

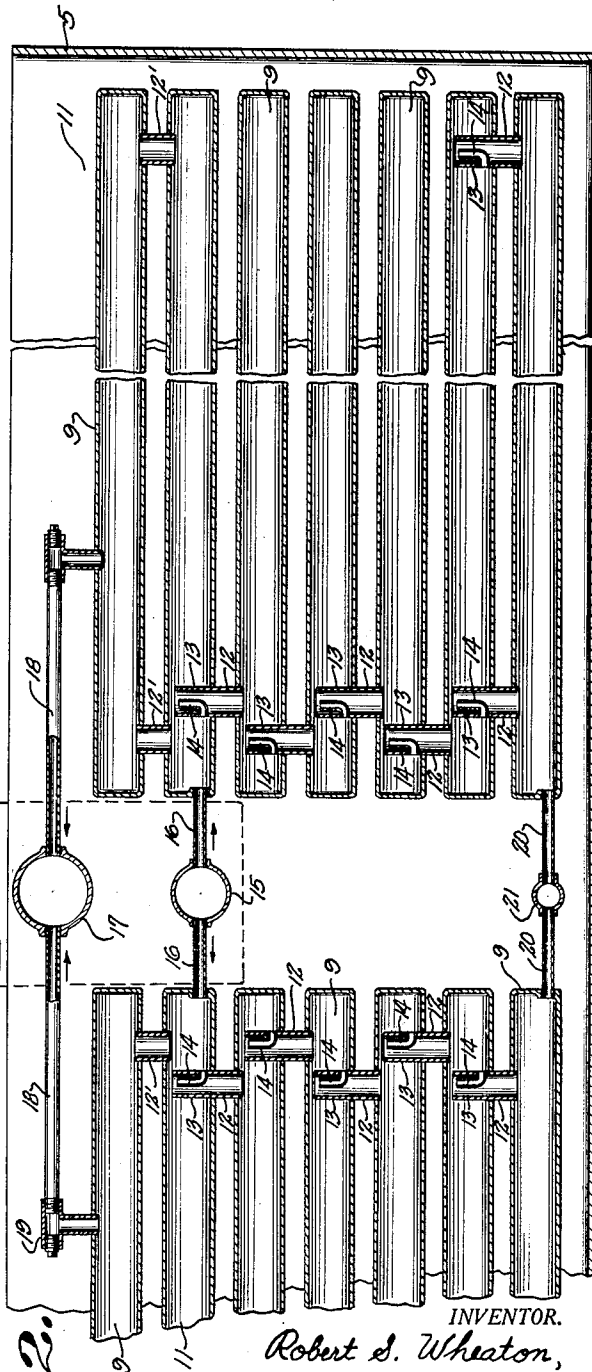
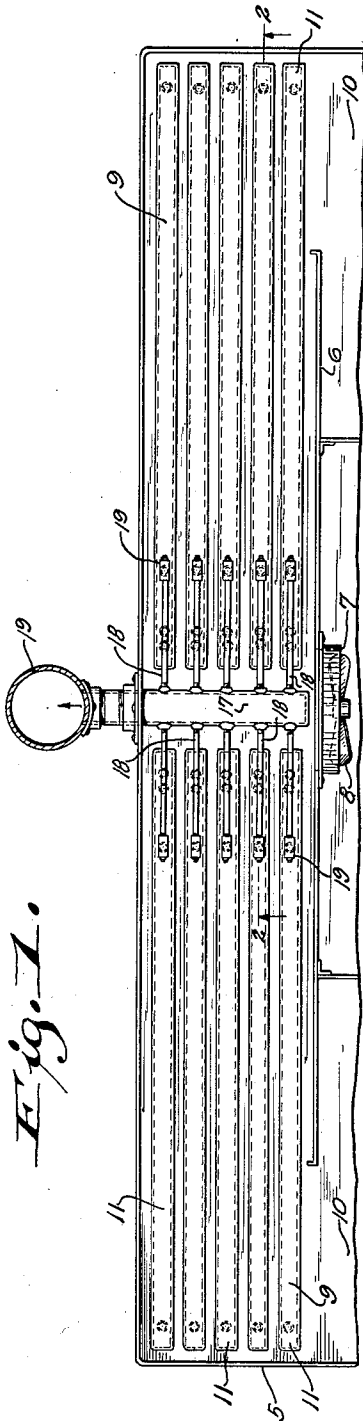
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REFRIGERATING APPARATUS

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REFRIGERATING APPARATUS

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This invention relates to improvements in refrigerating apparatus and more particularly to the cooling coils used in evaporating systems.

5 In refrigerating apparatus in general use the flooded coils are so arranged that as the liquid ammonia vaporizes or turns into gas, the bubbles of gas have to force their way upwardly through the liquid ammonia in the
10 coils to get out of the coils. This objectionable feature caused the pressure of the liquid in the coil, due to the static head, to be greater at the bottom of the coil than at the top, and as a result of this phenomenon the tempera-
15 ture of the ammonia at the bottom of the coil was always higher than the temperature of the ammonia at the top of the coil. This caused undue friction and eliminated efficient operation of the apparatus.

20 It is one of the objects of the present invention to overcome the above-mentioned objectionable feature and provide a refrigerating apparatus in which the static head of ammonia or other refrigerant in the flooded
25 coils is eliminated.

A further object of the invention is to provide a refrigerating apparatus in which comparatively large diameter pipes may be used in the coil assembly.

30 A further object of the invention is to provide a refrigerating apparatus in which the cooling coils may be easily installed in an ice tank or in a brine tank, and after erection the coils may be easily removed without
35 emptying the brine tank, as all connections may be arranged above the level of the brine within the tank.

40 A further object of the invention is to provide a refrigerating apparatus which is of simple construction, is efficient in operation and strong and durable, and is well adapted for the purpose desired.

45 With the above and other objects in view, the invention consists of the improved refrigerating apparatus and its parts and combinations as set forth in the claims, and all equivalents thereof.

50 In the accompanying drawings in which the same reference characters indicate the same parts in all of the views:

Fig. 1 is a top view of a portion of a brine tank with the improved cooling coils mounted therein; and

Fig. 2 is a vertical view taken on a larger scale on line 2-2 of Fig. 1.

Referring to the drawings the numeral 5 indicates a brine tank which is provided with the usual partition 6 having a central opening 7 and a propeller 8 positioned within said opening to circulate the brine around and
60 between the cooling tubes 9 and through the portions 10 of the brine tank in which the cans (not shown) in which the ice is formed are placed.

The cooling tubes 9, which are of larger
65 diameter than cooling tubes ordinarily used, are positioned one above another to form cooling units 11. The tubes 9 adjacent their inner ends are connected together in staggered relation by short sections of tubes 12
70 and 12', the tubes 12' being the shorter and merely connecting the upper tubes to the ones next below adjacent their inner ends. Each tube 12 is of greater length than the tubes
75 12' and extends from the upper side portion of the tube below, to and into the tube above to a point adjacent the upper inner side portion of said tube to form an inner extension
80 13 which permits the upflow of the gas from the refrigerating liquid in the flooded tube next below. Each extension tube 13 is provided with an inner overflow tube 14 which
85 is connected to the inner side portion of the extension tube adjacent the lower side portion of the cooling tube 9 and extends upwardly therefrom to a point a short distance below the upper edge of the extension
90 tube. The height of the overflow tube determines the height of the refrigerating liquid in the cooling tube in which it is positioned, and the slight distance the upper
95 end of the extension tube is positioned above the upper end of the overflow tube compensates for the gas bubbles rising to the surface of the refrigerant and extending above
100 the true liquid surface thereof, to prevent the overflow of the bubbles.

The connection of the lower end of each overflow tube with the connecting tube at a point adjacent the lower portion of the hori-

zontal tube insures the discharge of any oil which may have accumulated in said horizontal tube.

The extension and overflow tubes 13 and 14 are also provided for the outer end portions of some of the tubes as shown, and in which tubes 13 and 14 function in the same manner as before described.

An inlet header 15 preferably positioned between the cooling units 11 is connected usually to the inner ends of the second tubes from the top by short inlet pipes 16 to supply liquid ammonia or other refrigerant to the cooling tubes. A gas outlet header 17 of larger diameter than the liquid supplying header 15 and positioned above said inlet header is connected to the medial portions of the upper cooling tubes of each unit 11 by outlet tubes 18 and T's or elbows 19 to permit the discharge of the ammonia gas from the units 11. Both of the headers are usually connected to an accumulator 19 of usual construction.

The inner ends of the lower cooling tubes of each unit are provided with oil drain tubes 20 which are connected to a small drain header 21 which may lead to any desired point of discharge.

In operation the ammonia or other refrigerant in liquid form flows from the accumulator through the header 15, pipes 16, and into the second upper cooling tubes 9. As soon as the tubes are filled to a level corresponding in height to the height of the overflow pipes, the liquid will overflow through said pipes 14 to the tubes next below, and these tubes will also fill and overflow to the next tubes below and the supply will continue until all of the tubes except the bottom tubes are likewise filled. The bottom tubes will be virtually completely flooded. The supply of refrigerant is regulated to maintain this condition.

As the liquid ammonia or other refrigerant gasifies, the gas rises to the space in the upper portion of each horizontal cooling tube and flows along said space until it reaches the vertical connecting tubes 12 and will pass up said vertical tubes to the next horizontal tubes, and thus continue until it finally enters the upper horizontal tubes of the units. Any liquid ammonia which may be present and carried up with the gas to the upper tubes will, due to its long travel, separate from the gas and flow downwardly to the next tubes below and form part of the refrigerant liquid therein and continue its work.

The gas in the upper tubes will flow upwardly through the elbows and outlet pipes 18 to the upper header 17 and from said header to the upper portion of the accumulator and above the liquid ammonia therein. From the accumulator the ammonia gas is drawn to condenser pump and again liquefied and cooled and returned to the accumulator

and the cycle of operation is again repeated and continued.

Particular attention is directed to the fact that each cooling tube, while filled or partly filled with the liquid refrigerant, is so connected to the other tubes as to avoid a direct connection between the refrigerating liquid in one tube with the liquid in another tube, with the result that the static head ordinarily present in cooling tubes is eliminated.

From the foregoing description it will be seen that the refrigerating apparatus is of very simple construction, is strong and durable, and is well adapted for the purpose described.

What I claim as my invention is:

1. A refrigerating apparatus, comprising a refrigerant liquid inlet header, a refrigerant vapor outlet header, a cooling coil connected to the headers and consisting of a pair of approximately horizontally extending spaced superimposed tubes having closed ends, a vertically extending short tube connected to the upper portion of the lower tube and extending into the lower portion of the upper tube and terminating adjacent the upper inner wall of said upper tube, means for supplying a liquid refrigerant to the inlet header to maintain the tubes substantially filled with the refrigerant, and means below the plane of the upper ends of the short tubes for permitting a limited amount of the refrigerant to flow into the lower tube.

2. A refrigerating apparatus, comprising a refrigerant liquid inlet header, a refrigerant vapor outlet header, a cooling coil connected to the headers and consisting of a pair of approximately horizontally extending spaced superimposed tubes having closed ends, a vertically extending short tube connected to the upper portion of the lower tube and extending into the lower portion of the upper tube and terminating adjacent the upper inner wall of said upper tube, an overflow tube within and connected to the vertical tube at a point adjacent the inner lower surface of the upper tube and extending upwardly therefrom and terminating adjacent the upper end of the vertical tube, and means for supplying a liquid refrigerant to the inlet header.

3. A refrigerating apparatus, comprising a refrigerant liquid inlet header, a refrigerant vapor outlet header, a cooling coil consisting of upper and lower approximately horizontally extending tubes having closed ends, one end of the lower tube being connected to the inlet header and the upper portion of the upper tube being connected to the outlet header, a vertically extending short tube connecting the two tubes together and having an upward extension which terminates adjacent the upper portion of the upper tube, an overflow tube connected to the extension adjacent the inner lower surface of the upper tube and extending upwardly there-

from and terminating below the upper end of the extension, and means for supplying a liquid refrigerant to the inlet header.

4. A refrigerating apparatus, comprising a refrigerant liquid inlet header, a refrigerant vapor outlet header, a plurality of spaced superimposed approximately horizontal tubes having closed ends, a medial portion of the uppermost tube being connected to the outlet header and one of the other tubes being connected to the inlet header, short vertical tubes interposed between and connecting each lower tube to the one next above and some of said vertical tubes having upper extensions which terminate adjacent the inner upper surfaces of said next above tubes, overflow tubes within and connected to the extension tubes adjacent the inner lower walls of the horizontal tubes and extending upwardly therefrom to points just below the upper ends of the extension tubes, and means for supplying a liquid refrigerant to the inlet header.

5. A refrigerating apparatus, comprising a refrigerant liquid inlet header, a refrigerant vapor outlet header, a plurality of spaced superimposed approximately horizontal tubes having closed ends, a medial portion of the uppermost tube being connected to the outlet header and one of the other tubes being connected to the inlet header, short vertical tubes interposed between and connecting each lower tube to the one next above, and some of said vertical tubes having upper extensions which terminate adjacent the inner upper surfaces of said next above tubes, overflow tubes within and connected to the extension tubes adjacent the inner lower walls of the horizontal tubes and extending upwardly therefrom to points just below the upper ends of the extension tubes, an oil discharge header connected to the lowest one of the horizontal tubes, and means for supplying a liquid refrigerant to the inlet header.

6. A refrigerating apparatus, comprising a refrigerant liquid inlet header, a refrigerant vapor outlet header extending above the inlet header, a plurality of spaced superimposed approximately horizontal tubes extending on opposite sides of the headers and having closed ends, medial portions of the uppermost tubes being connected to the outlet header and adjacent tubes being connected to the inlet header, an oil outlet header extending below the inlet tube and connected to the lowermost tubes on each side of the headers, short vertical tubes interposed between and connecting each lower tube to the one next above, and some of said vertical tubes having upper extensions which terminate adjacent the inner upper surfaces of said next above tubes, overflow tubes within and connected to the extension tubes adjacent the inner lower walls of the horizontal tubes and extending upwardly therefrom and terminat-

ing just below the upper open ends of the extension tubes, and means for supplying a liquid refrigerant to the inlet header.

7. A refrigerating apparatus, comprising a refrigerant liquid inlet header, a refrigerant vapor outlet header extending above the inlet header, a plurality of spaced superimposed approximately horizontal tubes extending on opposite sides of the headers and having closed ends, medial portions of the uppermost tubes being connected to the outlet header and adjacent tubes being connected to the inlet header, an oil outlet header extending below the inlet tube and connected to the lowermost tubes on each side of the headers, short vertical tubes interposed between and connecting each lower tube to the one next above, and some of said vertical tubes having upper extensions which terminate adjacent the inner upper surfaces of said next above tubes, the vertical tubes of one horizontal pipe being staggered with relation to the vertical tubes of adjacent horizontal pipes, overflow tubes within and connected to the extension tubes adjacent the inner lower walls of the horizontal tubes and extending upwardly therefrom and terminating just below the upper open ends of the extension tubes, and means for supplying a liquid refrigerant to the inlet header.

8. A refrigerating apparatus, comprising a refrigerant liquid header, a refrigerant vapor header, a cooling coil connected to the headers and consisting of a pair of spaced superimposed tubes having closed ends and connected together by a short tubular member which extends from the upper portion of the tube below into the tube above and terminates adjacent the upper inner portion of the tube above to permit the overflow from the tube above to drop into the tube below without obstructing the upward flow of the refrigerating vapor through said short tube to the vapor header, the vertical tubes being staggered with relation to each other, and means for supplying a liquid refrigerant to the liquid header.

In testimony whereof, I affix my signature.
ROBERT S. WHEATON.