May 10, 1938. B. K. G. EHNBOM 2,116,998

REFRIGERATION

Filed June 22, 1936 3 Sheets-Sheet 1

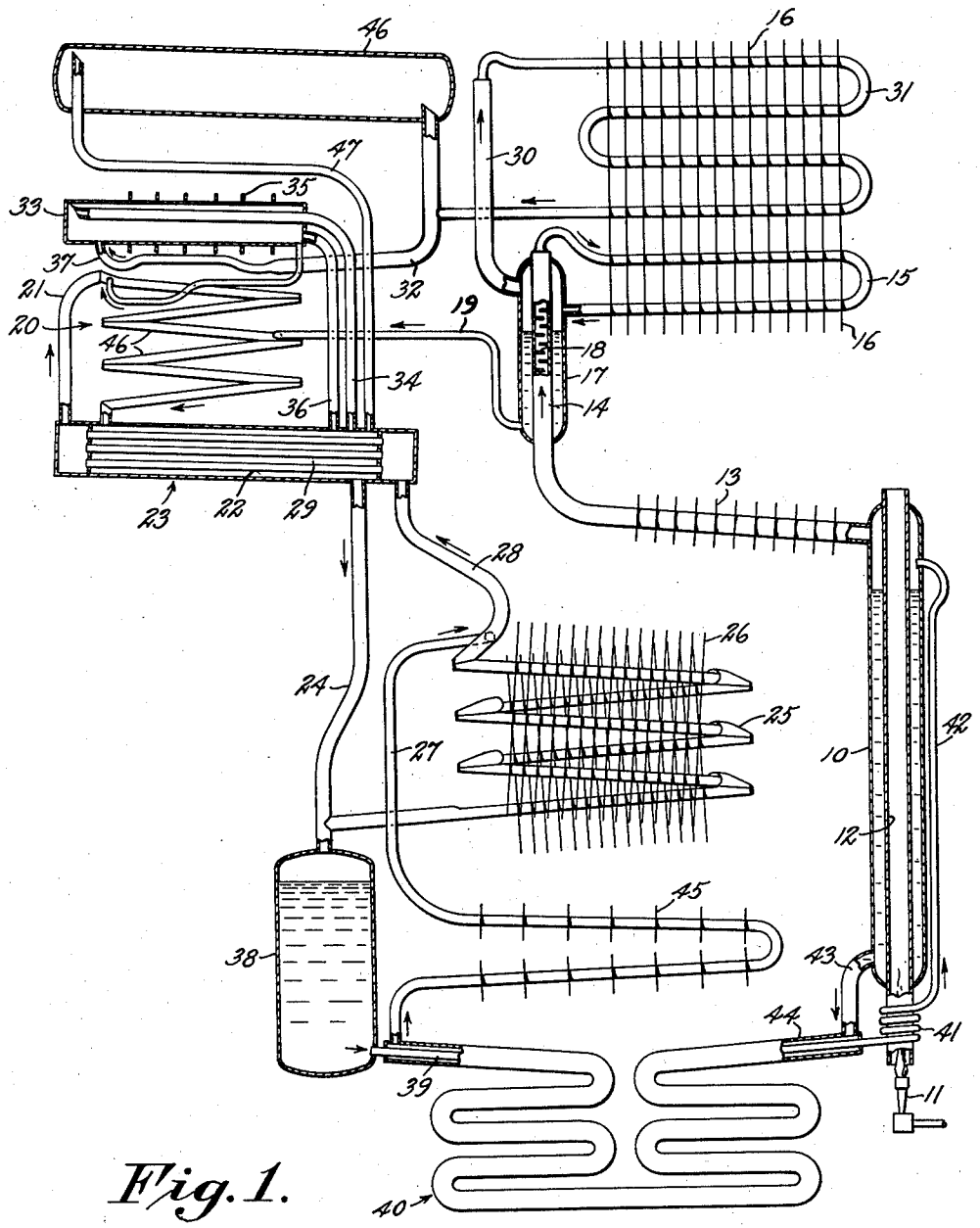


Fig. 1.

INVENTOR.

By Karl Georg Ehnbom

BY E A Alexander

his ATTORNEY.

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REFRIGERATION

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Fig. 2.

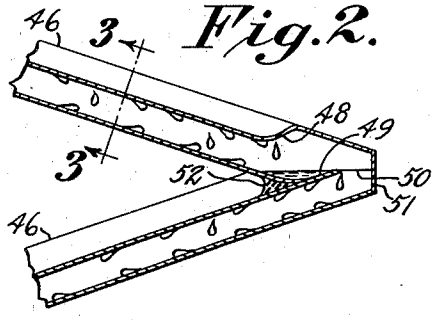


Fig. 3.



Fig. 5.

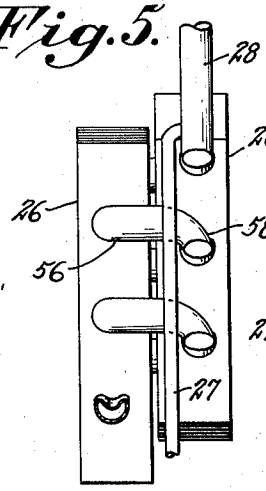


Fig. 4.

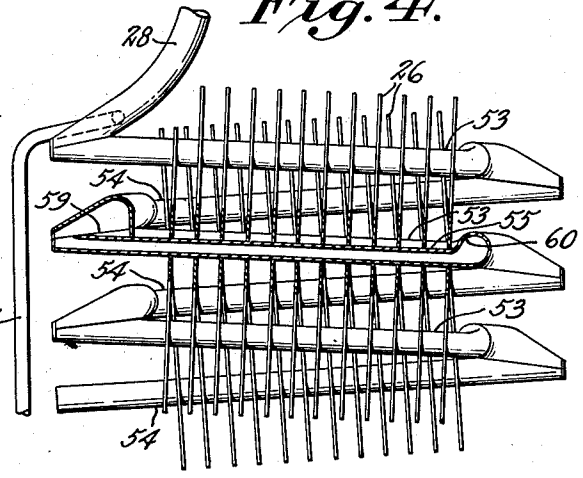
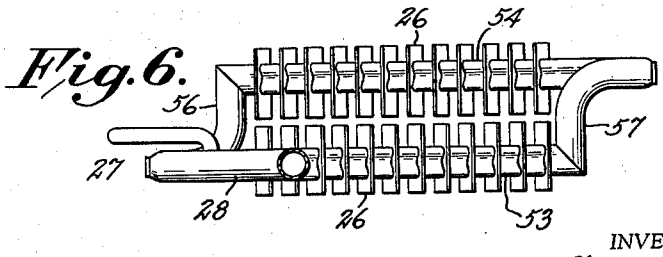


Fig. 6.



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REFRIGERATION

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Fig. 7.

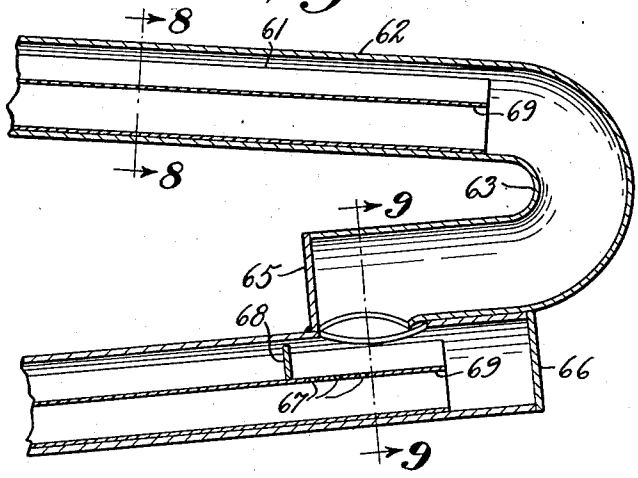


Fig. 8.

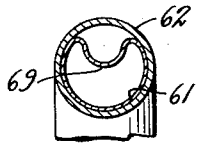


Fig. 9.

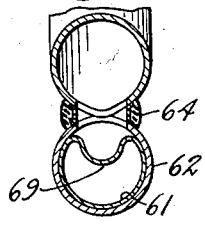
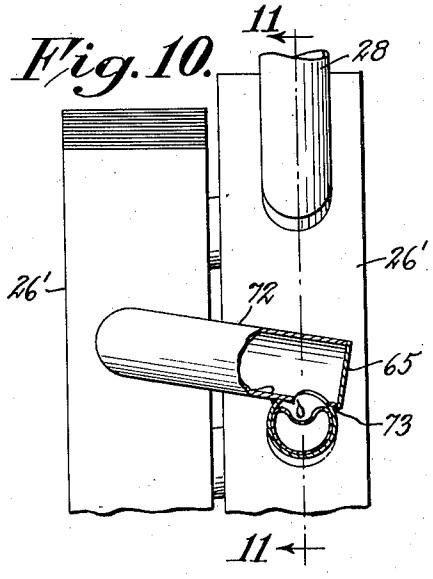


Fig. 10.



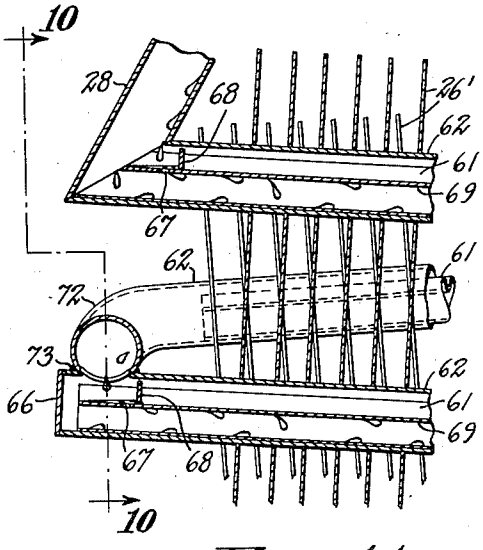


Fig. 11.

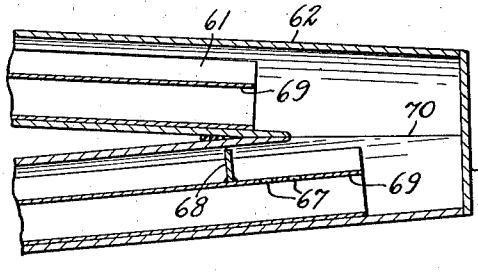


Fig. 12.

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Patented May 10, 1938

2,116,998

UNITED STATES PATENT OFFICE

2,116,998

REFRIGERATION

Bo Karl George Ehnbom, Stockholm, Sweden, assignor, by mesne assignments, to Servel, Inc., New York, N. Y., a corporation of Delaware

Application June 22, 1936, Serial No. 86,596
In Germany June 24, 1935

21 Claims. (Cl. 62—119.5)

My invention relates to refrigeration, and more particularly to absorption refrigeration apparatus containing an auxiliary pressure equalizing gas.

It is an object of my invention to provide an improved structure for refrigeration apparatus in which the surface contact between a gas and a liquid is increased considerably, whereby a reduction in size and weight of refrigeration apparatus is effected. I accomplish this by providing structure including a conduit through which a downward flowing liquid is directed to flow along the top as well as the bottom parts of the inner wall of the conduit, the top part of the inner wall being provided with a surface extending in the direction of flow to which liquid tends to adhere and along which liquid tends to flow.

Further objects and advantages of my invention will become apparent from the following description and accompanying drawings, and the features of novelty which characterize my invention are pointed out with particularity in the claims which form a part of this specification.

In the drawings, Fig. 1 diagrammatically illustrates absorption refrigeration apparatus of the pressure equalized type embodying my invention; Fig. 2 is an enlarged fragmentary sectional view of the evaporator shown in Fig. 1 illustrating more clearly one embodiment of my invention; Fig. 3 is a sectional view taken at line 3—3 of Fig. 2; Fig. 4 is an enlarged side elevation, partly in section, of the absorber shown in Fig. 1 illustrating more clearly a modification of the embodiment shown in Figs. 2 and 3; Figs. 5 and 6 are an end elevation and plan view, respectively, of the embodiment shown in Fig. 4; Fig. 7 is a fragmentary sectional view of another modification of the embodiments shown in Figs. 2 and 4; Figs. 8 and 9 are sectional views taken at lines 8—8 and 9—9, respectively, of Fig. 7; Fig. 10 is a fragmentary end view, taken at line 10—10 of Fig. 11, of a modification of the embodiment shown in Figs. 7 to 9 inclusive; Fig. 11 is a sectional view taken at line 11—11 of Fig. 10; and Fig. 12 is a fragmentary sectional view illustrating a further modification of the embodiment shown in Figs. 7 to 9 inclusive.

Referring to Fig. 1, I have shown my improved gas and liquid contact construction embodied in absorption refrigeration apparatus of the pressure equalized type generally as disclosed in Patent 1,609,334 to von Platen and Munters. The refrigeration apparatus comprises a generator 10 containing a refrigerant in solution in a body of absorption liquid, and, although I do not wish to be limited thereto, the refrigerant and absorption liquid may be ammonia and water, respectively. The generator may be heated in any suitable manner, as by a gas burner 11, which is disposed below the generator and projects its flame into the lower end of a flue 12 which extends vertically upward through the generator.

The heat applied to the generator 10 and its contents expels the ammonia out of solution, and the ammonia vapor thus generated flows upward through an air-cooled rectifier 13 and a conduit 14 to the lower section 15 of an air-cooled condenser comprising a coil provided with a plurality of heat dissipating elements or cooling fins 16. When the surrounding air flowing over the surfaces of the coil and fins is at a sufficiently low temperature, all of the ammonia is liquefied in lower section 15 of the condenser and flows into a jacket 17 which is disposed about a portion of conduit 14 provided with a plurality of distributing plates or baffles 18. The jacket 17 and conduit 14 form a liquid cooled rectifier, and any water vapor which may be carried upward with the ammonia vapor is condensed in the conduit 14 and air-cooled rectifier 13 and drains back to the generator 10.

Liquefied ammonia flows from the jacket 17 through a conduit 19 to the lower part of evaporator section 20 into the upper end of which is introduced an inert gas, such as hydrogen, from a vertically extending conduit 21. The hydrogen and liquid ammonia are in parallel flow or flowing in the same direction in the presence of each other, and the ammonia evaporates and diffuses into the hydrogen with consequent absorption of heat from the surroundings of the evaporator section 20. The resulting gas mixture of ammonia and hydrogen, that is, gas strong in ammonia, flows from the evaporator section 20 through the outer passage 22 of a gas heat exchanger 23 and vertically extending conduit 24 which communicates at its lower end with the lower end of an absorber 25 comprising a coil provided with a plurality of heat dissipating elements or fins 26.

The ammonia is absorbed out of the strong gas mixture into weak absorption liquid which enters the upper part of the absorber 25 through a vertically extending conduit 27. The hydrogen, which is practically insoluble and weak in ammonia, passes upwardly from the absorber 25 through conduit 28, a plurality of parallel tubes 29 which form the inner passage of the gas heat exchanger 23, and conduit 21 into the evaporator section 20. The gas heat exchanger 23 transfers

heat from the weak gas flowing toward the evaporator section 20 to the strong gas flowing to the absorber 25.

When the temperature of the surroundings is not sufficiently low to liquefy all of the ammonia vapor in the lower section 15 of the condenser, the ammonia vapor flowing into the jacket 17 passes through a conduit 30 into an upper section 31 of the condenser which also comprises a coil to which the fins 16 are secured. The ammonia vapor liquefied in the upper section 31 of the condenser by the surrounding cooler air flows through a conduit 32 into an evaporator section 33, the lower portion of the conduit 32 being substantially U-shaped to prevent gas in the evaporator from entering the condenser. Strong gas from the outer passage 22 of the gas heat exchanger 23 flows upwardly through a vertically extending conduit 34 into the evaporator section 33, and, since the partial vapor pressure of ammonia in the strong gas is less than the vapor pressure of the warm liquid ammonia entering the evaporator, liquid ammonia evaporates and diffuses into the strong gas with consequent absorption of heat from the liquid ammonia and surroundings of the evaporator section 33. The evaporation of ammonia in the evaporator section 33 takes place at a higher temperature than in the evaporator section 20 and may be employed for cooling the storage compartment of a refrigerator cabinet, a plurality of fins 35 being secured to the evaporator section 33 to increase the effective heat transfer surface.

The strong gas into which the liquid ammonia evaporates and diffuses in the evaporator section 33 flows through a downwardly extending conduit 36 back into the outer passage 22 of the gas heat exchanger 23. Due to the fact that the density of the strong gas leaving the evaporator section 33 is greater than that entering the evaporator section, a local circulation of strong gas is set up in the fluid circuit comprising the evaporator section 33, and conduits 34 and 36.

Liquid ammonia that is cooled in the evaporator section 33 flows through a conduit 37 into the upper end of the evaporator section 20. The cooled liquid ammonia evaporates and diffuses into the hydrogen, and, since this evaporation takes place at a lower temperature than in the evaporator section 33, the evaporator section 20 may be employed as a freezing unit. The resulting gas mixture of ammonia and hydrogen, as previously explained, flows into the lower end of the air-cooled absorber 25.

The absorption liquid flowing downward through the absorber 25 in counter-flow to the gas mixture becomes enriched in ammonia by absorption and passes through the lower end of conduit 24 to a vessel 38 which serves as an accumulation vessel for the absorption liquid. From the vessel 38, the strong absorption liquid flows through the inner conduit 39 of a liquid heat exchanger 40 to a coil 41 disposed about the lower end of the flue 12. The strong absorption liquid is raised by thermosiphon action from the coil 41 through conduit 42 into the upper part of the generator 10. The absorption liquid is raised to a higher level in the generator 10 than it is in the absorber 25, and absorption liquid weak in ammonia flows from the lower end of the generator through a conduit 43, outer conduit 44 of the liquid heat exchanger 40, and vertical conduit 27 into the upper end of the absorber 25, the lower end of the conduit 27 being provided with heat dissipating elements or cooling fins 45 to effect additional cooling of weak absorption liquid entering the absorber 25.

In order to vary the total pressure in the refrigeration system just described with changes in air temperature, a vessel 46 for storing hydrogen is provided with the lower part thereof communicating by a conduit 32 with the lower end of the upper section 31 of the condenser. The upper part of vessel 46 is in communication with the gas circuit through conduit 47 which is connected at its lower end to the outer passage 22 of the gas heat exchanger 23. The vessel 46 and conduits 32 and 47 provide a path of flow from the upper section 31 of the condenser to the gas circuit, so that any hydrogen which passes through the section 31 of the condenser can flow to the gas circuit and not be trapped in the condenser. Further, should the air temperature increase so that ammonia is not liquefied in the upper section 31 of the condenser, the ammonia vapor will flow through conduit 32 to displace hydrogen in the vessel 46 and force hydrogen through conduit 47 into the gas circuit. This raises the total pressure in the system, so that an adequate condensing pressure results for the increased air temperature.

In accordance with my invention the evaporator section 20 and absorber 25 of the refrigeration apparatus just described are of such construction that the surface contact between liquid ammonia and gas in the evaporator, and between the absorption liquid and strong gas in the absorber, is increased considerably, whereby a reduction in size and weight of the refrigeration apparatus is effected. The evaporator section 20, referring more particularly to Figs. 1 to 3 inclusive, comprises a coil including a plurality of inclined conduits 46 connected to each other and arranged in the same vertical plane. In order to increase the effective gas and liquid contact surface the top part of each conduit 46 is depressed or indented to form a downwardly curved outer wall portion, as indicated at 47 in Fig. 3. The downwardly curved top wall part does not extend to the extreme lower end of each conduit 46 but is flared or curved upwardly at a point a short distance from the lower end, as indicated at 48, and directly beneath the flared portion 48 at each bend of the coil is formed a shallow vessel 49. To unite the lower and upper ends of adjacent conduits they are formed with oblique ends which are united at 50 and to an end plate 51 in any suitable manner, as by welding, for example. The bottom wall part at the lower end of each conduit 46 is curved, and, with the upper end of the depressed wall part of the conduit directly below it, forms the shallow vessel 49. The seam formed by the wall portions of adjacent conduits about the shallow vessel 49 may be united by welding, as indicated at 52.

By providing the shallow vessels 49 at spaced intervals, that is, at the bends of the coil, the normal downward flow of liquid from the bottom wall part of one conduit directly to the bottom wall part of the succeeding lower conduit is retarded or checked. Although some of the liquid that flows over the edges of the vessels 49 is carried downward by gravity to the bottom wall part of each succeeding lower conduit, a considerable quantity of liquid that flows over the edges of the vessels 49 is directed onto the inner surface of the curved wall portion 47 of the conduits. Due to the inner convex surface provided at the top portion of the conduits 46, liquid directed onto the convex surfaces tends to adhere

thereto and flow along the underside of the top wall portion of the conduits. The liquid directed onto a convex inner surface flows downwardly about the surface until it reaches the lowest part thereof. The surface forces between the liquid and the downwardly inclined convex surfaces are such that the liquid tends to adhere to the surfaces; and the surface forces, together with the force of gravity, effectively move the adhering liquid in the form of drops downwardly along the inclined top surfaces of the conduits 46. By terminating the curved portions 47 a short distance back from the lower ends of the conduits 46, the liquid flowing along the curved top portions 47 drops off at the upwardly flared portions 48 into the shallow vessels 49. In this manner the direction of flow of the liquid is controlled so that the maximum quantity of liquid is directed onto the convex top surfaces of the conduits.

It will be understood from the foregoing that by utilizing the top as well as the bottom surfaces of the conduits 46 the surface contact between a gas and a liquid is greatly increased. In addition to increasing the surface contact between a gas and a liquid, additional advantages are also obtained. In the absorber, for example, the downward flowing absorption liquid becomes heated due to absorption of ammonia from the strong gas, and liquid convection currents cause the warmest absorption liquid to rise. In the liquid flowing along the top convex surface, effective dissipation of heat from the absorption liquid to the surroundings is obtained, because the warmest liquid rises and directly contacts the inner curved surface of the top portions 47 of the conduits 46.

Although there may be a tendency for liquid at the curved ends of ordinary cylindrical tubing to be directed onto the top curved surfaces of the straight portions of a coil, liquid will not adhere to the top concave inner surfaces but will flow downwardly about the inner walls to the bottom of the cylindrical tubing. Referring to Fig. 3, for example, liquid directed onto the concave wall portion indicated at 46' will flow to the bottom part of the conduits 46 in a manner similar to liquid flowing about the inner surface of an ordinary cylindrical coil. However, liquid directed onto the convex shaped portion indicated at 47' will flow downwardly about the depressed top part 47 of the conduits and, as explained above, tend to adhere to and flow along the surface thus provided due to the surface forces between the liquid and the surface.

In the embodiment just described the conduits 46 are arranged one above the other in substantially the same vertical plane. In order to reduce the total height of the apparatus of this character the conduits may be arranged in two substantially parallel planes. Referring to Figs. 1, 4 and 5, the absorber 26 is illustrated as such a modification in which conduits 53 and 54 are divided into two groups and arranged in substantially parallel planes. The conduits 53 and 54 are similar to the conduits 46 and are also depressed or indented in a lengthwise direction, as indicated most clearly at 55 in Fig. 4, to form a curved top wall portion to which liquid tends to adhere and along which the liquid tends to flow. The ends of adjacent conduits 53 and 54 are connected by curved cross conduits 56 and 57, respectively, which are bent downwardly adjacent their discharge ends, as indicated at 58, so that downwardly flowing liquid collects in the shallow vessels 59 formed by the extreme upper ends of the top curved portions of the conduits 53 and 54. The lower ends of the conduits 53 and 54 are flared upwardly, as indicated at 60, to cause liquid flowing along the top curved surfaces to drop to the bottom parts of the cross conduits 56 and 57. The liquid flowing downwardly through the inclined conduits 53 and 54 and the cross conduits 56 and 57 accumulates in the shallow vessels 59 and, in flowing over the edges of these vessels, is directed onto the inner curved top surface portions of the conduits as in the embodiment shown in Figs. 2 and 3 and described above.

In Figs. 7 to 9 inclusive I have illustrated a modification in which conduits or coils 61, similar in section to the conduit 46 shown in Fig. 3, extend within cylindrical conduits or coils 62 so that, in addition to the flow of liquid along the inner top and bottom wall portions of the conduits 61, liquid also flows along the top curved portions of the inner conduits 61 which are spaced from the top parts of the outer conduits 62. The lower end of each outer conduit 62 is curved or bent back upon itself at 63 and secured to the upper end of the succeeding lower outer conduit. This may be accomplished by providing aligned openings in the lower bent ends and upper ends of adjacent conduits and uniting the conduits about the openings by welding, as indicated at 64. To the lower bent end of each conduit and upper end of the conduit secured thereto are fixed end plates 65 and 66, respectively. In order to direct liquid along the inner top convex surfaces of conduits 61, the upper ends of the conduits are provided with a plurality of apertures 67 and a barrier 68 below the apertures. The barrier 68 permits the accumulation of liquid at the upper end of each conduit which partly flows over the extreme upper edge 69 and the top of the barrier 68. Some of the liquid that flows over the extreme upper edge 69 and through the apertures 67 is directed onto the downwardly convex surface portion 69 of the inner conduits 61. With this construction, therefore, liquid flows along three different paths to increase the effective surface contact between a liquid and a gas. The walls of the inner conduits 61 are relatively thin to facilitate the forming of the top indented or depressed portion 69 and, after insertion into the straight portions of the outer conduits 62, are secured therein, as by spot welding, for example.

In Fig. 12, I have illustrated a modification similar to that shown in Figs. 7 to 9 in which portions of the walls at the ends of the outer conduits 62 are cut at an acute angle to their lengthwise direction and united to each other at 70 and to an end plate 71, as by welding, for example.

Instead of arranging the outer conduits 62 in the same vertical plane they may be divided into two groups and arranged in parallel planes to reduce the height of the apparatus. Such a modification is shown in Figs. 10 and 11 which is similar to the modification shown in Figs. 7 and 9 and differs therefrom in that the lower end of each outer conduit 62 is bent transversely or at right angles at 72 and extends to the succeeding lower conduit in the opposite group of conduits. The lower bend ends 72 and the upper ends of an adjacent lower conduit are provided with aligned openings and united about the openings by welding as indicated at 73. The uppermost conduit 62 is connected to the lower end of con-

duit 28 of the refrigeration apparatus, and both groups of conduits are provided with heat dissipating elements or fins 26'.

In view of the foregoing, it will be understood that I have provided an improved gas and liquid contact structure for refrigeration apparatus and, while I have shown and described several embodiments of my invention, such variations and modifications are contemplated as fall within the true spirit and scope of my invention, as pointed out in the following claims.

What is claimed is:

1. Refrigeration apparatus having an inert gas circuit including a conduit having an inlet and outlet at different elevations, said conduit being so constructed and arranged that liquid flowing downward therethrough in the presence of gas is directed to flow along the top as well as the bottom parts thereof, and that adjacent the top part and extending in the direction of flow an inner depending ceiling surface is provided to which liquid tends to adhere and along which liquid tends to flow.

2. In an absorption refrigeration system, a gas heat exchanger, a storage vessel, a conduit extending vertically between said exchanger and said vessel, and an absorber coil having one end connected to said conduit and one end connected to said exchanger for circulation of a gas, a member for introducing absorption liquid into said coil, said coil being so constructed and arranged that liquid flowing downward therethrough in the presence of gas is directed at spaced intervals to flow along the top as well as the bottom parts thereof, and that at the top part and extending in the direction of flow an inner surface convex in section is provided to which liquid tends to adhere and along which liquid tends to flow.

3. Refrigeration apparatus including a generator, a condenser, an evaporator, an absorber, and members connecting the aforementioned parts to form a complete system for circulation of a refrigerant, an absorption liquid and an inert gas, said absorber including a conduit having an inlet and outlet at different elevations, said conduit being so constructed and arranged that absorption liquid flowing downward therethrough in the presence of a gas is directed at spaced intervals to flow along the top as well as the bottom parts thereof, and that at the top part and extending in the direction of flow an inner surface convex in section is provided to which liquid tends to adhere and along which liquid tends to flow.

4. Absorption refrigeration apparatus having an inert gas circuit including a conduit having straight portions and bends and an inlet and outlet at different elevations, a member for introducing liquid in said conduit into the presence of said gas, said conduit being so constructed and arranged that liquid flowing downward therethrough is directed at the bends to flow along the top as well as the bottom parts thereof, and that at the top part of said straight portions and extending in a lengthwise direction an inner surface convex in section is provided to which liquid tends to adhere and along which liquid tends to flow.

5. Absorption refrigeration apparatus having an inert gas circuit including a conduit having straight portions and bends and an inlet and outlet at different elevations, a member for introducing liquid in said conduit into the presence of said gas, at least one of said straight portions being so constructed and arranged that adjacent the top wall thereof and in a lengthwise direction an inward curved surface is provided to which downward flowing liquid tends to adhere and along which liquid tends to flow.

6. Absorption refrigeration apparatus having an inert gas circuit including a conduit having straight portions and bends and an inlet and outlet at different elevations, a member for introducing a liquid in said conduit into the presence of said gas, at least one of said straight portions being indented or depressed at the top wall part thereof in a lengthwise direction to provide an inner curved surface convex in section to which downward flowing liquid tends to adhere and along which liquid tends to flow.

7. In an absorption refrigeration system, a gas heat exchanger, a storage vessel, a conduit extending vertically between said exchanger and said vessel, and an absorber coil having one end connected to said conduit and one end connected to said absorber, said coil having downward inclined straight portions and bends, a member for introducing absorption liquid into said coil, and a shallow vessel formed at at least one of the bends for collecting liquid flowing downward through said coil and for causing liquid to flow along the top as well as the bottom parts of one of said straight portions, said straight portion below said vessel being so constructed and arranged that at the top part thereof and in a lengthwise direction an inner surface convex in section is provided to which liquid tends to adhere and along which liquid tends to flow.

8. Refrigeration apparatus having an inert gas circuit including a conduit having downward inclined straight portions and bends and an inlet and outlet, and shallow vessels formed at the bends for collecting liquid flowing downward through said conduit in the presence of a gas and for causing liquid to flow along the top as well as the bottom parts of said straight portions, said straight portions being so constructed and arranged that adjacent the top part thereof in a lengthwise direction an inner surface convex in section is provided to which liquid tends to adhere and along which liquid tends to flow, said convex surface terminating in said straight portions at a region substantially above the shallow vessels formed at said bends.

9. Absorption refrigeration apparatus having an inert gas circuit including a conduit having downward inclined straight portions and bends, a member for introducing liquid in said conduit into the presence of said gas, and shallow vessels formed at the bends for collecting liquid flowing downward through said conduit and for causing liquid to flow along the top as well as the bottom parts of said straight portions, said straight portions being so constructed and arranged that at the top part thereof and in a lengthwise direction an inner surface convex in section is provided to which liquid tends to adhere and along which liquid tends to flow.

10. An absorber for a refrigeration system utilizing inert gas including a conduit having downward inclined straight portions and bends, a member for introducing absorption liquid into said conduit, and shallow vessels formed at the bends for collecting liquid flowing downward through said conduit and for causing liquid to flow along the top as well as the bottom parts of said straight portions, said straight portions being indented or depressed at the top wall part thereof in a lengthwise direction to provide an

inner curved surface convex in section to which downward flowing liquid tends to adhere and along which liquid tends to flow, said convex surface terminating in said straight portions at a region substantially above the shallow vessels formed at said bends.

11. An evaporator for an absorption refrigeration system utilizing inert gas including a conduit having straight portions and bends and an inlet and outlet at different elevations, a member for introducing liquid refrigerant into said conduit, at least one of said straight portions being so constructed and arranged that adjacent the top wall part thereof and in a lengthwise direction an inward curved surface is provided to which downward flowing liquid tends to adhere and along which liquid tends to flow.

12. Absorption refrigeration apparatus having a circuit for gas including a conduit having a depending ceiling for continuous downward flow of liquid therethrough in the presence of said gas along the top as well as the bottom parts thereof, means for introducing liquid into said conduit, and means to direct flow of liquid onto a top part of the conduit.

13. Refrigeration apparatus having an inert gas circuit including a conduit having straight portions and bends and an inlet and outlet at different elevations, said straight portions being divided into two groups in substantially parallel planes, and at least one of said straight portions being so constructed and arranged that at the top wall part thereof and in a lengthwise direction an inward curved surface is provided to which downward flowing liquid tends to adhere and along which liquid tends to flow.

14. Absorption refrigeration apparatus having an inert gas circuit including a conduit having straight portions and bends and an inlet and outlet at different elevations, a member for introducing liquid in said conduit into the presence of said gas, said straight portions being divided into two groups in substantially parallel planes, at least one of said straight portions being so constructed and arranged that at the top wall part thereof and in a lengthwise direction a surface convex in section is provided to which downward flowing liquid tends to adhere and along which liquid tends to flow, and a shallow vessel at a bend for collecting liquid flowing downward through said conduit and for directing liquid onto the convex surface of said straight portion.

15. Absorption refrigeration apparatus having an inert gas circuit including a conduit having an inlet and outlet at different elevations, a member for introducing liquid in said conduit into the presence of said gas, said conduit comprising an outer hollow member and inner hollow member extending therein, the top part of said inner member being spaced from the top part of said outer member and having a depending ceiling to which downward flowing liquid tends to adhere and along which liquid tends to flow.

16. Absorption refrigeration apparatus having an inert gas circuit including a conduit having an inlet and outlet at different elevations, a member for introducing liquid in said conduit into the presence of said gas, said conduit comprising an outer hollow member and inner hollow member extending therein, said inner member being indented or depressed at the top wall part thereof in a lengthwise direction to provide an inward curved surface to which downward flowing liquid tends to adhere and along which liquid tends to flow, and means to direct flow of liquid onto the inward curved surface of said inner member.

17. Absorption refrigeration apparatus having an inert gas circuit including a coil having inclined straight portions and bends and an inlet and outlet at different elevations, a member for introducing liquid in said coil into the presence of said gas, at least one of said straight portions comprising an outer conduit and inner conduit extending therein, the top part of said inner conduit being spaced from the top part of said outer conduit and being so constructed and arranged that a surface convex in section and extending in a lengthwise direction is provided to which downward flowing liquid tends to adhere and along which liquid tends to flow, and a barrier at the upper end of said inner conduit adjacent a bend for retarding the normal downward flow of liquid and for directing liquid onto the curved convex surface of said inner conduit.

18. Absorption refrigeration apparatus having an inert gas circuit including a coil having straight portions and bends and an inlet and outlet at different elevations, a member for introducing liquid into said coil into the presence of said gas, at least one of said straight portions comprising an outer conduit and inner conduit extending therein, the top part of said inner conduit being spaced from the top part of said outer conduit and having a curved inner surface convex in section and extending in a lengthwise direction to which liquid tends to adhere and along which liquid tends to flow, and a barrier at the top part of said inner conduit adjacent a bend for retarding the normal downward flow of liquid, said inner conduit having an opening in the top part thereof above said barrier.

19. Absorption refrigeration apparatus having an inert gas circuit including a coil having straight portions and bends and an inlet and outlet at different elevations, a member for introducing liquid in said coil into the presence of said gas, said straight portions being divided into two groups in substantially parallel planes, at least one of said straight portions comprising an outer conduit and inner conduit extending therein, the top part of said inner conduit being spaced from the top part of said outer conduit with said inner conduit being so constructed and arranged that at the top part thereof and in a lengthwise direction a curved surface is provided to which liquid tends to adhere and along which liquid tends to flow.

20. Absorption refrigeration apparatus having an inert gas circuit including a coil having straight portions and bends and an inlet and outlet at different elevations, a member for introducing liquid in said coil into the presence of said gas, said straight portions being divided into two groups in substantially parallel planes, at least one of said straight portions comprising an outer conduit and inner conduit extending therein, the top part of said inner conduit being indented or depressed at the top wall part thereof in a lengthwise direction to provide an inner curved surface convex in section to which liquid tends to adhere and along which liquid tends to flow.

21. Absorption refrigeration apparatus having an inert gas circuit including a coil having straight portions and bends and an inlet and outlet at different elevations, a member for introducing liquid in said coil into the presence of

said gas, said straight portions being divided into two groups in substantially parallel planes at least one of said straight portions comprising an outer conduit and inner conduit extending therein, the top part of said inner conduit being indented or depressed at the top wall part thereof in a lengthwise direction to provide an inner curved surface convex in section to which liquid tends to adhere and along which liquid tends to flow, a shallow vessel at a bend for collecting downward flowing liquid and for directing liquid onto the inner convex surface of said inner conduit.

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