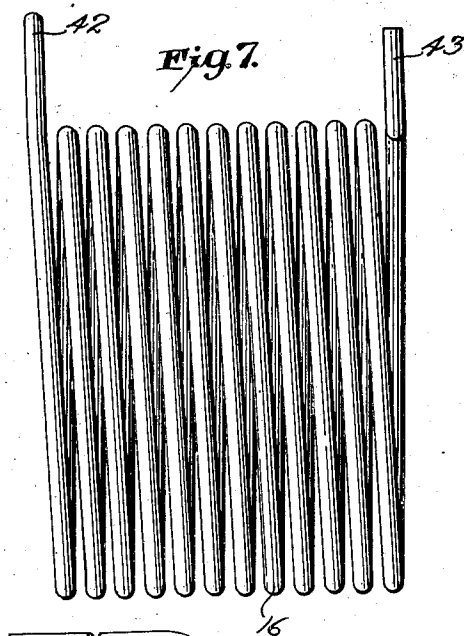
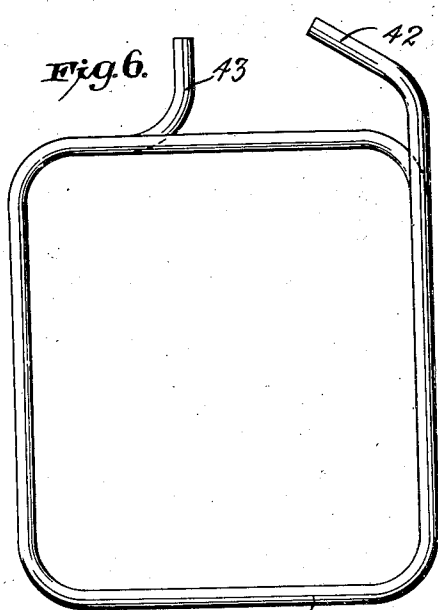
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REFRIGERATION

Filed Feb. 26, 1927

5 Sheets-Sheet 5



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UNITED STATES PATENT OFFICE

FRANK DESNOYERS PELTIER, OF EVANSVILLE, INDIANA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO SERVEL, INC., OF NEW YORK, N. Y., A CORPORATION OF DELAWARE

REFRIGERATION

Application filed February 26, 1927. Serial No. 171,112.

My invention relates to the art of refrigeration and particularly to that type of mechanical refrigerating system employing a compressor-condenser-evaporator circuit.

One object of my invention is to provide an improved form of evaporator including a low side actuated float valve with positive means for returning lubricant which circulates with the refrigerant to the compressor. Another object is to provide an improved arrangement for holding ice trays. Still another object is to provide improved evaporator header and coil constructions and arrangements. These as well as other objects and advantages will be apparent from the following description and the accompanying drawings of which:

Fig. 1 is a front view of a portion of a refrigerator cabinet showing the improved evaporator;

Fig. 2 is a cross-sectional view of the cabinet of Fig. 1 showing the evaporator in side elevation;

Fig. 3 is a cross-section view of a float valve header forming part of the evaporator shown in Figs. 1 and 2, taken partly on line 3—3 of Fig. 1 and partly on line 3—3 of Fig. 4;

Fig. 4 is an end view of a head which is part of the float valve header;

Fig. 5 is a cross-section view of the head shown in Fig. 4, taken on line 3—3, Fig. 4;

Fig. 6 is an end view of an expansion coil shown in Figs. 1 and 2;

Fig. 7 is a side view of the expansion coil shown in Fig. 6;

Fig. 8 is an end view of another expansion coil shown in Figs. 1 and 2;

Fig. 9 is a side view of the expansion coil shown in Fig. 8;

Fig. 10 is an end view of a Venturi tube used in the float valve header; and

Fig. 11 is a cross-section view of the Venturi tube shown in Fig. 10.

Referring more particularly to Fig. 1, reference character 10 designates a refrigerator cabinet only a part of which is shown. 11 is an opening in the front of cabinet 10 which is ordinarily closed by a door (not shown). Within cabinet 10 and secured to the top thereof are brackets 12—12. Depending from brackets 12—12 are rods 13—13 which serve

to support the float valve header 15 and the evaporator tube assembly designated generally by reference character 14.

Evaporator tube assembly 14 comprises two expansion coils 16 and 17 shown more in detail in Figs. 6, 7, 8 and 9. Coils 16 and 17 are formed around and supported by a frame or housing 18 to which are secured the supporting rods 13—13. Frame 18 is preferably made as a substantially rectangular box, open at the front end, closed at the back and having thin, solid top, bottom and sides of sheet metal. Formed within the frame are vertical members 19 and projecting strips 19 which serve to hold two rows of ice trays 20.

Float valve header 15 is supported by rods 13—13 in any suitable way as by the circular bands 21—21 and 22—22. Float valve header 15 comprises a float chamber 23 formed within and between cylindrical members 24 and 25 and heads 26 and 27. Secured to head 27 by bolts 28—28 is a member 29 in which is formed a passageway 30. Passageway 30 communicates with an opening 31 to which is connected a conduit 32 which leads from the condenser (not shown). Washer 33 is placed between member 29 and head 27 to insure a gas tight fit between the two. Within head 27 is a member 34 which has a central passageway 35 therethrough. An annular member 36 fits snugly into an enlarged portion of passageway 35. Member 36 has a central passageway 37 and serves to support a cylindrical screen 38. The left restricted end of passageway 35, shown in Fig. 3, communicates with a passageway 39 formed within head 27. A valve needle 40 acts in conjunction with a valve seat 41 formed in the end of passageway 35 to regulate the flow of a fluid from passageway 35 to passageway 39. Passageway 39 communicates with a conduit 42 which leads to the first or primary evaporator coil 16.

A conduit 43 leads from evaporator coil 16 to passageway 44 formed within the header 26 (Fig. 4). Another passageway 45 is formed in header 26 at right angles to passageway 44 and leads from passageway 44 to the upper part of float chamber 23. Float 46 is contained within float chamber 23 and floats on liquid therein. Float 46 is attached to arm 47

which is pivoted at 48. Arm 49 is pivotally connected to arm 47 at 50 and to valve needle 40 at 51. Valve needle 40 passes through a passageway 69 formed within header 27. Needle 40 is provided with a number of circumferential slots 70. The length of passageway 69 is much greater than its diameter.

A passageway 52 formed within header 26 leads from the upper part of float chamber 23 to passageway 53 also formed within header 26. The top of passageway 53 is threaded so as to receive plug 54. A Venturi tube 55 is placed within passageway 53 and held in position therein by shoulder 56. Venturi tube 55 is formed after the nature of Venturi tubes with a restricted portion 57 in the passageway 53 therethrough (Fig. 11). A circumferential slot 59 is provided around the outside of the Venturi tube adjacent to restricted portion 57. A hole (or holes) 60 establishes communication between restricted portion 57 and slot 59. Slot 59 communicates with a passageway 61 formed within header 26 and passageway 61 in turn communicates with a conduit 62, one end of which extends below the surface of the liquid contained within chamber 23. Passageway 53 communicates with a conduit 63 which leads to a second evaporator coil 17. A conduit 64 leads from the other end of evaporator coil 17 to a union 65 which is supported by bracket 66 on the top of member 25. A conduit 67 leads from union 65 to the suction side of the compressor. Member 24 may be supplied with a number of radiating fins 68.

The operation of the apparatus is as follows:

For convenience, it is assumed that the refrigerant used is methyl chloride but it is to be understood that other refrigerants may be employed. Liquid methyl chloride is supplied under a relatively high pressure of, for instance, 80 lbs. per sq. in., from the condenser through conduit 32. Assuming the valve needle 40 not to be seated in valve seat 41, the liquid passes through opening 31 into passageway 30 and through screen 38 upon which any particles of dirt are deposited. From within screen 38 the liquid passes through passageways 37 and 35. Although needle 40 is not seated in valve seat 41, it is in close proximity thereto and serves to throttle the high pressure liquid which passes from passageway 35 to passageway 39. This throttling action reduces the pressure of the methyl chloride to a comparatively low value, for instance, to between 10 and 20 pounds per square inch. This reduction in pressure causes some of the liquid to vaporize immediately but most of it passes, as a liquid under low pressure, through passageway 39 and conduit 42 to the first evaporator coil 16. In evaporator coil 16 most of the liquid methyl chloride evaporates and absorbs heat. This absorption of heat may be utilized to freeze

water placed in trays 20 and to cool the air within refrigerator cabinet 10. The vaporous methyl chloride and some liquid methyl chloride pass from evaporator coil 16, through conduit 43 and passageways 44 and 45 into float chamber 23. The liquid collects in the bottom of the float chamber while the vapor passes out through passageway 52. The liquid in float chamber 23 buoys up float member 46 and thus regulates the admission of liquid methyl chloride into evaporator 16. If the level of the liquid in chamber 23 drops slightly due to the fact that the liquid is not supplied as fast as it evaporates, float member 46 tends to descend and thus causes arm 47 to pivot about 48. This movement is communicated by arm 49 to valve needle 40 and cause needle 40 to move away from valve seat 41 and thus admit a greater quantity of liquid to evaporator 16. This causes liquid to enter float chamber 23 at a faster rate and thus the liquid level therein rises. Float member 46 is raised and causes valve needle 40 to move closer to valve seat 41 and thus reduce the flow of liquid into evaporator 16. In this way the float valve mechanism operates to maintain a substantially constant liquid level within chamber 23 and a substantially constant amount of liquid within evaporator 16. The pressure in conduit 42 is somewhat greater than that in conduit 43. It is this difference of pressure which causes flow to take place through evaporator 16 and tends to cause leakage past needle 40 in passageway 69. This leakage is reduced to a negligible amount by making needle 40 of considerable length and of small diameter. Needle 40 is also provided with circumferential slots 70 in which liquid tends to collect and form a liquid seal.

Methyl chloride vapor passes out of float chamber 23 through passageways 52 and 53 and Venturi tube 55. At the restricted portion 57 of Venturi tube 55 a reduction of pressure takes place which causes liquid to pass from the lower part of float chamber 23 through conduit 62, passageway 61, slot 59 and hole 60 to within the Venturi tube. This liquid consists of methyl chloride and lubricant that has been carried from the compressor. The mixture of liquid methyl chloride, lubricant and vaporous methyl chloride passes through the remainder of Venturi tube 55, passageway 53 and conduit 63 to second evaporator 17. Here the liquid methyl chloride is evaporated. The mixture of vaporous methyl chloride and lubricant passes from evaporator 17 through conduit 64, union 65 and conduit 67 to the suction side of the compressor. The methyl chloride is compressed over again while the lubricant is returned to the crank case of the compressor.

While I have described one form of my invention, it is to be understood that I am not limited thereto.

Having thus described my invention, what I claim is:

1. An evaporator for refrigeration comprising a box-like frame adapted to receive ice trays, a header above said frame, evaporator tubing extending around said frame and connected to said header, said tubing comprising two sections, one section being arranged in heat exchange relation with substantially the greater portion of said frame and the other section being arranged in heat exchange relation with a relatively small portion of said frame and means to pass refrigerant first through the tubing in heat exchange relation with substantially the greater portion of said frame, thence into the header and therefrom through tubing arranged in heat exchange relation with a relatively small portion of the frame, said last mentioned tubing communicating with the upper part of said header.

2. An evaporator for refrigeration comprising a box-like frame open at one end for reception of ice trays, a header extending longitudinally of and above said frame, a plurality of evaporator tubes extending around said frame and connected to said header, said tubing comprising two sections, one section being arranged in heat exchange relation with substantially the greater portion of said frame and the other section being arranged in heat exchange relation with a relatively small portion of said frame and means to pass refrigerant first through the tubing in heat exchange relation with substantially the greater portion of said frame, thence into the header and therefrom through tubing arranged in heat exchange relation with a relatively small portion of the frame, said last mentioned tubing communicating with the upper part of said header.

3. An evaporator for refrigeration comprising a float valve header having end heads and containing a float chamber, a passageway within each head, one passageway being adapted for connection with evaporator tubing and with a source of refrigerant under pressure and having its connection openings outside said chamber, and the other passageway being connected with the float chamber and adapted for connection with evaporator tubing, evaporator tubing connecting said passageways, a second passageway in one of said heads connected with said float chamber and adapted for connection with evaporator tubing and means to induce liquid from the float chamber into said second passageway.

4. An evaporator for refrigeration comprising a box-like frame adapted to receive ice trays, a header adjacent said frame comprising a chamber, evaporator tubes extending around said frame in a plurality of loops and so connected to said header that said chamber is arranged in series between said tubes, means for passing refrigerant into and

through one of said evaporator tubes before entering said chamber and means within said chamber regulating the supply of refrigerant to the last mentioned tube.

5. An evaporator for refrigeration comprising a box-like frame adapted to receive ice trays, a float valve header above said frame comprising a float chamber, evaporator tubes, including a primary evaporator tube, extending around said frame and arranged in series with said float chamber connected between them, a float within said chamber, means at the inlet of said primary evaporator tube to control flow of fluid thereinto and a connection between said float and said means whereby said float controls said flow of fluid.

6. An evaporator for refrigeration comprising a box-like frame having thin solid top, bottom and sides of sheet metal and a plurality of sections of loops of coiled evaporator tubing wrapped around said frame, one of said sections being arranged in heat exchange relation with substantially the greater portion of the frame and a second section being arranged in heat exchange relation with a relatively small portion of the frame and a header connected between said sections in series therewith, said last mentioned section communicating with the upper part of said header.

7. An evaporator for refrigeration comprising a header, a tube mounted on said header and arranged longitudinally thereof, said header including end heads and containing a chamber, a passageway within each head, one passageway being adapted for connection to a source of refrigerant, the other passageway being connected to said chamber, evaporator tubing connecting said passageways, a second passageway within one of said heads connected to said chamber, and evaporator tubing connecting said second passageway with said longitudinal tube.

8. In a refrigerating apparatus, in combination, a float valve header having an inner float chamber and having an end head containing a passageway through the same, both ends of said passageway terminating outside said chamber, a bore connecting said chamber with said passageway, a restriction in said passageway in line with said bore, an elongated valve needle extending through said bore having grooving around the same and adapted to cooperate with said restriction to determine flow through said passageway, a float within said chamber and a connection between said float and said valve needle.

9. An evaporator for refrigeration comprising a box-like frame adapted to receive ice trays, a float valve header adjacent said frame comprising a float chamber, primary and secondary evaporator tubes extending around said frame and arranged in series with said float chamber connected between them, a float within said chamber, means to

control flow of liquid refrigerant into the inlet end of said primary evaporator tube and a connection between said float and said means whereby said float controls said flow of liquid refrigerant to the primary evaporator tube.

10. An evaporator for refrigeration comprising a box-like frame adapted to receive ice trays, a float valve header adjacent said frame comprising a float chamber, primary and secondary evaporator tubes arranged in contact with said frame and arranged in series with said float chamber connected between them, a float within said chamber, means at the inlet of said primary evaporator tube to control flow of liquid refrigerant thereinto and mechanism connecting said float with said means whereby said float controls said flow of liquid refrigerant.

11. An evaporator for refrigeration comprising a box-like frame adapted to receive ice trays, a float valve header adjacent to said frame comprising a float chamber and a head at one end of said float chamber, a passageway in said head, a plurality of evaporator tubes including a primary evaporator tube extending in heat exchange relation with said frame and arranged in series with said float chamber connected between them, said primary evaporator tube being connected to said passageway in said head, a float within said chamber, means to control flow of liquid refrigerant through said passageway into the primary evaporator tube and mechanism connecting said float with said means whereby said float controls said flow of liquid refrigerant.

12. An evaporator for refrigeration comprising a box-like frame adapted to receive ice trays, a header adjacent to said frame, a primary evaporator consisting of a coiled tube wound around said frame and arranged in heat exchange relation with the greater portion of said frame and a secondary evaporator consisting of a coil wound around a relatively small portion of said frame, the coils being connected in series with said header between them and said secondary evaporator communicating with the upper part of said header.

13. An evaporator for refrigeration comprising a float valve header having end heads and containing a float chamber, a passageway within each head, one passageway being adapted for connection with evaporator tubing and with a source of refrigerant under pressure and having its connection openings outside said chamber; and the other passageway being connected with the float chamber, a box-like chamber adapted to receive ice trays, evaporator tubing connecting said passageways and extending around said box-like frame, a second passageway in one of said heads connected with such float chamber, evaporator tubing connected with said

second passageway and means to induce liquid from the float chamber into said second passageway.

14. An evaporator for refrigeration comprising a float valve header having end heads and containing a float chamber, a passageway within each head, one passageway being adapted for connection with evaporator tubing and with a source of refrigerant under pressure and having its connection openings outside said chamber, the other passageway being connected with the float chamber, a box-like frame adapted to receive ice trays, the header and frame being arranged adjacent and parallel in general extent, flanges extending outwardly from said header, evaporator tubing connecting said passageways and extending around said frame, a second passageway in one of said heads connected with said float chamber, an evaporator tubing connected with said second passageway and means to induce liquid from the float chamber into said second passageway.

In testimony whereof I hereunto affix my signature.

FRANK DESNOYERS PELTIER.