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C. F. CHAMBERS ET AL

2,302,189

REFRIGERATION APPARATUS

Filed Sept. 16, 1940

Fig. 1

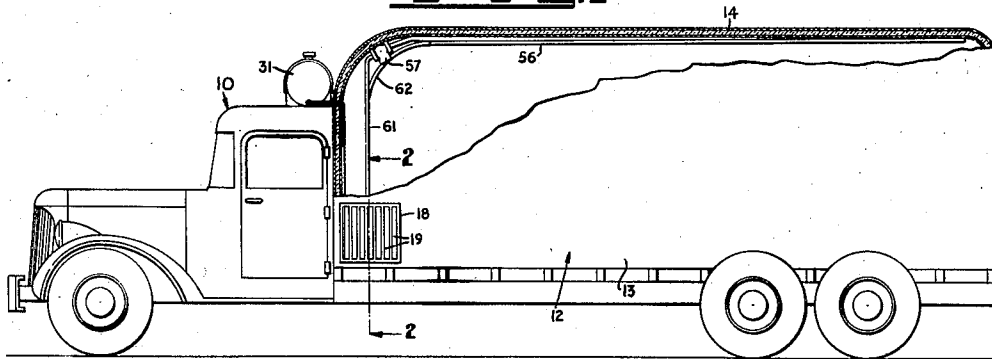


Fig. 2

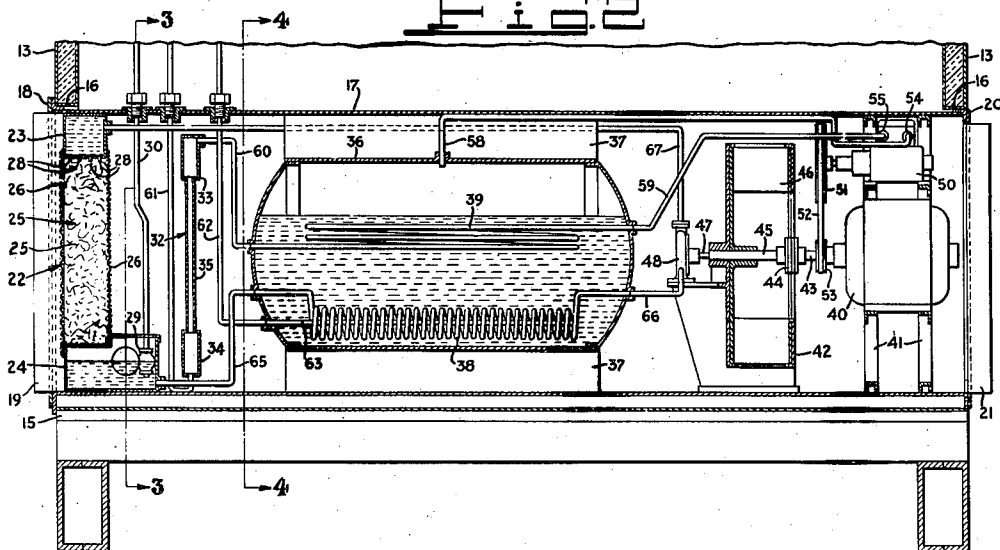


Fig. 3

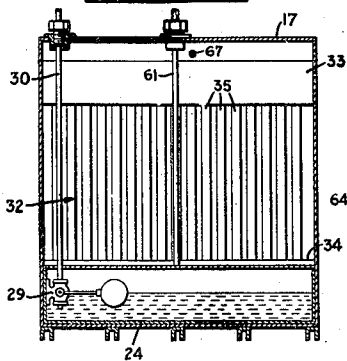


Fig. 5

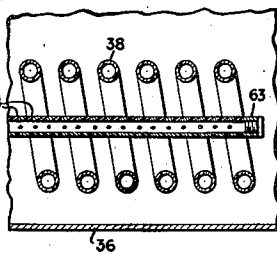
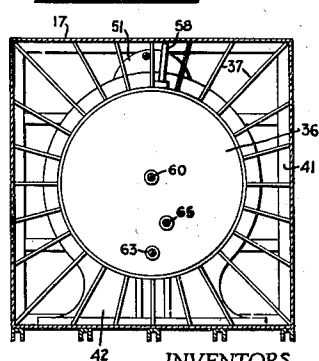


Fig. 4



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BY

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UNITED STATES PATENT OFFICE

2,302,189

REFRIGERATION APPARATUS

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Application September 16, 1940, Serial No. 356,916

21 Claims. (Cl. 62—117)

This invention relates to refrigerating apparatus and it is a general object of the invention to provide a practical highly effective refrigerating apparatus capable of efficient operation over long periods.

The refrigerating apparatus of the present invention, while capable of a wide range of application, is particularly well suited for refrigerating freight vehicles. Accordingly, we will herein refer to this one application of the invention and will describe an embodiment particularly suited for refrigerated freight vehicles, it being understood that this is merely a typical illustrative application of the invention.

Another object of this invention is to provide a refrigerating apparatus embodying an evaporative cooling means whereby the refrigerating mechanism is subjected to wet bulb temperatures as distinguished from dry bulb temperatures. This is particularly advantageous in arid regions where the dry bulb temperatures run very high relative to the wet bulb temperatures. The apparatus employs both the air cooled by the evaporative action and the water cooled in the cooler and it is possible to materially reduce the condensing area and thus reduce the size and weight of the apparatus.

Another object of the invention is to provide a refrigerating apparatus capable of dependable efficient operation even when subjected to severe shock heat loads such as produced by opening the doors of the refrigerated compartment of the vehicle and such as result from the vehicle passing through very hot regions.

Another object of this invention is to provide a refrigerating apparatus of the character referred to embodying an element which provides a capacity effect or fly-wheel effect preventing sudden variations in the pressures at the suction side of the compressor thereby preventing overloading of the compressor.

Another object of this invention is to provide a refrigerating apparatus of the character mentioned in which the refrigerant cannot return to the compressor in a liquid state and, therefore, cannot freeze up the compressor regardless of the operating conditions.

Another object of this invention is to provide a refrigerating mechanism of the character referred to embodying an absorption tank connected in series between the evaporator means and the suction side of the compressor and containing a refrigerant-absorbing liquid into which the gaseous refrigerant returning from the evaporator is discharged and further embodying an

effective means for cooling that portion of the liquid which receives the returning refrigerant. The means for cooling the zone of liquid which receives the returning gaseous refrigerant materially increases the efficiency of the apparatus. The heat incident to the absorption of the returning gas by the liquid is immediately carried away by the cooling means and the cooling means serves to maintain the adjacent liquid at a low temperature to increase its absorptivity. Where the temperature of the liquid is lowered at the point of introduction of the gas the liquid more readily absorbs the refrigerant and a higher concentration by weight of the solution results.

Another object of this invention is to provide a refrigerating apparatus of the character referred to in which the condenser is disposed in the upper portion of the liquid in the absorption tank to function in a highly concentrated refrigerant solution and thereby obtain a most effective condensing action. The high concentration of the refrigerant solution brought about by the cooling means, referred to above, materially increases the efficiency of the condenser.

Another object of this invention is to provide a refrigerating apparatus of the character referred to embodying a refrigerant receiver in the form of a radiator interposed between the condenser and the expansion valve and positioned in the path of cool air issuing from an evaporative cooler so that the liquid refrigerant is held below condensing temperatures, this cooling of the refrigerant giving the machine a greater operating capacity.

A further object of this invention is to provide a refrigerating mechanism embodying an effective cooling system which cools the gas receiving zone of the absorption tank liquid as above described, which serves to cool the liquid refrigerant receiver, which serves to cool the exterior of the absorption tank to produce thermal currents in the tank and which operates to cool the compressor.

The various objects and features of our invention will be fully understood from the following detailed description of a typical preferred form and application of our invention, throughout which description reference is made to the accompanying drawing, in which:

Fig. 1 is a side elevation, partly in section, of a motor truck of the refrigerated type showing our improved refrigeration apparatus operatively installed therein;

Fig. 2 is an enlarged fragmentary section taken on line 2—2, Fig. 1;

Fig. 3 is a section through the tunnel taken on line 3—3, Fig. 2;

Fig. 4 is a section through the tunnel taken on line 4—4, Fig. 2; and

Fig. 5 is a fragmentary enlarged sectional detail of the absorption tank.

Referring to the drawing by reference characters we have shown a motor truck 10 having thermally insulated body 12 thereon which includes sides 13, a top 14 and a floor 15.

Adjacent the forward end the sides 13 of the body 12 have opposed polygonal apertures 16 therein in which we provide a polygonal metal tunnel member 17.

One end of the tunnel 17 is shown provided with a plate 18 having forwardly directed air scoop louvers 19. The opposite end of the tunnel 17 is shown provided with a plate 20 which has rearwardly directed louvers 21.

Within the tunnel 17 adjacent the plate 18 we provide an evaporative air cooler 22 which includes an upper tank 23 adjacent the top of the tunnel and a lower tank 24 on the bottom of the tunnel.

Between the tanks 23 and 24 a chamber 25 is formed by wire mesh 26 and the chamber 25 is filled with excelsior 27. The bottom of the upper tank 23 has a multiplicity of outlets 28 therein which discharge into the chamber 25. The lower tank 24 has a float controlled valve 29 to maintain a predetermined fluid level therein.

One end of a conduit 30 communicates with the valve 29 and the opposite end communicates with an elevated water reservoir tank 31 which may be mounted on the cab of the truck.

Spaced inwardly from the cooler 25 we provide a refrigerant receiver constructed in the form of a radiator 32 which comprises an upper tank 33 and a lower tank 34 communicatively connected by a plurality of spaced vertical tubes 35. Positioned in the tunnel 17 intermediate the length thereof we provide an absorption tank 36. The tank 36 may have a plurality of radially extending fin members 37 thereon extending to the inner surface of the tunnel.

Within the tank 30 adjacent the bottom thereof we provide a water conduit coil 38 and thereabove we provide a refrigerant condenser conduit coil 39.

Within the tunnel 17 adjacent the plate 20 we provide a power drive means which is shown as an electric motor 40 supported on suitable frame members 41.

Intermediate the tank 36 and the motor 40 I provide a blower 42. The blower as shown is of a type wherein air is taken in from the periphery and is discharged at the center of the blower although any suitable type of blower may be employed. The armature shaft 43 of the motor 40 is connected through a suitable coupling member 44 to the drive shaft 45 of the blower rotor member 46.

Opposite the coupling 44 the blower driveshaft 45 includes a reduced portion 47 which drives a suitable fluid pump 48 of any desired type.

Within the tunnel 17 we provide a compressor 50 of any suitable type. The compressor 50 may be supported on the frame 41 to be above the motor 40. The compressor 50 is shown as adapted to be driven by a pulley 51 connected by a belt 52 to a reduced pulley 53 on the armature shaft 43 of the motor 40. The compressor 50 includes an inlet port 54 and an outlet port 55.

Within the body 12 of the truck adjacent the

top 14 thereof we provide an evaporator expansion conduit 56 the inlet end of which communicates with an expansion valve 57 of the differential pressure type.

One end of a conduit 58 communicates with the inlet port 54 of the compressor 50 and the opposite end communicates with the interior of the tank 36 adjacent the top thereof.

One end of a conduit 59 communicates with the outlet port 55 of the compressor 50 and the opposite end communicates with one end of the refrigerant condensing coil 39.

The opposite end of the coil 39 communicates with one end of a conduit 60. The conduit 60 communicates with the interior of the upper tank 33 of the radiator 32.

One end of a conduit 61 communicates with the interior of the lower radiator tank 34 and the opposite end of the conduit 61 communicates with the expansion valve 57.

The return end of the expansion coil or conduit 56 communicates with one end of a conduit 62. The conduit 62 extends into the tunnel 17 and communicates with a conduit 63 which extends longitudinally within the coil 38 in the tank 36.

Spaced along its length the conduit 63 has a multiplicity of perforations 64. The perforations 64 are preferably inclined outwardly towards the closed end of the conduit (see Fig. 5).

One end of a conduit 65 communicates with the lower tank 24 of the cooler 22 adjacent the bottom thereof and the opposite end of the conduit communicates with one end of the coil 38.

The opposite end of the coil 38 communicates with one end of a conduit 66 which leads to the inlet of the pump 48.

A pipe or conduit 67 extends from the outlet of the pump 48 to the interior of the upper cooler tank 23.

In operation a predetermined quantity of aqua-ammonia is placed in the absorption tank 36 and the water tank 31 is filled with water.

The float actuated valve 29 operates to maintain a predetermined water level in the tank 24 of the cooler 22.

When the motor 40 is started it drives the blower 42, the pump 48 and the compressor 50. When the compressor operates, it draws ammonia vapor from the tank 36 through the conduit 58 and forces it through the conduit 59 into the coil 39 where it is condensed through a heat interchange with the aqua ammonia.

The liquid ammonia is forced through the conduit 60 into the upper tank 33 of the radiator 32. From the tank 33 it is forced downward through the conduits 35 into the lower tank 34 from whence it is forced through the conduit 61 to the expansion valve 57 and thence into the expansion coil 56 where it is again vaporized thus absorbing heat from the interior of the truck and reducing the temperature thereof. The vapor returns from the expansion coil 56 through the conduit 62 and passes into the conduit 63 from which it discharges through the inclined perforations 64 into the liquid in the absorption tank 36. As the vapor emerges from the conduit it creates a circulation of the aqua ammonia longitudinally along the conduit 63 within the coil 56 due to the angular discharge thereof.

At the same time the refrigerant is being circulated water is drawn from the lower tank 24 of the cooler 22 through the conduit 65 into and through the coil 38 and through the conduit 66 into the pump 48. The water is forced from the pump through the conduit 67 into the upper

tank 23 of the cooler 22 from which it emerges through the multiplicity of outlets 28 onto the excelsior 27 and flows downward therethrough into the lower tank 24.

At the same time the refrigerant and water are being circulated the blower 42 is operating and draws air into the tunnel 17 through the excelsior 27 of the cooler 22 and through the conduits 25 of the radiator 32 around the absorption tank 36 and forces the air out of the tunnel through the louvers 21. When the truck is in motion the air circulation is increased by the action of the louvers 19 and 21.

As the air passes through the excelsior 27 of the cooler 22, the water passing therethrough is evaporated thus cooling both the air and the water. Thereafter as the air passes between the conduits 35 of the radiator 32 it cools the refrigerant passing therethrough and as it passes around the absorption tank 36 it cools the tank itself and the fins 37 thereon. After the air passes the tank it acts to cool the motor 40 and the compressor 50.

Considering the action in more detail and beginning the cycle at the high pressure side of the compressor 50 the operation is as follows: The compressor 50 having drawn the gaseous refrigerant from the upper portion of the tank 36 forces it through the condenser 39. The compressor increases the pressure on the gas in the condenser 39 and condensation occurs in the condenser. The condensation of the gas in the condenser 39 results in the conversion of the latent heat of the refrigerant to sensible heat in the aqueous refrigerant solution in the tank 36. The sensible heat of the liquid solution is reconverted to latent heat as the ammonia or refrigerant evaporates from the surface of the liquid body and from the surface of the submerged condensing coil. This vapor or gaseous refrigerant supplies the suction side of the compressor 50. The action just described provides an equal heat exchange between the condenser 39 and the liquid or solution. This serves to maintain a substantially constant vapor pressure in the absorption tank 36.

In completing the cooling cycle the gas returns from the evaporating conduit 56 through the conduits 62 and 63 and is discharged through the ports 64 into the aqueous solution in the absorption tank 36. The invention provides for the maximum absorption of the returning gas in the liquid. The cooling medium or water flowing through the coil 38 lowers the temperature of the liquid around the conduit 63. This reduction in temperature of the liquid greatly increases the absorptivity of the solution and the gas may be absorbed to the extent that a solution of high concentration by weight is produced. Furthermore, the cooling medium passing through the coil 38 serves to absorb, through the medium of the liquid in the tank 36, the heat created incidental to the absorption of the gaseous refrigerant by the liquid. Thus, there is a direct and immediate heat exchange accompanying the absorption of the gaseous refrigerant to increase the efficiency of the system.

The saturating of the liquid in tank 36 by introducing the returning gaseous refrigerant into a chilled or cooled zone of the liquid promotes efficient operation of the condenser 39. The relative positions of the condenser 39 and the cooling coil 38 provide for thermal currents in the tank 36. Furthermore, the passage of cool air from the cooler 25 over the tank 36 cools the

wall of the absorber tank and assists in developing thermal currents which cause the saturated solution at the point of introduction of the gaseous refrigerant to rise to the upper part of the tank through the middle portion of the tank and cause the under saturated or weaker solution to drop to the lower part of the tank adjacent the tank walls. The motion of the truck or vehicle agitates the solution in the absorption tank 36 and assists in bringing about a uniform and more complete absorption of the refrigerant in the tank.

It is to be observed that refrigerant in a liquid state returning from the evaporator 56 cannot directly reach the compressor. This is of importance where the refrigeration apparatus is employed on vehicles passing through localities where high and low temperatures exist with the refrigerating system in continuous operation. Under such conditions continuous operation of the compressor 50 when the vehicle is travelling through a cold region tends to cause the liquid refrigerant to run back through the return lines 62 and 63. With the apparatus of the present invention this liquid merely returns to the liquid in the tank 36 and cannot directly reach the compressor 50. Accordingly, there is no danger of the compressor 50 becoming frozen and vaporous refrigerant only can reach the compressor.

It should be noted that the compressor 50 receives the refrigerant from the open or gas containing portion of the tank 36 and never receives refrigerant in a liquid state. Because of this the vapor supplying the compressor 50 must be taken from the surface of the solution in the absorption tank 36. This is important particularly where the apparatus is subjected to shock heat loads as when the doors of the refrigerated compartment are suddenly opened or when exceedingly high outside temperatures are encountered. In the case of such shock heat loads there is a possibility that the refrigerant remaining in the evaporator coil 56 will boil violently and cause liquid refrigerant to be entrained in the vapor leaving the evaporator. This raises the suction pressure on the compressor 50 and the corresponding evaporating temperatures. Liquid refrigerant that might otherwise be drawn into the compressor 50 as a result of the violent boiling and entrainment remains in the absorber tank 36.

The absorption tank 36 connected in series between the return from the evaporator means and the suction side of the compressor 50 constitutes a stabilizing element operating as a capacity or fly-wheel. Where it is necessary for the gaseous refrigerant returning from the evaporator coil 56 to be put into solution in the liquid and then re-evaporated there can be no sudden changes in the vapor pressure on the suction side of the compressor. This is of great importance in maintaining even or stabilized operation and efficiency.

Having described a typical preferred form and application of our invention, we do not wish to be limited or restricted to the specific details herein set forth, but wish to reserve to ourselves any variations or modifications that may appear to those skilled in the art or fall within the scope of the following claims.

Having thus described our invention we claim:
1. In a refrigerated vehicle, a thermally insulated body, a tunnel member transversely disposed in said body and having open ends at opposite sides of the vehicle, forwardly disposed

louvers at one of said open ends, rearwardly disposed louvers disposed at the other of said open ends, an evaporative cooler within said tunnel adjacent said forwardly disposed louvers, and refrigerating means within said tunnel for absorbing heat from the interior of said body, said refrigerating means including a refrigerant handling element disposed adjacent to said cooler and adapted to be cooled thereby.

2. In a refrigerated vehicle, a thermally insulated body, a tunnel disposed in said body, means to induce air motion through said tunnel, an evaporative cooler within said tunnel, said cooler including an upper water tank and a lower water tank, evaporative means disposed between said tanks, a radiator adjacent said cooler, said radiator including upper and lower tanks with tubes disposed therebetween, an absorption tank adjacent said radiator, a pump, means to drive the pump, a coiled conduit in said absorption tank and communicating with said upper tank, means to supply water to said lower water tank, means whereby said pump draws water from said lower tank and discharges the water to said coiled conduit, an expansion valve and evaporator coils disposed in said vehicle body, a second coiled conduit in said absorption tank, means whereby said compressor draws refrigerant from said absorption tank and discharges through said second coiled conduit in said absorption tank, thence to said radiator and to said expansion valve and evaporator coils, said evaporator coils discharging into said absorption tank.

3. In a refrigerated vehicle, a thermally insulated body, a tunnel disposed in said body, means to draw a column of air through said tunnel, an evaporative cooler within said tunnel, said cooler including an upper water tank and a lower water tank, evaporative means disposed between said tanks, a radiator adjacent said cooler, an absorption tank adjacent said radiator, a coiled conduit in said absorption tank, means to pump water from said lower water tank through said coiled conduit in said absorption tank and to said upper tank, means to supply water to said lower water tank, an expansion valve and evaporator coils disposed in said vehicle body, a second coiled conduit in said absorption tank, and means to draw refrigerant from said absorption tank and to discharge it through said second coiled conduit in said absorption tank, thence to said radiator and thence to said expansion valve and evaporator coils, said evaporator coils having an outlet discharging into said absorption tank.

4. In a refrigerated vehicle, a thermally insulated body, a tunnel transversely disposed in said body and having open ends, means to induce air motion through said tunnel, an evaporative cooler within said tunnel adjacent one end thereof, said cooler including an upper water tank and a lower water tank, evaporative means disposed between said tanks, a radiator adjacent said cooler, an absorption tank adjacent said radiator, a coiled conduit in said absorption tank, means to pump water from said lower water tank through said coiled conduit in said absorption tank and to said upper tank, means to supply water to said lower water tank, an expansion valve and evaporator coils disposed in said truck body, a second coiled conduit in said absorption tank, and means to draw refrigerant from said absorption tank and to discharge it through said second coiled conduit in said absorption tank, thence to said radiator and thence

to said expansion valve and evaporator coils, said evaporator coils having an outlet discharging into said absorption tank, said outlet comprising a perforated conduit adjacent to said first mentioned coiled conduit.

5. In a refrigerated truck, a thermally insulated body, a tunnel disposed transversely in said body and having open ends, forwardly disposed louvers in one of said open ends, rearwardly disposed louvers disposed in the other of said open ends, said louvers being adapted to induce air motion through said tunnel when said truck is in motion, an evaporative cooler within said tunnel adjacent said forwardly disposed louvers, said cooler including an upper water tank and a lower water tank, evaporative means disposed between said tanks, a radiator adjacent said cooler, said radiator including upper and lower tanks with tubes disposed therebetween, an absorption tank adjacent said radiator, a pump, a blower and a compressor within said tunnel and means to drive the same, a coiled conduit in said absorption tank and communicating with said upper tank, said pump being adapted to draw water from said lower tank and to discharge water into said coiled conduit, means to supply water to said lower water tank, said blower being disposed to induce air motion through said tunnel, an expansion valve and evaporator coils disposed in said truck body, a second coiled conduit in said absorption tank, means whereby said compressor draws refrigerant from said absorption tank and discharges through said second coiled conduit, thence to said radiator and to said expansion valve and evaporator coils, said evaporator coils discharging into said absorption tank.

6. In refrigerating apparatus the combination of, an absorption tank for containing a liquid refrigerant solution, an evaporator, a condenser within the absorption tank and communicating with the evaporator, a line for returning refrigerant from the evaporator to the liquid of the tank, means for drawing gaseous refrigerant from the tank, forcing it through the condenser, to be condensed therein, and then through the evaporator and said return line, and means for cooling that portion of the tank which receives the refrigerant from said line to increase the absorptivity of the liquid in said portion of the tank.

7. A refrigerating apparatus comprising an absorption tank for containing a liquid refrigerant solution, evaporator means, a condenser in the liquid of the tank in communication with the evaporator means, a line for returning gaseous refrigerant from the evaporator means to the interior of the tank at a point below the condenser, means receiving gaseous refrigerant from the upper portion of the tank and forcing it through the communicating condenser, evaporator means and line, and means for cooling that portion of the tank which receives the returning refrigerant from said line to increase the ability of the liquid to absorb the returning refrigerant and to dissipate the heat incident to the absorption of the refrigerant by the liquid.

8. A refrigerating apparatus comprising an absorption tank for containing a liquid refrigerant solution, evaporator means, a condenser in the liquid of the tank in communication with the evaporator means, a line for returning gaseous refrigerant from the evaporator means to the interior of the tank at a point below the condenser, means receiving gaseous refrigerant from

the upper portion of the tank and forcing it through the communicating condenser, evaporator means and line, and means for cooling that portion of the tank which receives the returning refrigerant from said line to increase the ability of the liquid to absorb the returning refrigerant and to dissipate the heat incident to the absorption of the refrigerant by the liquid, the last named means including a conduit entering said portion of the tank and containing a cooling medium.

9. A refrigerating apparatus comprising an absorption tank for containing a liquid refrigerant solution, evaporator means, a condenser in the liquid of the tank in communication with the evaporator means, a line for returning gaseous refrigerant from the evaporator means to the interior of the tank at a point below the condenser, means receiving gaseous refrigerant from the upper portion of the tank and forcing it through the communicating condenser, evaporator means and line, and means for cooling that portion of the tank which receives the returning refrigerant from said line to increase the ability of the liquid to absorb the returning refrigerant and to dissipate the heat incident to the absorption of the refrigerant by the liquid, the last named means including an evaporative cooler, and a conduit leading from said cooler to said portion of the tank and carrying a cooling medium.

10. A refrigerating apparatus comprising an absorption tank for containing a liquid refrigerant solution, evaporator means, a condenser in the liquid of the tank in communication with the evaporator means, a line for returning gaseous refrigerant from the evaporator means to the interior of the tank at a point below the condenser, means receiving gaseous refrigerant from the upper portion of the tank and forcing it through the communicating condenser, evaporator means and line, and means for cooling that portion of the tank which receives the returning refrigerant from said line to increase the ability of the liquid to absorb the returning refrigerant and to dissipate the heat incident to the absorption of the refrigerant by the liquid, the last named means including a cooling coil around the part of said line in said portion of the tank, and means for circulating a cooling medium through said coil.

11. A refrigerating apparatus comprising an absorption tank for containing a liquid refrigerant solution, evaporator means, a condenser in the liquid of the tank in communication with the evaporator means, a line for returning gaseous refrigerant from the evaporator means to the interior of the tank at a point below the condenser, means receiving gaseous refrigerant from the upper portion of the tank and forcing it through the communicating condenser, evaporator means and line, said line having a part in the tank provided with spaced ports for discharging the returning refrigerant into the liquid in the tank, and a cooling coil around said part of the line carrying a cooling medium for absorbing the heat incident to the absorption of the returning refrigerant by the liquid and for cooling the liquid to increase its absorptability.

12. A refrigerating apparatus comprising an absorption tank for containing a liquid refrigerant solution, evaporator means, a condenser in the liquid of the tank in communication with the evaporator means, a line for returning gaseous refrigerant from the evaporator means to the

interior of the tank at a point below the condenser, means receiving gaseous refrigerant from the upper portion of the tank and forcing it through the communicating condenser, evaporator means and line, and means for cooling that portion of the tank which receives the returning refrigerant from said line to increase the ability of the liquid to absorb the returning refrigerant and to dissipate the heat incident to the absorption of the refrigerant by the liquid, the last named means including an evaporative cooler, a line leading from said cooler to said portion of the tank and carrying a cooling medium, and means for producing a movement of air through the cooler to bring about the evaporative cooling effect and for passing the cooled air from the cooler around the tank.

13. A refrigerating apparatus comprising an absorption tank for containing a liquid refrigerant solution, evaporator means, a condenser in the liquid of the tank in communication with the evaporator means, a receiver interposed between the condenser and evaporator means, a line for returning gaseous refrigerant from the evaporator means to the tank, said line discharging the returning refrigerant into a zone of the tank below the condenser, means for receiving gaseous refrigerant from the upper portion of the tank and for forcing refrigerant through the condenser, receiver, the evaporator means and said line to return to said tank through said line, and a single means for cooling said receiver and said zone of the tank.

14. A refrigerating apparatus comprising an absorption tank for containing a liquid refrigerant solution, evaporator means, a condenser in the liquid of the tank in communication with the evaporator means, a receiver interposed between the condenser and evaporator means, a line for returning gaseous refrigerant from the evaporator means to the tank, said line discharging the returning refrigerant into a zone of the tank below the condenser, means for receiving gaseous refrigerant through the condenser, receiver and evaporator means for returning to said tank through said line, and a single means for cooling said receiver and said zone of the tank, said single means including an evaporative cooler causing the passage of cool air over the receiver and embodying a conduit carrying a cooling medium and leading into said zone of the tank.

15. A refrigerating apparatus comprising an absorption tank for containing a liquid refrigerant solution, evaporator means, a condenser in the liquid of the tank in communication with the evaporator means, a receiver interposed between the condenser and evaporator means, a line for returning gaseous refrigerant from the evaporator means to the tank, said line discharging the returning refrigerant into a zone of the tank below the condenser, means for receiving gaseous refrigerant from the upper portion of the tank and for forcing refrigerant through the condenser, receiver and evaporator means for returning to said tank through said line, and cooler means comprising a cooler, means for producing a movement of cool air from the cooler through the receiver and over the tank, and a conduit carrying cooling medium from the cooler and extending into said zone of the tank.

16. A refrigerating apparatus comprising an absorption tank for containing a liquid refrigerant solution, evaporator means, a condenser in the liquid of the tank in communication with the evaporator means, a line for returning gaseous

refrigerant from the evaporator means to the interior of the tank at a point below the condenser, compressor means for receiving gaseous refrigerant from the upper part of the tank and for circulating the refrigerant through the condenser, evaporator means and return line, and means for cooling that portion of the liquid in the tank which receives the returning refrigerant and for cooling the compressor means.

17. A refrigerating apparatus comprising an absorption tank for containing a liquid refrigerant solution, evaporator means, a condenser in the liquid of the tank in communication with the evaporator means, a line for returning gaseous refrigerant from the evaporator means to the interior of the tank at a point below the condenser, compressor means for receiving gaseous refrigerant from the upper part of the tank and for circulating the refrigerant through the condenser, evaporator means and return line, and means for cooling that portion of the liquid in the tank which receives the returning refrigerant and for cooling the compressor means, the last named means comprising a conduit carrying a cooling medium and extending into said portion of the liquid.

18. A refrigerating apparatus comprising an absorption tank for containing a liquid refrigerant solution, evaporator means, a condenser in the liquid of the tank in communication with the evaporator means, a line for returning gaseous refrigerant from the evaporator means to the interior of the tank at a point below the condenser, compressor means for receiving gaseous refrigerant from the upper part of the tank and for circulating the refrigerant through the condenser, evaporator means and return line, and means for cooling that portion of the liquid in the tank which receives the returning refrigerant and for cooling the compressor means, the last named means including an evaporative cooler, and a conduit carrying cooling medium from the cooler through said portion of the liquid.

19. A refrigerating apparatus comprising an absorption tank for containing a liquid refriger-

ant solution, evaporator means, a condenser in the liquid of the tank in communication with the evaporator means, a line for returning gaseous refrigerant from the evaporator means to the interior of the tank at a point below the condenser, compressor means for receiving gaseous refrigerant from the upper part of the tank and for circulating the refrigerant through the condenser, evaporator means and return line, and means for cooling that portion of the liquid in the tank which receives the returning refrigerant and for cooling the compressor means, the last named means including an evaporative cooler, a conduit carrying cooling medium from the cooler through said portion of the liquid, and means for causing a movement of air through the cooler and around the tank and compressor means to cause the evaporative action at the cooler and to cool the compressor means.

20. A refrigerating apparatus comprising an absorption tank for containing a liquid refrigerant solution, evaporator means, a condenser in the liquid of the tank in communication with the evaporator means, a line for returning gaseous refrigerant from the evaporator means to the interior of the tank at a point below the condenser, means receiving gaseous refrigerant from the upper portion of the tank and forcing it through the communicating condenser, evaporator means and line, and means for absorbing the heat resulting from the absorption of the returning refrigerant by the liquid.

21. Refrigerating apparatus for a vehicle comprising an absorption tank for containing a refrigerant-absorbent liquid, a condenser in the upper portion of the liquid, evaporator means in communication with the condenser, a return line for returning gaseous refrigerant from the evaporator means to the lower portion of the tank to be absorbed by the liquid therein, and means for internally cooling the lower portion of the tank and for externally cooling the tank to create thermal currents in said liquid.

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