Nov. 3, 1936. W. G. KÖGEL 2,059,877

REFRIGERATION

Filed July 3, 1934 3 Sheets-Sheet 1

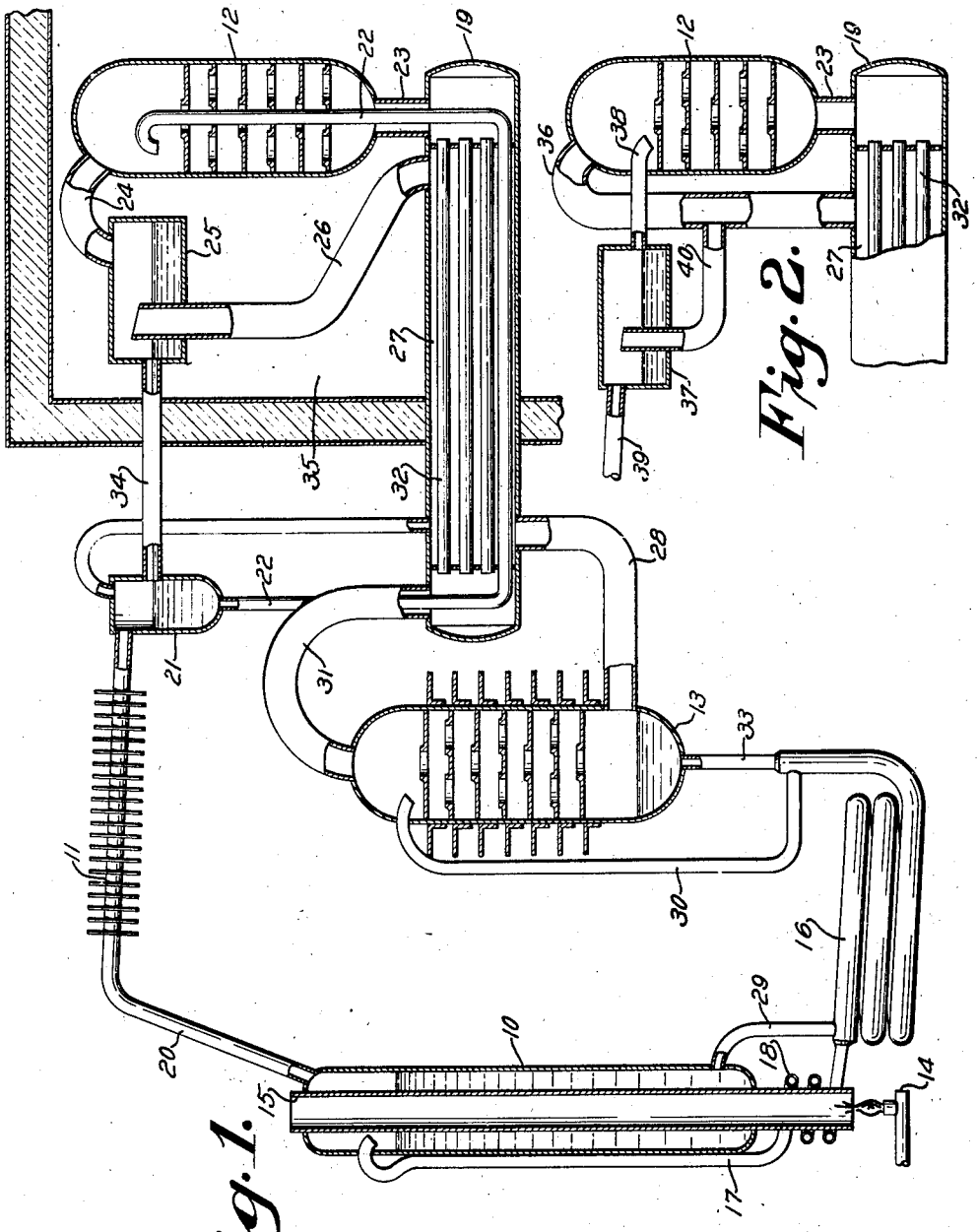


Fig. 1.

Fig. 2.

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REFRIGERATION

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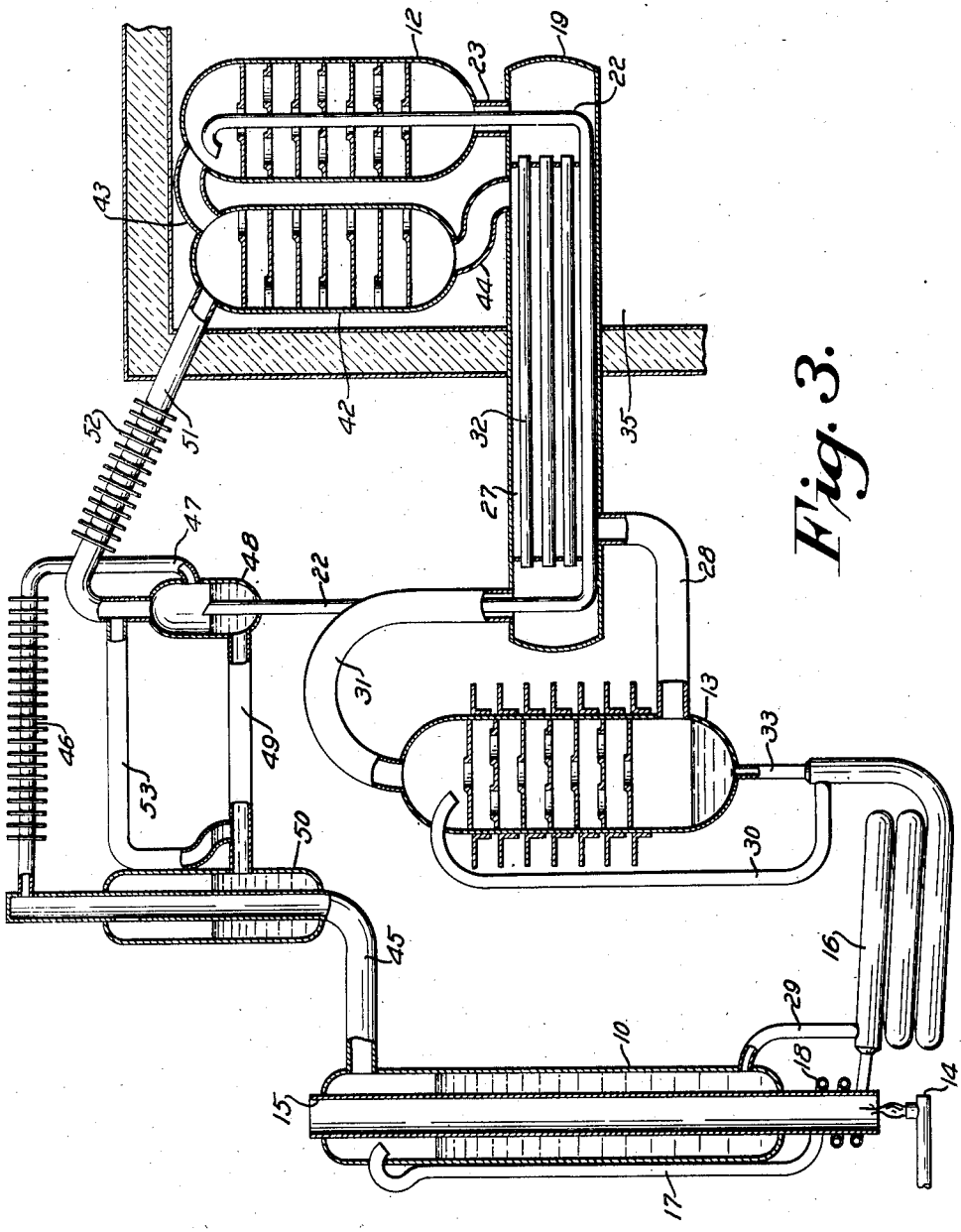


Fig. 3.

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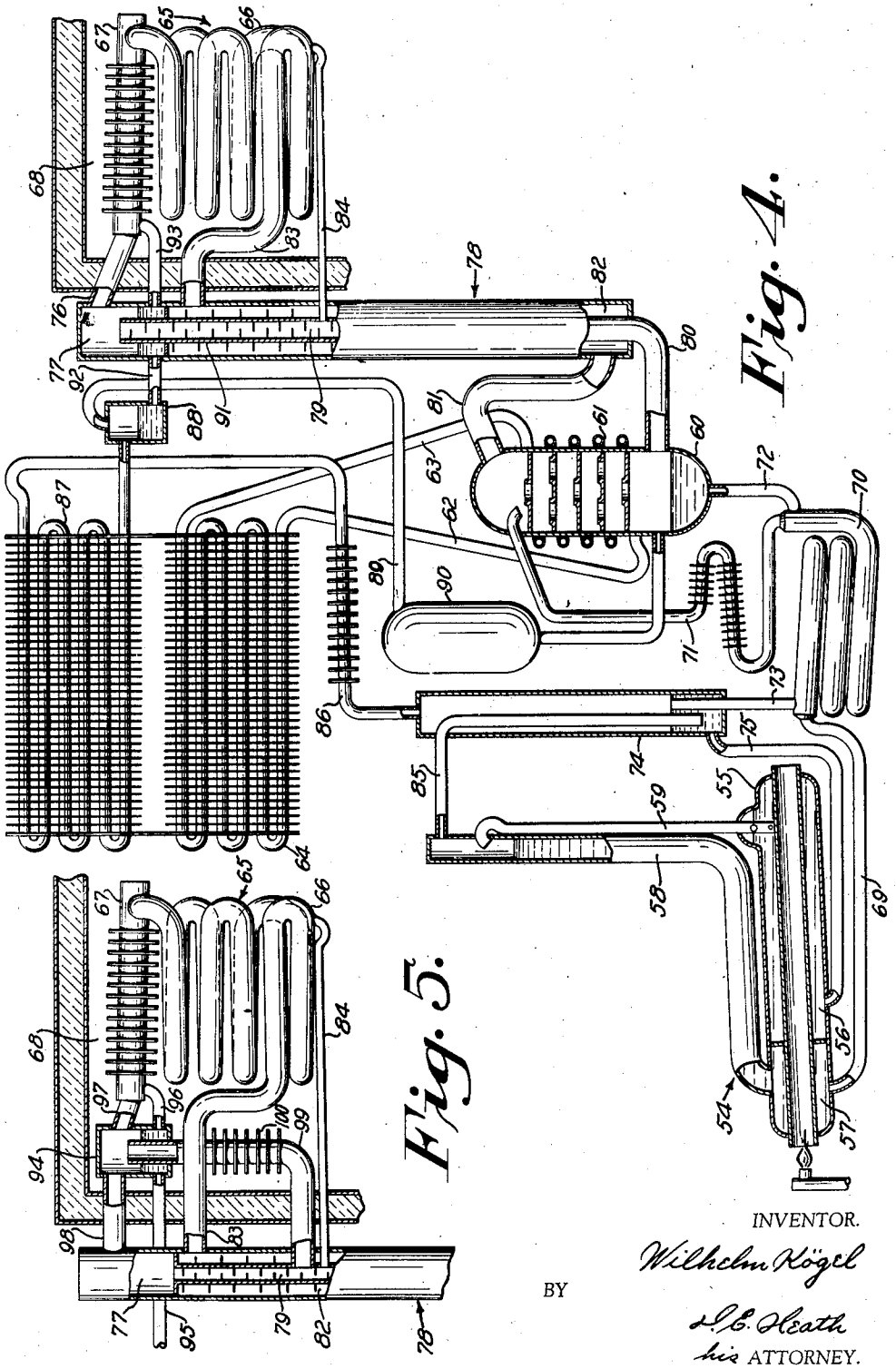


Fig. 4.

Fig. 5.

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Patented Nov. 3, 1936 2,059,877

UNITED STATES PATENT OFFICE

2,059,877

REFRIGERATION

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Application July 3, 1934, Serial No. 733,573
In Germany July 15, 1933

19 Claims. (Cl. 62—119.5)

My invention relates to refrigeration and more particularly to production of refrigeration by evaporation and diffusion of refrigerant fluid into an auxiliary inert gas.

In refrigerating systems of this type, it is advantageous to conduct liquid refrigerant by gravity into the presence of the inert gas and in counterflow thereto. It has therefore been proposed to flow the inert gas upwardly in the evaporator or cooling element. When the refrigerant used is of greater specific gravity than the inert gas and differences in specific gravity are utilized to cause the gas flow, the column of gas in the evaporator tends to exert a downward force, which, in the case of the desired upward flow in the evaporator, opposes the gas circulation. The effect of this opposite force is greatest at starting and renders the direction of gas flow at that time uncertain.

It is an object of my invention to provide a refrigeration system of this type in which the gas flow is initiated in the desired direction and thereafter aided in the same direction. Another object is to provide such a system operable to produce cooling simultaneously at a plurality of temperatures and therefore advantageous for refrigerators requiring both a freezing temperature and a higher food preserving temperature.

In accordance with my invention, I obtain the above objects by providing a member or second evaporator in a downward path of flow of the gas from the usual low temperature evaporator, and conduct refrigerant liquid to the latter through the second evaporator, whereby, on starting, the liquid reaches the additional evaporator first and creates a column of descending gas and refrigerant vapor which is heavier than the purer gas, thus creating a circulating force in the desired direction before the above mentioned opposing force is developed. In its broad aspects, my invention resides in initially evaporating refrigerant into a desired descending column of gas prior to evaporation of refrigeration into an ascending column of gas, to exert an unopposed force for initiating gas circulation in the desired direction, and also, preferably, continuing the evaporation into the column of descending gas, which follows the ascending column in the direction of gas flow, to produce refrigeration at a higher temperature than that produced by the evaporation of refrigerant into the column of ascending gas. The temperature difference is due to the difference in partial pressures of the refrigerant in the two columns of gas.

My invention, together with the objects and advantages thereof, will be more fully understood from consideration of the following description and the accompanying drawings forming part of this specification, and of which:

Fig. 1 shows schematically a refrigeration system embodying my invention;

Fig. 2 is a partial view of a system shown in Fig. 1 and illustrating a modification of my invention;

Fig. 3 is a view similar to that of Fig. 1 and illustrating a further modification of my invention;

Fig. 4 is a more or less schematic view of a refrigeration system comprising a modification of that shown in Figs. 1 and 3 and embodying one form of my invention; and

Fig. 5 is a partial view illustrating a modification of my invention embodied in an apparatus like that in Fig. 4.

I shall point out the principle of my invention in connection with the embodiment illustrated in Fig. 1 of the drawings and thereafter direct attention to the variations encountered in the several modifications illustrated in Figs. 2 through 5. Referring then to Fig. 1, the refrigeration system illustrated is generaly of the nature of a system disclosed in Patent 1,609,334 to Von Plat, et al., to which reference may be had for a complete understanding of the operation. Briefly, however the refrigeration system includes as essential parts a generator 10, a condenser 11, an evaporator 12, and an absorber 13. The generator 10 is heated in any suitable manner as, for instance, by a gas burner 14 so arranged that the burner flame projects into the lower end of a heating flue 15 which extends vertically through the generator 10. The absorber 13 and condenser 11 may be cooled in any desired manner as, for instance, by air, both of these parts being shown provided with heat radiation fins for this purpose. The absorber 13 and the generator 10 are interconnected through a liquid-heat exchanger 16 for circulation therebetween of absorption liquid, the liquid circulation being caused by thermosiphonic action in a thermosiphon conduit 17 having its lower end formed as a coil 18 around the lower end of the heating flue 15 and in thermal exchange relation therewith. The evaporator 12 and the absorber 13 are interconnected through a gas heat exchanger 19 for circulation of gas therebetween as hereinafter described. The condenser 11 is connected to receive vapor from the generator 10 and deliver liquid to the evaporator 12 in a

manner hereinafter described. The system is charged, for instance, through a charging plug, not shown, on the absorber 13, with a suitable solution of refrigerant fluid in an absorption liquid, such as a water solution of ammonia, and an inert pressure equalizing gas, such as hydrogen. The hydrogen is admitted into the system at a pressure corresponding to the condensing pressure of ammonia at a predetermined temperature which is preferably a high room temperature in the case of air cooling.

In operation, ammonia vapor is expelled from solution in the generator 10 by heating and flows through conduit 20 into the condenser 11. In the latter, the ammonia is condensed to liquid which drains from the condenser into a collecting vessel 21. From the lower part of the vessel 21, the liquid ammonia flows through a conduit 22 to the upper part of the evaporator 12. The conduit 22 is formed as a liquid trap comprising a downward loop and extends through the gas heat exchanger 19 and upwardly within the evaporator 12 for precooling of the ammonia from the condenser temperature downwardly toward the evaporator temperature, as well known in the art.

In the evaporator 12, ammonia evaporates and diffuses into the hydrogen which enters the lower part of the evaporator through conduit 23. The resulting gas mixture or "strong gas" flows from the upper part of the evaporator 12 through a conduit 24, a receiver 25, a conduit 26, the outer space 27 of the gas heat exchanger 19, and conduit 28 to the lower part of the absorber 13. Absorption solution from which ammonia has been expelled by heating in the generator 10 may be referred to as "weak" solution, and flows from the lower part of the generator through conduit 29, the liquid heat exchanger 16 and conduit 30 into the upper part of the absorber 13. In the absorber, ammonia is dissolved out of the strong gas into the weak solution. The resulting "weak gas" flows from the upper part of the absorber 13 through conduit 31, the inner passages 32 of the gas heat exchanger 19, and conduit 23 back to the lower part of the evaporator 12, thus completing the gas circuit. Enriched absorption solution flows from the lower part of the absorber 13 through a conduit 33, the liquid heat exchanger 16, and the thermosiphon element 17 into the upper part of the generator 12, thus completing the absorption liquid circuit.

The above described circulation of gas between the absorber 13 and evaporator 12 takes place after the system has been in operation for an appreciable length of time and is caused principally by the action in the absorber 13 which creates a rising column of gas flowing from the absorber to the evaporator which is lighter than the descending column of gas flowing from the evaporator to the absorber. However, at starting, evaporation of ammonia into the hydrogen in the evaporator 12 creates a partial column of strong gas which is heavier than the hydrogen or weak gas and tends to oppose or at least make uncertain the desired upward flow of gas in the evaporator. I therefore provide the above-mentioned receiver 25 in the path of flow of gas from the upper part of the evaporator to the lower part of the absorber and provide a conduit 34, connecting the receiver 25 with the vessel 21 so that the lower part of the receiver 25 receives liquid ammonia. The upper end of conduit 26 opens into the receiver 25 above the liquid level therein which is determined by the overflow level at the upper end of conduit 22 in the evaporator 12. I preferably arrange the connecting points of conduit 34 with the vessel 21 and receiver 25 with respect to the upper end of the conduit 22 in the evaporator 12 so that, at starting, liquid ammonia from the condenser 11 flows from the vessel 21 through conduit 34 into the receiver 25 just prior to overflow of liquid ammonia from the upper end of conduit 22 in the evaporator 12. With this arrangement, ammonia in the receiver 25 evaporates into the hydrogen in the upper part of this receiver, forming a heavier gas mixture which descends through conduit 26 toward the absorber and starts the circulation of gas in the desired direction prior to or coincidentally with formation of the above-mentioned heavier gas column in the evaporator 12 which is created upon evaporation of the ammonia into the hydrogen. In effect, a column of strong gas is created in conduit 26 which at least balances the column of gas in the evaporator 12 whereby the gas circulation is created in the desired direction by the action in the absorber 13. In operation, the column of gas in conduit 26 is heavier than the column of gas in the evaporator 12 for the reason that ammonia in the receiver 25 may be caused to evaporate into the strong gas flowing from the top of the evaporator through conduit 24 into the receiver 25 at a higher temperature than the evaporation of ammonia into the weak gas in the evaporator 12. Receiver 25 may therefore be referred to as a second evaporator or a high temperature evaporator. The cooling effect of the liquid in the receiver 25 and the gas in conduit 26 may advantageously be used for cooling the air in a refrigerator by locating these elements, along with the low temperature evaporator 12, in a refrigerator storage compartment 35.

Referring now to Fig. 2 of the drawings, there is shown only the evaporator 12 and one end of the gas heat exchanger 19 of a refrigeration system similar to that previously described in connection with Fig. 1 except as follows: In this modification of my invention, I provide a conduit 36 connected from the upper part of the evaporator 12 to the outer passage 27 of the gas heat exchanger 19. A receiver 37 is provided with an overflow conduit 38 into the evaporator 12 and is connected to receive liquid ammonia from the condenser, not shown, through conduit 39. From within the upper part of the vessel 37 and above the liquid level therein as determined by said overflow of conduit 38, I provide a conduit 40 having its other end connected to said conduit 36. The upper part of the receiver 37 is in permanently open gas communication with the upper part of the evaporator 12 through the overflow conduit 38, which latter is arranged so that it is never completely filled with liquid, as shown. If the overflow conduit 38 is otherwise arranged so that it may be filled with liquid, an equalizing conduit should be provided from the upper part of the receiver 37 to the gas circuit.

In operation, liquid ammonia, which enters the receiver 37 from the condenser through conduit 39, evaporates and diffuses into the hydrogen in the upper part of receiver 37, forming a heavier gas mixture which descends through conduit 40 into conduit 36 and thereby creating a column of heavier strong gas in the circuit between the evaporator and absorber as previously described in connection with Fig. 1 to cause circulation in the desired direction, namely upwardly in the evaporator 12. In this modi-

fication also, since the gas in the upper part of the receiver or auxiliary evaporation vessel 37 flows from the upper part of the evaporator 12, the gas flowing through conduit 40 into the conduit 36 is heavier than the gas in the evaporator 12.

In Fig. 3 of the drawings is shown a refrigeration system similar to that previously described in connection with Fig. 1 with the exception that the receiver or evaporation vessel 25 and the conduit 26 described in connection with Fig. 1 are replaced by an evaporator 42 somewhat similar to the evaporator 12, and different means is provided for supplying liquid refrigerant to the second or high temperature evaporator 42. Like parts in Figs. 1 and 3 are indicated by like reference numerals.

The evaporator 42 is connected at its upper portion by a conduit 43 to the upper part of the evaporator 12, and the lower part of the evaporator 42 is connected to the outer passage 27 of the gas heat exchanger 19 by a conduit 44. Both of the evaporators 12 and 42 are located within the insulated storage compartment 35, and the evaporator 42 may be provided with heat radiation fins, not shown, for cooling the air in the compartment 35 while the evaporator 12 may be provided, as well known in the art, with a recessed casting or other means for receiving trays containing water or other substance to be frozen. It will be understood that the evaporator 12 illustrated in Figs. 1, 2 and 3 and the evaporator 42 illustrated in Fig. 3 need not be of the type illustrated but may be of any suitable type such as the coil type evaporator illustrated in Fig. 4.

From the upper part of the generator 10, vapor flows through a conduit 45 to a condenser 46. In the latter, the refrigerant vapor is condensed to liquid which flows through a conduit 47 to a collecting vessel 48. The latter is connected by a conduit 49 to a rectifier jacket 50 around the vapor conduit 45 so that the rectifier jacket 50 contains liquid refrigerant to the same level as that in the collecting vessel 48. The liquid level in the collecting vessel 48 is determined by the overflow conduit 22 which extends through the gas heat exchanger 19 into the upper part of the evaporator 12 as previously described in connection with Fig. 1. The upper part of the collecting vessel 48 is connected to the upper part of the evaporator 42 by a conduit 51. The conduit 51 is provided with heat radiation fins 52 or any other suitable cooling means, forming a condenser. A conduit 53 is connected at one end to the conduit 49 and at the other end to the conduit 52, and extends in thermal conductive relation with the rectifier jacket 50, as shown. Liquid refrigerant also stands in conduit 53 to the same level as that in the collecting vessel 48 and the rectifier jacket 50. Due to said thermal association with the rectifier jacket 50, refrigerant vapor is formed in conduit 53 and flows into conduit 51 in which the vapor is condensed to liquid. This supply of vapor could also be obtained by connecting conduit 53 to the upper part of the rectifier jacket 50 instead of to the conduit 49. Liquid refrigerant formed by condensation in conduit 51 flows into the evaporator 42 where it evaporates and diffuses into the hydrogen or other inert gas, forming a heavier column of gas in the path of flow from the evaporator 12 to the absorber 13, thereby instigating or maintaining gas circulation in the desired direction. During operation of the system, the higher temperature of the evaporator 42 depends upon the partial pressure of refrigerant in the gas which flows from the upper part of the evaporator 12 through conduit 43 into the upper part of the evaporator 42.

Referring now to Fig. 4 of the drawings, the refrigeration system illustrated is similar to that disclosed in an application Serial No. 673,815 of Albert R. Thomas, to which reference may be had for a complete description of construction and operation. Briefly, however, the generator 54 is of a so-called horizontal type comprising a horizonal vessel 55 divided by a partition into a strong liquid chamber 56 and a weak liquid chamber 57. The lower end of a standpipe 58 communicates with the weak liquid chamber 57 and a thermosiphon conduit 59 extends from within the strong liquid chamber 56 into the upper part of the standpipe 58.

In this system, the absorber 60 is cooled by a secondary vaporization-condensation element including a cooling coil 61 arranged in thermal conductive relation around the absorber and connected by conduits 62 and 63 to an air-cooled condenser 64. This absorber cooling element is charged with a suitable refrigerant such as methyl chloride which vaporizes in the coil 61 and condenses in the condenser 64.

The evaporator 65 is of the coil type comprising a lower section 66 suitably arranged for freezing water or the like in so-called ice trays, and an upper section 67 having an extensive heat transfer surface for cooling the air in the thermally insulated storage compartment 68.

This system may be charged similarly to that described in connection with Fig. 1 by sealing in a water solution of ammonia and hydrogen at a pressure corresponding to the condensing pressure of ammonia at a high room temperature. Weak solution flows from the generator 54 through conduit 69, the liquid heat exchanger 70, and conduit 71 to the upper part of the absorber 60, and enriched solution flows from the lower part of the absorber 60 through conduit 72, the liquid heat exchanger 70, conduit 73, the lower part of an analyzer vessel 74, conduit 75, the strong liquid chamber 56, and the thermosiphon element 59 into the upper end of the standpipe 58.

Rich gas flows from the upper part 67 of the evaporator or through conduit 76, chamber 77 in the upper end of a gas heat exchanger 78, the inner passage 79 of the gas heat exchanger, and conduit 80 to the lower part of the absorber 60. Weak gas flows from the upper part of the absorber 60 through conduit 81, the outer passage 82 of the gas heat exchanger 78 and conduit 83 to the lower part 66 of the evaporator. A drain for unevaporated liquid is provided by conduit 84 connected from the lower part of the evaporator to the inner passage 79 of the gas heat exchanger.

Vapor flows from the upper part of the generator standpipe 58 through a conduit 85 into the lower part of the analyzer vessel 74 where it bubbles upwardly through strong solution flowing from the absorber to the generator as previously described. From the upper end of the analyzer vessel 74, the vapor flows through a conduit 86 to the upper end of an air-cooled coil type condenser 87. Liquid ammonia formed in the condenser 87 flows into a collecting vessel 88. The latter is vented to the gas circuit for pressure equalization or return of trapped hy-

drogen by a conduit 89 connected from the upper part of the receiver 88 to the absorber 60. A so-called pressure vessel 90 is connected in the vent conduit 89 for storage of varying quantities of hydrogen depending upon the pressure in the system, as known in the art.

In accordance with my invention, the inner conduit 91 of the gas heat exchanger 78, which separates the inner passage 79 and outer passage 82, is extended upwardly into the chamber 77 at the upper end of the gas heat exchanger. The lower part of the collecting vessel 88 is connected to the lower part of the chamber 77 by a conduit 92 and the lower part of the chamber 77 is connected by an overflow conduit 93 to the upper part 67 of the evaporator 65. Thus, liquid ammonia from the condenser 87 stands in the vessel 88 and the chamber 77 to a level determined by the overflow point of conduit 93 into the evaporator. In chamber 77, ammonia evaporates into the hydrogen, forming a heavier gas mixture which descends through the inner passage 79 of the gas heat exchanger 78 to instigate or maintain the gas circulation between the evaporator 65 and absorber 60 in the desired direction, namely, upwardly through the evaporator 65.

In the modification illustrated in Fig. 5, I provide a receiver 94 corresponding to the receiver 87 illustrated in Fig. 2. The receiver 94 is connected to receive liquid ammonia from the condenser or a collecting vessel through conduit 95 and is provided with an overflow connection 96 to the upper part 67 of the evaporator 65 which is the same as that described in connection with Fig. 4. The upper part of the receiver 94 is connected between the upper part 67 of the evaporator and the chamber 77 of the gas heat exchanger 78 by conduits 97 and 98. From the upper part of the receiver 94, a descending conduit 99 is connected to the inner passage 79 of the gas heat exchanger. The receiver 94 and the conduit 99 are located within the storage chamber 68 of the refrigerator together with the evaporator 65, and the conduit 99 is preferably provided with heat transfer fins 100.

In operation, liquid refrigerant in receiver 94 evaporates into the hydrogen, forming a heavier gas mixture which descends through conduit 99 into the inner passage 79 of the gas heat exchanger 78, thus instigating or maintaining gas circulation in the desired direction, namely, upwardly through the evaporator 65. The receiver 94 and conduit 99 serve in addition to the upper portion 67 of the evaporator 65 to cool the air in the storage compartment 68. If desired, the upper portion 67 of the evaporator may be omitted and the upper end of the lower evaporator section 66 connected directly to the upper part of the receiver 94.

Various other changes and modifications will be readily apparent to one skilled in the art, wherefore my invention is not limited to that which is shown in the drawings or described in the specification but only as indicated in the following claims.

What I claim is:

1. A method of refrigeration which includes expelling refrigerant vapor from solution in an absorbent, condensing the expelled vapor to liquid, conducting the liquid into contact with an inert gas at a first place to cause evaporation of some of the liquid, utilizing the difference in specific gravities of the resulting gas mixture and the purer inert gas to initiate circulation of the inert gas, subsequently conducting the liquid into further contact and counterflow with the circulating gas at a second place in which said gas flows upwardly toward said first place, and absorbing the refrigerant vapor out of the inert gas into the absorbent from which it was previously expelled and at a place in an upward path of flow of the circulating gas.

2. A method of refrigeration which includes expelling refrigerant vapor from solution in an absorbent, condensing the expelled vapor to liquid, conducting the liquid into contact with inert gas in a first evaporator to cause evaporation of some of the liquid, utilizing the difference in specific gravities of the resulting gas mixture and the purer inert gas to initiate circulation of the inert gas, subsequently conducting the liquid into further contact and counterflow with the circulating gas in a second evaporator through which said gas flows upwardly toward said first evaporator, and absorbing the refrigerant vapor out of the inert gas into said absorbent in an absorber through which gas flows upwardly toward said second evaporator.

3. A method of refrigeration which includes distilling refrigerant fluid from solution in a liquid absorbent, circulating inert gas between a place of evaporation and a place of absorption, each of said places being in a rising path of flow of said gas, circulating liquid absorbent downwardly through said place of absorption, and conducting distilled refrigerant liquid into the presence of said inert gas first in a descending path of flow of said gas and then downwardly in said place of evaporation.

4. A method of refrigeration which includes distilling refrigerant fluid from solution in a liquid absorbent, circulating inert gas between an evaporator and an absorber, each being in a rising path of flow of said gas, flowing liquid absorbent downwardly through said absorber, and conducting distilled refrigerant liquid first into a second evaporator in a descending path of flow of said gas and then into said first evaporator.

5. A method of refrigeration which includes circulating inert gas between an evaporator and an absorber, each being in a rising path of flow of said gas, conducting refrigerant liquid first into a second evaporator in a descending path of flow of said gas and then into said first evaporator, and flowing liquid absorbent through said absorber.

6. Refrigeration apparatus including a cooling element comprising a first member adapted for upward flow of gas and downward flow of liquid therethrough and a second member adapted for downward flow of gas and communicating at its upper end with the upper end of said first member, an absorber interconnected with said cooling element for circulation of inert gas therebetween, a generator interconnected with said absorber for circulation of absorption liquid therebetween, a condenser connected to receive refrigerant vapor expelled from solution in the absorption liquid in said generator, a receiver for liquid in open communication with the second member of said cooling element, an overflow connection for liquid from said receiver to the upper part of the first member of said cooling element and a conduit for liquid from said condenser to said receiver.

7. In a refrigerator, a thermally insulated storage compartment, a cooling element in said

compartment comprising a pipe coil adapted for upward flow of gas and downward flow of liquid therethrough, a second cooling element in said compartment comprising a descending conduit for gas and communicating at its upper end with the upper end of said pipe coil, an absorber interconnected with said cooling elements for circulation of inert gas therethrough in series, a generator interconnected with said absorber for circulation of absorption liquid therebetween, a condenser connected to receive refrigerant vapor expelled from solution in the absorption liquid in said generator, a receiver for liquid in open communication with said second cooling element, an overflow connection for liquid from said receiver to the upper part of said first cooling element, and a conduit for liquid from said condenser to said receiver.

8. In a refrigerator, a thermally insulated storage compartment, a cooling element in said compartment adapted for upward flow of gas and downward flow of liquid therethrough, a second cooling element in said compartment adapted for downward flow of gas and communicating at its upper end with the upper end of said first cooling element, an absorber interconnected with said cooling elements for circulation of inert gas therethrough in series, a generator interconnected with said absorber for circulation of absorption liquid therebetween, a condenser connected to receive refrigerant vapor expelled from solution in the absorption liquid in said generator, a receiver for liquid in open communication with said second cooling element, an overflow connection for liquid from said receiver to the upper part of said first cooling element, and a conduit for liquid from said condenser to said receiver.

9. In a refrigerator, a thermally insulated storage compartment, a cooling element in said compartment comprising a pipe coil adapted for upward flow of gas and downward flow of liquid therethrough, a descending conduit for gas communicating at its upper end with the upper end of said pipe coil, an absorber interconnected with said cooling element and said descending conduit for circulation of inert gas therethrough in series, a generator interconnected with said absorber for circulation of absorption liquid therebetween, a condenser connected to receive refrigerant vapor expelled from solution in the absorption liquid in said generator, a receiver for liquid in open communication with said descending conduit, an overflow connection for liquid from said receiver to the upper part of said cooling element, and a conduit for liquid from said condenser to said receiver.

10. In a refrigerator, a thermally insulated storage compartment, a cooling element in said compartment comprising a pipe coil adapted for upward flow of gas and downward flow of liquid therethrough and a descending conduit for gas communicating at its upper end with the upper end of said pipe coil, an absorber interconnected with said cooling element for circulation of inert gas therebetween, a generator interconnected with said absorber for circulation of absorption liquid therebetween, a condenser connected to receive refrigerant vapor expelled from solution in the absorption liquid in said generator, a receiver for liquid in open communication with the upper end of the descending conduit of said cooling element, an overflow connection for liquid from said receiver to the upper part of the pipe coil of said cooling element, and a conduit for liquid from said condenser to said receiver.

11. Refrigeration apparatus including a cooling element adapted for upward flow of gas and downward flow of liquid therethrough, a member adapted for downward flow of gas and communicating at its upper end with the upper end of said cooling element, an absorber interconnected with said cooling element and said member for circulation of inert gas therethrough in series, a generator interconnected with said absorber for circulation of absorption liquid therebetween, a condenser connected to receive refrigerant vapor expelled from solution in the absorption liquid in said generator, a receiver for liquid in open communication with said member, an overflow connection for liquid from said receiver to the upper part of said cooling element, and a conduit for liquid from said condenser to said receiver.

12. In an absorption refrigeration system, a plurality of evaporators and an absorber interconnected for circulation of gas therethrough in series, one of said evaporators providing a rising path of flow for said gas and another of said evaporators providing a descending path of flow for said gas, means for supplying refrigerant liquid to said second evaporator, and means for conducting liquid from said second evaporator to said first evaporator.

13. In an absorption refrigeration system, an evaporator and an absorber interconnected for circulation of gas therebetween and upwardly through each, a member forming a descending path for flow of gas from said evaporator, and means including said member for conducting liquid refrigerant to said evaporator, the liquid being brought into contact with gas in said member.

14. In an absorption refrigeration system, an evaporator and an absorber interconnected for circulation of gas therebetween and upwardly through each, a member forming a descending path in the flow of gas from said evaporator, and means for initially supplying liquid refrigerant to said member prior to entrance of liquid refrigerant into said evaporator.

15. An absorption refrigeration system including an evaporator and an absorber interconnected for circulation of gas therebetween and upwardly through each, and means for conducting liquid refrigerant to said evaporator in contact with said gas in a downward path of flow of the latter from said evaporator.

16. In an absorption refrigeration system, a cooling element and an absorber interconnected for circulation of gas therebetween, said cooling element providing alternate up and down paths of flow for said gas in series, and means for conducting liquid refrigerant into the presence of gas in said cooling element, first in one of said down paths and then in a preceding up path.

17. In a method of refrigeration which includes the steps of evaporating and diffusing liquid refrigerant into an auxiliary inert gas, absorbing refrigerant vapor out of the inert gas, and utilizing the difference in specific gravity of the gas mixture to initiate and maintain circulation of the inert gas, that improvement which consists in bringing the liquid into contact with the gas at a place in an upward path of flow of the gas, and conducting the liquid to said place in a path which brings it first into contact with the gas in a downward path of flow thereof.

18. In a method of refrigeration which includes

the steps of evaporating and diffusing liquid refrigerant into inert gas, absorbing refrigerant vapor out of the gas and utilizing the difference in specific gravity of the mixture to cause circulation of the gas, that improvement which consists in conducting liquid refrigerant into contact with the gas at several places so that it arrives at one place prior in time to reaching a second place, said places being arranged so that circulation of the gas with upward flow at said second place is initiated and maintained by evaporation of liquid at said first place.

19. In a method of refrigeration which includes the steps of evaporating and diffusing refrigerant liquid into inert gas and absorbing refrigerant vapor out of the gas at several places of evaporation and absorption, that improvement which consists in utilizing difference in specific gravity of the mixture to cause circulation of the gas with the same vertical direction of flow in said places of evaporation and absorption, and conducting liquid refrigerant to said place or places of evaporation in such a manner that it first reaches a further place of evaporation in contact with the gas where the gas flow is in a vertical direction opposite to that in said place or places of absorption.

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