Oct. 9, 1934. E. ALTENKIRCH 1,976,593

ABSORPTION APPARATUS

Filed April 13, 1926 5 Sheets-Sheet 1

Fig. 1.

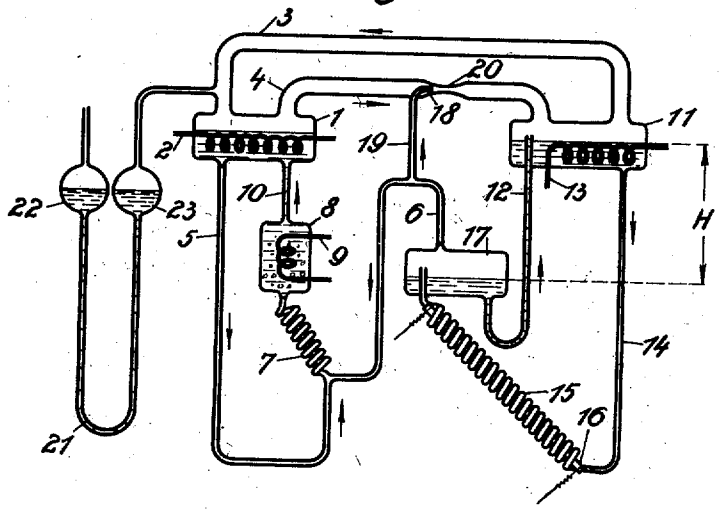
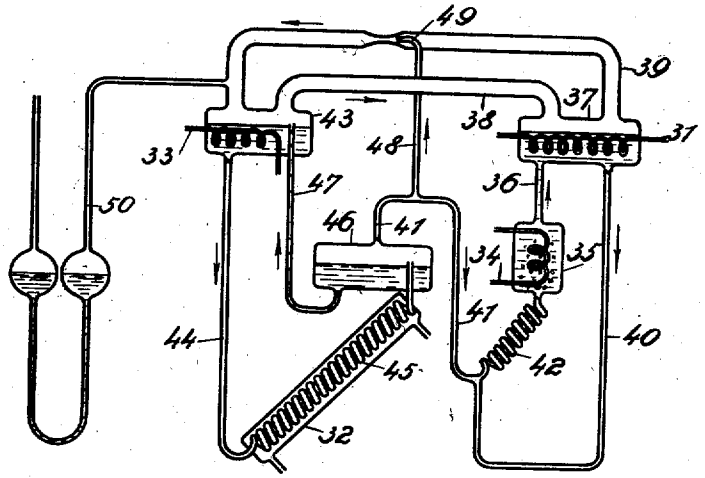


Fig. 15.



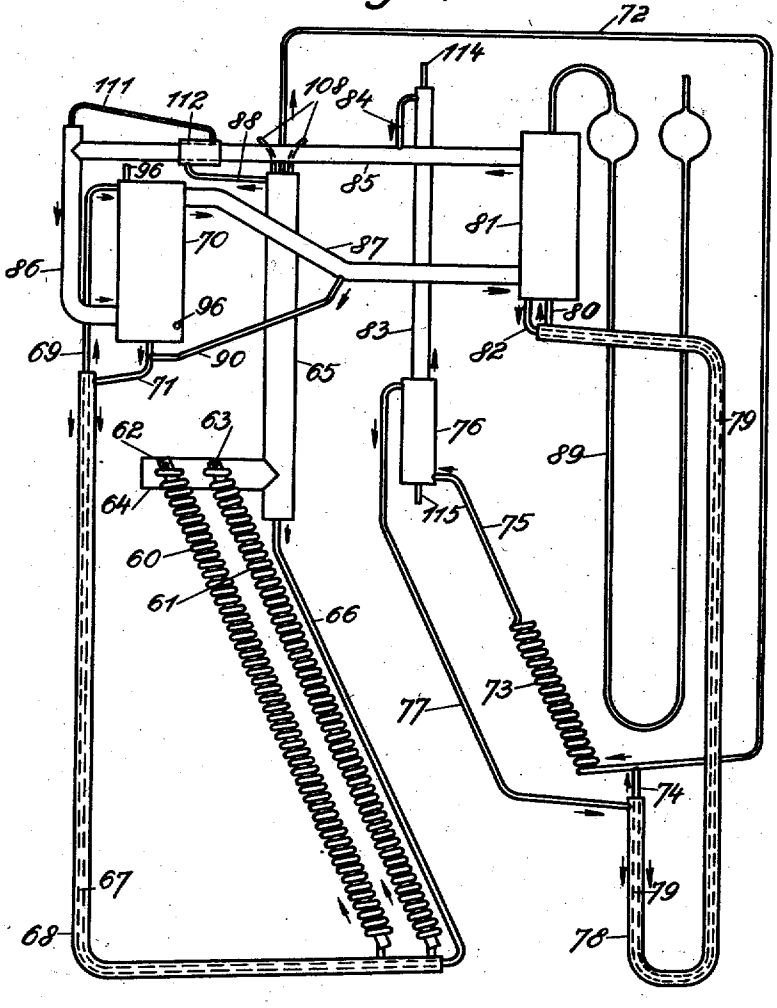
Inventor.
Edmund Altenkirch
by Knight Bros
Attorneys

Oct. 9, 1934. E. ALTENKIRCH 1,976,593

ABSORPTION APPARATUS

Filed April 13, 1926 5 Sheets-Sheet 2

Fig. 2



Inventor
Edmund Altenkirch
by Knight Bros
Attorneys

Oct. 9, 1934. E. ALTENKIRCH 1,976,593

ABSORPTION APPARATUS

Filed April 13, 1926 5 Sheets-Sheet 3

Fig. 3

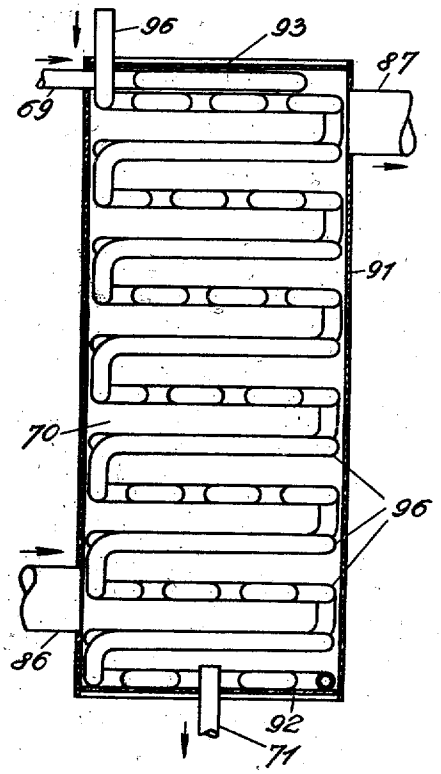


Fig. 4

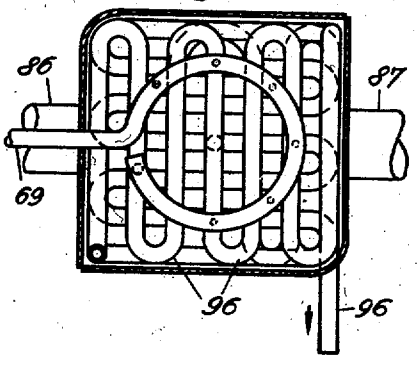


Fig. 6

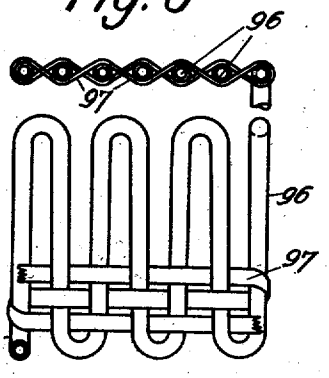


Fig. 5

Inventor
Edmund Altenkirch
by Knight Bros
Attorneys

Oct. 9, 1934. E. ALTENKIRCH 1,976,593

ABSORPTION APPARATUS

Filed April 13, 1926 5 Sheets-Sheet 4

Fig. 7

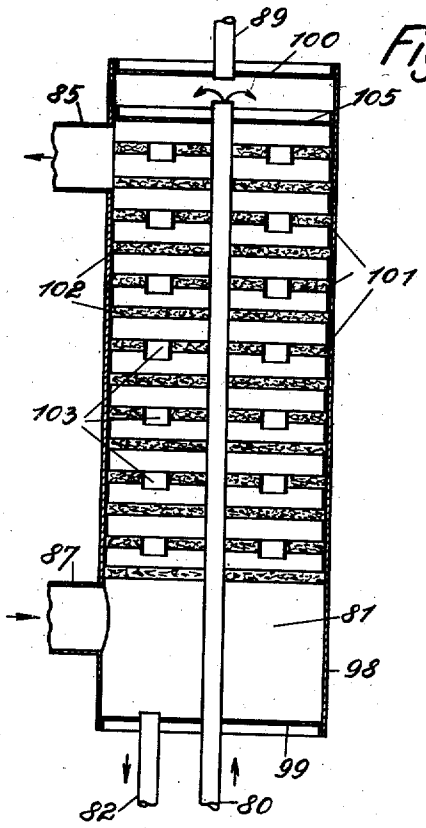


Fig. 8

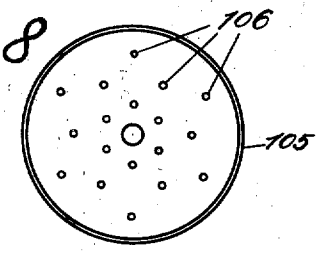


Fig. 9

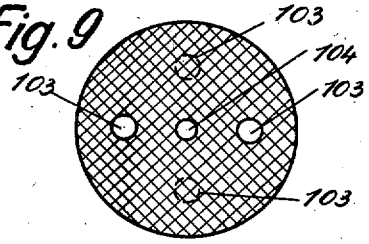


Fig. 10

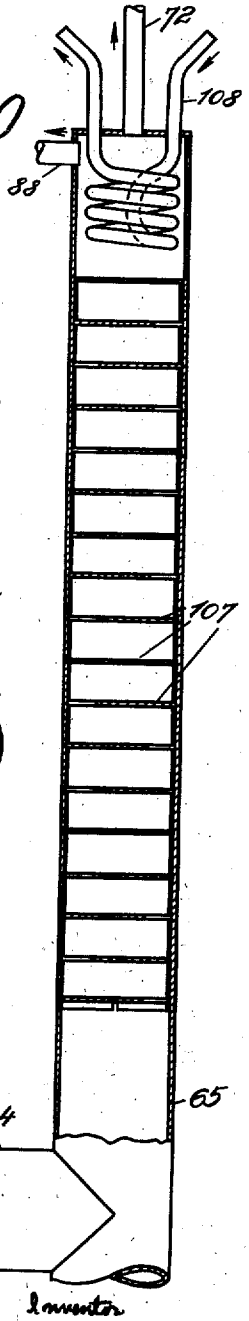


Fig. 11



Inventor
Edmund Altenkirch
by Knight Bros
Attorneys

Oct. 9, 1934. E. ALTENKIRCH 1,976,593

ABSORPTION APPARATUS

Filed April 13, 1926 5 Sheets-Sheet 5

Fig. 12

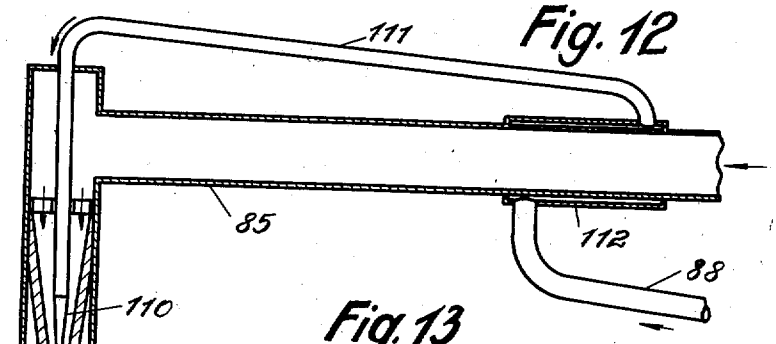


Fig. 13

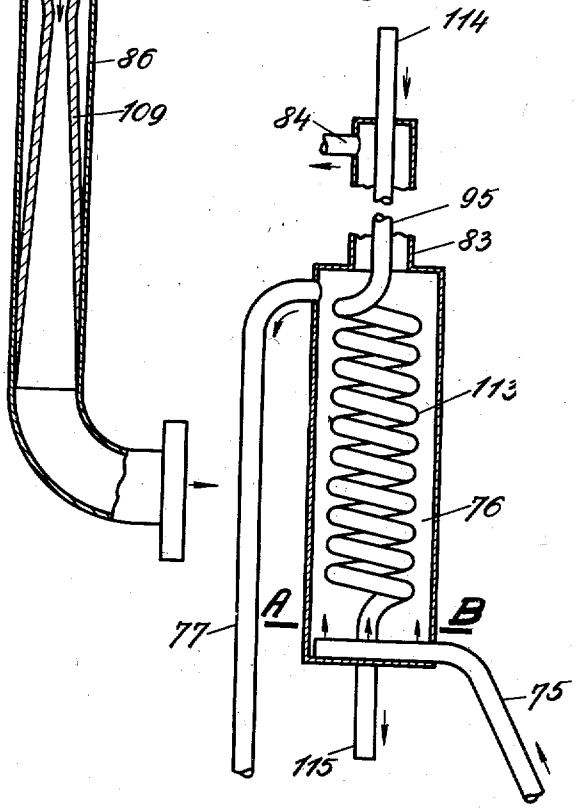
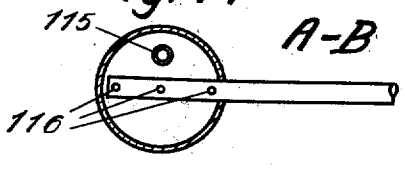


Fig. 14



Inventor
Edmund Altenkirch
by Knight Bros
Attorneys

Patented Oct. 9, 1934 1,976,593

UNITED STATES PATENT OFFICE

1,976,593

ABSORPTION APPARATUS

Edmund Altenkirch, Alt-Landsberg-Sud, Germany, assignor, by mesne assignments, to The Hoover Company, North Canton, Ohio, a corporation of Ohio

Application April 13, 1926, Serial No. 101,745

77 Claims. (Cl. 62—119.5)

In certain respects, the present application relates back to my copending application Serial No. 99,890, filed April 5, 1926.

This invention relates to heat transfer means and methods, in certain phases to refrigerating apparatus, and more particularly to an apparatus of the continuous absorption type in which an auxiliary agent (sometimes called a neutral or inert gas) is employed as an aid to the main heat transfer agent (sometimes called the cooling agent or refrigerant) in carrying out the heat transfer process.

It will be readily understood that, although in the following description the invention is considered largely from the viewpoint of refrigeration, many features herein presented are not limited to this particular field. For simplicity in description, however, the terms commonly used in the refrigeration art, will be employed.

It is an object of the invention to devise a new method and a new apparatus which have certain advantages over known methods and apparatus particularly in the circulation and disposition of fluids. In one important phase of the invention, it relates to the circulation of a solution of the refrigerant through the evaporation chamber or expeller of the apparatus.

Another object of the invention is to provide apparatus for allocating the fluids to the proper parts of the system.

It is a further object of the invention to provide a novel method and a novel apparatus of the type just mentioned and which uses an auxiliary agent which is inert with respect to the main refrigerant and the absorbent. By circulating the auxiliary agent through the evaporator and absorber in a certain way, various economies and advantages are obtained.

It is another object to devise means and method for producing refrigeration substantially at atmospheric pressure.

In accordance with a major phase of the invention, I make use of a neutral gas into which the absorbable medium or refrigerant evaporates out of the absorption liquid in the evaporator. The refrigerant is thereafter reabsorbed by the absorption liquid in another part of the apparatus. It is even possible to operate the apparatus substantially at atmospheric pressure and the vessels and pipes forming the various parts need not be sealed from the atmosphere.

Further objects, advantages and applications of different features of the invention to different kinds and combinations of apparatus will be apparent as the description proceeds.

In the drawings affixed to this specification and forming part thereof, several forms of apparatus embodying my invention are illustrated diagrammatically by way of example. In the drawings,

Fig. 1 is a diagram of an absorption refrigerating apparatus according to the invention;

Fig. 2 is a showing of an actual apparatus operating on the principles of the invention as diagrammatically illustrated in Fig. 1;

Fig. 3 is a vertical section, and

Fig. 4 is a horizontal cross-sectional view of an absorber adapted for use in apparatus embodying the invention;

Figs. 5 and 6 are a plan view and cross-section, respectively, of the cooling pipe forming part of the absorber;

Fig. 7 is a vertical section of the evaporator, and

Figs. 8 and 9 are plan views of two of its parts;

Fig. 10 is a vertical section of the gas rectifier;

Fig. 11 illustrates the shape of the disc partitions;

Fig. 12 is a longitudinal section of the circulation nozzle;

Fig. 13 is a longitudinal vertical section of a reabsorptive device,

Fig. 14 being a cross-section thereof on the line A—B in Fig. 13; and

Fig. 15 is a diagram of an absorption apparatus adapted for raising the temperature.

Referring first to Fig. 1, a continuous absorption refrigerating system is there shown as consisting of an evaporator or expeller 1, an absorber 11, a boiler or expeller (sometimes also called generator) 15 and a second absorber or resorber 8, as essential elements, these parts being connected by various conduits as shown. The total pressure is substantially the same throughout the system, except for small differences due to liquid columns, and may be at or near atmospheric pressure in the case where ammonia is used as the refrigerant, water as the absorbent and air as the inert auxiliary agent. In describing the invention, it will be assumed that these substances are used, as they are preferred, but various other substances may be used as is apparent to those skilled in the art.

The air is confined to the evaporator 1, absorber 11 and the conduits 3 and 4 connecting these vessels for circulating the air between them.

A solution of ammonia in water is supplied to the evaporator or expeller 1 by the conduit 10 and refrigeration is produced in this chamber by the evaporation of the ammonia out of the solu-

tion therein into the air. The chamber 1 may contain a coil of pipe 2 or the like, for bringing a liquid to be cooled into proximity with the evaporating ammonia so that as the evaporation takes place, heat may be transferred from the liquid in the pipe 2 to the fluids in the evaporation chamber 1.

To carry the ammonia gas out of the evaporator 1, the air is circulated between it and the absorber 11. The air enters the evaporator 1 through the pipe 3. This air comes in contact with the ammonia solution, mixes with the gaseous ammonia and escapes from the evaporator through the pipe 4. The weak ammonia solution, being now heavier, descends through the pipe 5 and, at the base of coil 7, comes in contact with the ammonia gas which is admitted through the pipe 6. The absorption liquid, carried along by gas bubbles, ascends through the inclined helical pipe 7 without substantial quantities of the ammonia gas being absorbed since the pipe 7 is not cooled. In the resorber 8 provided with the cooling coil 9, the ammonia gas is absorbed by the solution and the strong solution, now being lighter ascends again into the evaporator 1 through the pipe 10. The resorber 8 is merely a device for bringing the ammonia gas and the water solution leaving the evaporator into intimate contact, while cooling the same so as to cause the ammonia to be absorbed. Insofar as this vessel itself is concerned it may be like any known absorber.

The air with a large content of ammonia gas flows from the evaporator 1 through the pipe 4 to the absorber 11. Weak absorption solution is supplied to the absorber 11 through the pipe 12. This weak solution absorbs ammonia from the gas mixture. The absorption heat developed as a result of this absorption is removed by the cooling coil 13. The air, to great extent deprived of the ammonia gas, returns into the evaporator 1 through the pipe 3. The absorption solution, which has been enriched with gas in the absorber 11, is conducted through pipe 14 to the lower end of a helically wound inclined tube 15 which is heated by an electric heating rod 16. Owing to the increase in the temperature the ammonia gas is expelled from the solution. Hence the tube 15 is called a boiler or expeller. The ascending gas bubbles carry the liquid upwards into a gas separator 17 in which gas and liquid separate. The gas is conducted into the helical tube 7 through the pipe 6 to be absorbed by the resorber solution as explained above while the absorption solution from which the gas has been expelled ascends into the absorber 11 through the pipe 12. Thus evaporation occurs in the vessels 1 and 15 and absorption occurs in the vessels 8 and 11. Due to the presence of the air in the evaporator 1, the evaporation in this vessel takes place at a much lower temperature than the evaporation in the boiler 15. In accordance with well known laws of partial pressure, the total pressure in the evaporator 1 is the sum of the pressure due to the air and that due to the ammonia therein. Hence it may be said that the pressure of the refrigerant in the expeller 15 is considerably higher than that in the expeller 1. Likewise, in the absorbers 8 and 11, the refrigerant pressures are quite different due to the air in the absorber 11, the absorber 8 having the higher refrigerant pressure in this case.

It should also be noted that although the temperature difference between the two expellers may be great, the expeller 1 being the point of lowest temperature in the system and the expeller 15 the point of highest temperature, the two absorbers operate at about the same temperature somewhere near the temperature of the cooling water.

The level of the liquid in the absorber 11 is above the level of the liquid in the gas separating chamber 17 by the distance H. A higher pressure consequently prevails in chamber 17. This pressure difference is utilized to supply refrigerant gas to nozzle 18, the supply pipe 19 being branched off from the pipe 6 conducting the gas. The nozzle 18 is located near one end of a venturi 20 in the gas pipe 4 and keeps the gas mixture flowing therein. Thus the flow of gas is produced due to force within the system. For actuating this nozzle a pressure difference of less than 0.1 atmosphere is sufficient. The height H need therefore not exceed 1 meter.

An important advantage of my invention resides in the fact that the concentrations are so chosen that the absorption in the re-absorber 8 and the expulsion in the boiler 15 take place approximately at atmospheric pressure. The quantity of neutral gas admixed in the evaporator 1 and the absorber 11 is so proportioned that approximately the same pressure prevails in these vessels also, except for the small difference in pressure which is necessary for operating the nozzle 18 in the gas circulation system, as explained above.

A U-tube 21 may be connected to the pipe 3 and filled with a suitable liquid in its lower portion which forms a seal against the atmosphere so that the apparatus is unable to diffuse any ammonia into the atmospheric air. This open U-tube 21 ensures that no essential pressure differences can develop in relation to the atmosphere. During operation of the unit small variations in pressure may occur. Accordingly, the tube 21 is provided with two liquid reservoirs 22 and 23 which prevent material changes in volume in the unit.

The entire apparatus consists preferably of metal vessels or containers and pipes, all welded together. The U-tube may be made of glass or be at least equipped with transparent portions to permit inspection of the levels of the liquid therein which would indicate the pressure within the unit.

The actual construction of an apparatus according to the diagrammatic representation in Fig. 1 is shown by way of example in Figs. 2 to 14.

Referring to these figures, the boiler or expeller or generator consists of two helically wound pipes 60 and 61, the axes of which are disposed obliquely and which are heated by electric heating rods 62 and 63. The helical pipes open into a gas separator 64 upon which is mounted a vertical pipe 65 which forms part of a rectifier, which is separately illustrated in its details and on an enlarged scale in Figs. 10 and 11. The gas empoverished absorption solution flows through the pipe 66 into a heat exchanger formed by the inner tube 67 and the outer tube 68. From the heat exchanger the solution is conducted into the upper part of the absorber 70 through the pipe 69. This absorber is illustrated in its details in Figs. 3 to 6 on an enlarged scale. From the lower part of absorber 70, the solution, enriched with refrigerant, returns through the pipe 71 and the outer pipe 68 of the heat exchanger into the expeller tubes 60 and 61. The gas expelled in the expeller or boiler 60, 61 leaves the rectifier 65 aforementioned through the pipe 72 and passes into the lower end of the

liquid elevating pipe 73 which is likewise helically wound and located obliquely. Simultaneously, weak absorption solution flows into this pipe from the pipe 74. The gas carries the liquid through the elevating pipe and the adjoining straight pipe 75 into the resorber 76 which is specifically illustrated in the Figs. 13 and 14. In the resorber, the ammonia supplied by the conduit 72 is largely absorbed in the absorption liquid. In other words, the ammonia gas is changed to a more dense fluid phase therein. After the solution has absorbed the gas here, it passes through the pipe 77 into a heat exchanger which is formed by the outer pipe 78 and the inner pipe 79. It flows through the outer pipe 78 and the pipe 80 into the evaporator 81. This evaporator is illustrated in its details in Figs. 7, 8 and 9. After the gas has been expelled from the liquid here (by the heat furnished by the evaporator surroundings), the empoverished liquid returns through the pipe 82, the inner pipe 79 of the heat exchanger and the tube 74 into the elevating pipe 73. The resorber 76 together with a vertical tube 83 also acts as a receiver for any refrigerant gas not absorbed or for any inert gas which may have found its way into the vessel 76. The conduit 84 provides a vent for this gas back to the inert gas circuit, the vent 84 being connected to the gas conduit 35. In the conduit 85 the ammonia gas-air mixture flows from the evaporator 81 into the absorber 70. In the vertical pipe 83 the liquid stands at about the level of the top of the pipe 80 within the evaporator 81, (see Fig. 7). Gas bubbles which have not been absorbed by the liquid, ascend in the vertical pipe 83 and are able to escape through the vent pipe 84. The current of air enriched by ammonia vapor passes from the evaporator 81 through the pipe 85 and the pipe 86 into the absorber 70 and returns through the pipe 87 into the evaporator 81. In the pipe 86, the nozzle is arranged as shown in Fig. 12. It is fed from the rectifier 65 through the pipes 88 and 111. Joined to the upper end of the evaporator 81 is the U-tube 89 similar to the U-tube 21 of Fig. 1. If the rectifier 65 does not separate and detain the water vapor completely, a portion of the water is thus boiled out of and travels gradually from the expeller pipes 60 and 61 by way of pipe 72 and elevator 73 into the re-absorber 76 and hence by way of pipes 77, 78 into the evaporator 81. As soon as the level of the liquid rises in the evaporator to such a height that it flows into the gas circulation pipe 87, it is able to return into the expeller system through the drain pipe 90 terminating in pipe 71. Prior to its entry into the pipe 90, the liquid is in contact with air of low ammonia content along a comparatively long path in the pipe 87, and therefore the ammonia which may still be contained in this overflow liquid has ample opportunity to separate, so that almost water only returns into the other system.

The absorber 70 is shown in vertical cross-section in Fig. 3 and in horizontal cross-section in Fig. 4. It consists essentially of the casing 91 having a bottom 92 and a cover 93. A pipe 96 traversed by cooling water is sinuously wound in numerous planes within the absorber. The cooling water enters at the top and escapes at the bottom. The gas empoverished absorption solution enters through the pipe 69 which is bent in a circle within the absorber and is provided with a plurality of perforations at the underside, which are indicated in dotted lines in Fig. 4. The solution drips onto the cooling pipe 96. In order to spread the solution over as large a surface as possible a broad wick 97 is braided over the windings of the pipe 96, which is not illustrated in the Figs. 3 and 4. Fig. 5 shows the sinuous windings of the pipe 96 in one plane in plan. The wick 97 braided around the windings is shown in Figs. 5 and 6. The strong ammonia gas mixture enters through the pipe 86 and flows upwardly through the absorber, coming in intimate contact with the wick 97 saturated with liquid which latter absorbs the ammonia. The empoverished ammonia gas mixture leaves the absorber through the pipe 87 and flows to the evaporator (Fig. 2).

The evaporator is shown in cross-section and on an enlarged scale in Fig. 7. Figs. 8 and 9 show constituent parts in plan. The evaporator includes a cylindrical shell 98 with end walls 99 and 100. The shell is equipped with insertions 101 and 102 in its interior which are shown in plan view in Fig. 9. Each insertion consists of two circular discs of a wire fabric between which is located a disc of cloth. Each is provided with a central opening 104 for the pipe 80, and with two diametrically opposite openings 103 spaced equidistant from the disc center. Each insertion 101 is displaced with respect to the adjacent insertion 102 so that the openings 103 in adjacent discs are displaced by 90 degrees, as indicated in Fig. 9. Above the insertions is located a sheet-iron dish 105, which is shown in plan view in Fig. 8. It is provided with numerous perforations 106 which are just sufficiently large to allow the liquid contained in the dish 105 to issue in drops. The liquid is supplied to the dish by a central pipe 80. It drips from insertion to insertion through the evaporator and escapes through the pipe 82. The current of gas weak in ammonia enters through the pipe 87 and escapes through the pipe 85. As it is obliged to take its way through the openings 103 in staggered arrangement, it sweeps along the insertions saturated with liquid and thus absorbs ammonia from the liquid. The heat of evaporation necessary for this is withdrawn through the evaporator wall 98 from the surroundings of the evaporator 81 to be cooled.

The interior of the evaporator communicates with the atmosphere through the pipe 89, separated from it through a liquid seal only as shown in Fig. 2. It is important that the stream of ammonia enriched neutral gas entering at the bottom flows through the evaporator in opposite direction to the direction of flow of the absorption solution dripping down from above, because the solution which has reached the bottom is comparatively poor in ammonia and can therefore only give off ammonia gas at a lower ammonia pressure. This lower partial pressure is obtained as the result of the entrance of the practically pure air at the bottom.

The rectifier 65 is shown in cross-section in Fig. 10. It includes a vertical pipe in which are located sheet iron discs 107. In Fig. 11 such a disc is shown in plan. As clearly shown in the drawings, a section is cut off from the discs so that sufficient space is left for the gas flowing past. Any two adjacent discs 107 are displaced in relation to their cut away portions by an angle of 180°. In the upper portion of the rectifier 65 a cooling coil 108 is arranged.

Fig. 12 shows the pipe 86 and a portion of the tube 85 in cross-section. Into the pipe 86 is inserted a venturi 109 into which vaporous refrigerant is blown through the nozzle 110. The

nozzle is fed with ammonia vapor through the pipe 111, which, coming from the rectifier 65, first passes from the pipe 88 into a jacket 112 which surrounds the pipe 85. This pipe is traversed by the cold ammonia-neutral gas mixture coming from the evaporator 81 and thus cools the ammonia vapor passing through the pipe 88 still further than it is cooled in the rectifier 65 and so condenses still further quantities of admixed water vapor. The condensed water flows back through the pipe 88 into rectifier 65.

The resorber is illustrated in Fig. 13 in longitudinal section and in Fig. 14 in cross-section along the line A—B in Fig. 13. It consists essentially of a cylindrical shell or housing into which is inserted a cooling coil 113, and of the vertical pipe extension 83 surrounding the straight portion of pipe 113. The cooling water enters at 114, flows first through the straight part 95 of the cooling pipe which is located within the vertical pipe 83, and then flows through the cooling coil 113 and escapes at 115. The cooling of the vertical pipe 83 serves the purpose of avoiding an evaporation in the column of liquid standing here. Vaporous ammonia and absorption liquid, supplied jointly through coil 73 (Fig. 2), flows through pipe 75 into the resorber 76 where both issue through bores 116. The ammonia enriched solution leaves the re-absorber through the pipe 77. Quantities of ammonia which may not have absorbed can escape through the pipe 84 which, as Fig. 2 shows, leads into pipe 85 in which it is admixed to and further enriches the ammonia-gas mixture coming from the evaporator.

Another embodiment of my invention is the absorption apparatus illustrated diagrammatically in Fig. 15. It serves the purpose to raise existing quantities of heat of medium temperature to a higher temperature at which they may be utilized. These quantities of heat may, for instance, be contained in waste waters of medium temperature. The waste waters are conducted through the coil 31 located in the evaporator 37 and the heating vessel 32 which surrounds the expeller or boiler 45 of the system. A part of the heat is thus given up by the water and therefore its temperature is lowered. This raises the temperature of the evaporator and expeller and causes it to function. The heat of lower temperature is absorbed by the cooling water in the coil 33. The useful heat of the desired higher temperature is transmitted to a liquid which is passed through the coil 34 for the purpose of heating it. This coil is located in the interior of a resorber 35 into which is conducted a mixture of ammonia gas and water. By the absorption of the ammonia gas, the heat of higher temperature to be transmitted to the coil 34 is generated. The absorption solution thus enriched by gas ascends through the pipe 36 into the evaporator 37. Here heat of medium temperature of the waste water is supplied to it by the heating coil 31. The solution comes, furthermore, in contact with a stream of air poor in ammonia which enters the vessel 37 through the pipe 38. The partial pressure of the ammonia in this gas mixture is so low that the ammonia is evaporated. The air now enriched with ammonia escapes from the vessel 37 through the pipe 39. The weaker solution escapes through the pipe 40 and again comes in contact with gaseous ammonia which streams in through the pipe 41. Gas and liquid ascend into the resorber 35 through a helically wound pipe 42.

The air enriched with ammonia in the evaporator 37 passes into an absorber 43 through the pipe 39. The absorption solution cooled by the coil 33 again withdraws a portion of the ammonia from the gas mixture and the gas mixture weak in ammonia escapes again through the pipe 38. The strong solution leaves the absorber 43 through a pipe 44 and enters a helically wound boiler or expeller pipe 45. This pipe is located in the heating jacket 32 and the gas is expelled by the supplied heat of medium temperature derived from the waste water. Gas and liquid ascend together into the gas separating chamber 46 whence the weak solution returns into the absorber 43 through the pipe 47 while the expelled gas is supplied to the absorption solution flowing in the pipe 40 through the pipe 41. The gas pipe 48 which leads to the nozzle 49 is branched off from the pipe 41. The gas escaping here maintains the circulation of the gas mixture in the pipes 38 and 39 the same as previously described. The apparatus is in communication with the atmosphere by a U-tube 50, similar to the apparatus shown in Fig. 1, and is only separated from it by a liquid seal.

It will be apparent that the apparatus herein described is of the continuous absorption type, that is, it is capable of producing refrigeration continuously without the necessity of manipulation and does not pass through cycles in which the functions of certain vessels are changed from time to time as is common in the so called intermittently operating absorption systems. However it will be apparent that certain novel features may be used in other types of apparatus.

Various modifications and changes may be made without departing from the spirit and the scope of the invention, and I desire, therefore, that only such limitations shall be placed thereon as are imposed by the prior art.

What is claimed is,

1. The method of causing variations of temperature which includes expelling an absorbable medium from an absorption liquid directly into a neutral gas and causing the reabsorption of said medium by said liquid.

2. The method of causing variations of temperature which includes expelling an absorbable medium from an absorption liquid directly into a neutral gas and causing the reabsorption of said medium by said liquid, the operation being carried through substantially at atmospheric pressure.

3. The method of causing variations of temperature which includes expelling an absorbable medium from an absorption liquid into a neutral gas, causing the reabsorption of said medium by said liquid, and circulating said liquid and said gas in counter currents.

4. The method of causing variations of temperature which includes transferring an absorbable medium from a body of absorption liquid into a neutral gas, absorbing the transferred medium out of said gas by another body of absorption liquid, expelling the absorbed medium from the said other body of absorption liquid and reabsorbing the medium thus expelled by said first body of absorption liquid.

5. The method of causing variations of temperature which includes transferring an absorbable medium from a body of absorption liquid into a neutral gas, absorbing the transferred medium from said gas by another body of absorption liquid, expelling the absorbed medium from the said other body of absorption liquid, reab-

sorbing the medium thus expelled by said first body of absorption liquid and causing movement of the neutral gas.

6. Apparatus for causing variations of temperature containing an absorption liquid, an absorbable medium, a neutral gas and which includes means for transferring said absorbable medium from said absorption liquid into said neutral gas substantially at atmospheric pressure and a liquid seal forming the only means for separating the interior of said apparatus from the outer air.

7. Apparatus for causing variations of temperature comprising a vessel acting as evaporator and gas transfer means, an absorber, a communication duct between said vessel and said absorber, said vessel and said absorber each containing absorption liquid and a medium absorbable by said liquid, said duct containing a neutral gas and means outside of said absorber for separating the absorbed medium from the liquid contained in said absorber and for returning such liquid into said absorber.

8. Apparatus for causing variations of temperature comprising a vessel acting as an evaporator and as a gas transferring means, an absorber, a communication duct between said vessel and said absorber, said vessel and said absorber each containing absorption liquid and a medium absorbable by said liquid, said vessel, absorber and duct containing a neutral gas, means for causing the expulsion of the medium from the absorption liquid in said vessel, means for causing the absorbtion of the medium by the absorption liquid in said absorber, means outside of said absorber for separating the absorbed medium from the liquid in said absorber and for returning such liquid into said absorber, and means for returning said medium into contact, outside of said transfer vessel, with the liquid, from which it is expelled in said vessel.

9. Apparatus for causing variations of temperature containing an absorption liquid, an absorbable medium, a neutral gas, and including means for transferring said medium from said absorption liquid directly into said neutral gas and means for causing movement of the inert gas.

10. Apparatus for causing variations of temperature containing two bodies of absorption liquid, an absorbable medium and a neutral gas in contact with said two bodies, and including means for transferring absorbable medium from one of said bodies into said neutral gas and means for projecting absorbable medium derived from the other of said bodies into said gas.

11. Apparatus for causing variations of temperature containing an absorbable gas and a neutral gas, and including means for transferring absorbable gas into said neutral gas, an absorber containing an absorption liquid, means for circulating neutral gas between said transferring means and said absorber, means for circulating absorption liquid through said transferring means, means for circulating absorption liquid through said absorber, means cooperating with said latter circulating means for separating liquid and absorbable gas, and means for conducting absorbable gas thus separated into contact with liquid circulating through said transferring means.

12. Apparatus for causing variations of temperature containing two bodies of absorption liquid, an absorbable medium and a neutral gas in contact with said two bodies, and including means for transferring absorbable medium from one of said bodies into said neutral gas, an absorber, means for circulating neutral gas between said transferring means and said absorber, means for circulating liquid through said transferring means, means for circulating liquid through said absorber, means cooperating with said latter circulating means for separating liquid and absorbable gas, and means for conducting absorbable gas thus separated into contact with liquid circulating through said transferring means.

13. Apparatus for causing variations of temperature containing an absorbable gas and neutral gas, and including a gas transfer vessel containing absorption liquid and having means for transferring absorbable gas into said neutral gas, an absorber containing absorption liquid, means for circulating neutral gas between said vessel and said absorber, means for circulating absorption liquid through said transfer vessel, means for circulating absorption liquid through said absorber, means cooperating with said latter circulating means for separating liquid and absorbable gas, means for conducting absorbable gas thus separated into contact with liquid circulating through said transfer vessel and means in the latter circuit for causing the reabsorption of said absorbable gas brought into contact with the absorption liquid.

14. Apparatus for causing variations of temperature containing two bodies of absorption liquid, and absorbable medium and a neutral gas in contact with said two bodies, and including means for transferring absorbable medium from one of said bodies into said neutral gas, an absorber, means for circulating neutral gas between said transferring means and said absorber, means for circulating liquid through said transferring means, means for circulating liquid through said absorber, means cooperating with said latter circulating means for separating liquid and absorbable gas, means for conducting absorbable gas thus separated into contact with liquid circulating through said transferring means and means in the latter circuit for causing reabsorption of said absorbable gas in said latter liquid.

15. Apparatus for causing variations of temperature containing an absorption liquid, an absorbable medium, a neutral gas and having means for transferring said absorbable medium from said absorption liquid into said neutral gas, said transfer means including means for finely dividing said liquid and means for conducting the liquid so divided into intimate contact with said neutral gas.

16. Apparatus for causing variations of temperature containing an absorption liquid, an absorbable medium, a neutral gas and having means for transferring said absorbable medium from said absorption liquid into said neutral gas, said transfer means including means for finely dividing said liquid and means for conducting the liquid so divided into intimate contact with said neutral gas and means for conveying heat from without to said liquid while in a finely divided state to remove the absorbable medium from the liquid.

17. Apparatus for causing variations of temperature containing an absorption liquid, an absorbable medium, a neutral gas and having means for transferring said absorbable medium from said absorption liquid into said neutral gas, said transferring means including perforate heat conductive metallic bodies and porous material associated with the said bodies for finely dividing said liquid, and means for conducting said gas

through said bodies and material, to mix with said medium freed from the liquid.

18. Apparatus for causing variations of temperature including a transfer vessel, an absorber, a communication between said vessel and said absorber, said transfer vessel and said absorber each containing a body of absorption liquid and a medium absorbable by said liquid, and a neutral gas in said vessel, absorber and communication, means for circulating each liquid body through its respective container, means operating for separating the absorbed medium from the absorption liquid and for returning the empoverished liquid into said absorber, the body of absorption liquid in said transfer vessel having a higher concentration of absorbable medium than the body of absorption liquid in said absorber.

19. Apparatus for causing variations of temperature, containing an absorption liquid, an absorbable medium, a neutral gas, and including an evaporating vessel for transferring said absorbable medium from said absorption liquid into said neutral gas, and means comprising an absorption vessel for lowering the partial pressure of said medium in the neutral gas-medium mixture to permit the evaporation of said medium in said first-named vessel.

20. Apparatus for causing variations of temperature containing an absorption liquid, an absorbable medium, a neutral gas, and including an evaporating vessel for transferring said absorbable medium from said absorption liquid into said neutral gas, means for withdrawing the absorbable medium from said neutral gas, thus lowering the partial pressure of said medium in the neutral gas-medium mixture and permitting the evaporation of said medium in said first-named vessel and means for maintaining a pressure in said evaporating vessel substantially equal to that of the atmosphere.

21. The method of producing refrigeration including the steps of circulating an absorption solution into and out of an evaporating vessel, charging the absorption solution with a refrigerant at a point outside of said vessel and circulating a gas into and out of the evaporating vessel to maintain the refrigerant at a low partial pressure in the vessel and thus cause the same to be expelled from the absorption liquid in said vessel.

22. The method of producing refrigeration including the steps of conveying an absorption liquid charged with a refrigerant into an evaporator and causing the refrigerant to be expelled from the absorption liquid by maintaining a partial pressure of refrigerant and a partial pressure of an auxiliary gas in the evaporator.

23. Refrigerating apparatus including means for conveying an absorption liquid into an evaporator, means remote from said evaporator for charging said liquid with a refrigerant and means for circulating an auxiliary gas into and out of the evaporator thereby maintaining a low partial pressure of refrigerant therein.

24. In a refrigerating apparatus of the continuous absorption type, the combination of a generator, an absorber, an evaporator, a second absorber connected to said evaporator and containing an absorption liquid and means operable by gas pressure for causing said absorption liquid to circulate between said second absorber and said evaporator.

25. In a refrigerating apparatus of the continuous absorption type, the combination of a generator, an absorber, an evaporator, a second absorber connected to said evaporator and containing an absorption liquid and means operable incident to the lifting action of a gas for circulating said absorption liquid between said second absorber and said evaporator.

26. In absorption refrigeration apparatus, the combination with a boiler system including a gas separating chamber and an absorber of a rectifier, means for conveying vapor from said boiler system to said rectifier, means independent of said gas separating chamber for conveying liquid from said rectifier to said absorber and means for conveying liquid from said absorber to said boiler system whereby vapor expelled from the boiler may condense in said rectifier and return to said boiler system after passing through said absorber.

27. Absorption refrigerating apparatus including a generator, an evaporator, an absorber, a system for circulating an absorption liquid between said generator and absorber, a conduit for conveying gas from the evaporator to the absorber, a conduit for conveying gas from the absorber to the evaporator and means independent of said last mentioned conduit for draining absorption liquid which collects therein back into said absorption liquid circulating system.

28. Refrigerating apparatus including a generator, an evaporator, an absorber, a system for circulating an absorption liquid between said generator and said absorber, a system for circulating an inert gas between the evaporator and absorber and including a gas conduit connected to the top part of the absorber and having a portion located near the lower part of the evaporator and means for draining absorption liquid which collects in said conduit back into said absorption liquid circulating system.

29. Absorption refrigerating apparatus including an absorber, an evaporator, and a system for circulating an inert gas between said evaporator and absorber, said system including a jet, means for supplying a gas to said jet for driving the inert gas and means for causing an exchange of heat between the gas supplied to the jet and the inert gas passing from the evaporator to the absorber.

30. In a continuous absorption refrigerating system, the combination with vessels constituting an evaporator and an absorber, of means for causing liquids to flow downwardly in said vessels and stationary means constituting a fixed integral part of said system for causing an inert gas to circulate between said vessels and pass upwardly in each so as to have a flow in the opposite direction to the flow of liquids therein.

31. In a continuous absorption refrigerating apparatus, the combination with vessels constituting an absorber and an evaporator, of means for causing liquids to flow therein and stationary means constituting a fixed integral part of said apparatus for causing an inert gas to circulate between said vessels and pass through each of said vessels in a direction opposite to the direction of flow of said liquids.

32. A continuous refrigerating system having an absorption liquid circuit including a first vertically extending branch containing liquid, and a second vertically extending branch containing liquid, connections for flow of fluid between said branches, a vessel wherein application of heat changes a fluid from a dense phase to gaseous form, and means to conduct gaseous fluid from said vessel and introduce the same into said first branch to lighten the fluid therein and cause circulation upwardly in said first branch and downwardly in said second branch.

33. That improvement in the art of continuous refrigerating through the agency of an absorption system which consists in evaporating a cooling agent to form a gas, and mixing the gas with absorption liquid and circulating absorption liquid due to the introduction of vaporized gas thereinto.

34. That improvement in the art of refrigeration through the agency of an absorption system including a plurality of circuits of liquid circulation which consists in developing gaseous fluid in one circuit, conveying the developed gaseous fluid to another circuit and introducing the same into the liquid therein to promote the flow of said liquid over its circuit.

35. Refrigerating apparatus comprising a generator, an evaporator, a connection for flow of fluid from said generator to said evaporator, an absorber interposed in said connection, means to force gaseous fluid from said generator into said connection, members for carrying fluid forming an absorption fluid circulation system between the generator and evaporator in parallel to said connection and a connection between the evaporator and absorber.

36. That improvement in the art of refrigeration through the agency of an absorption system including an evaporator and an absorber which consists in generating force within the system, forming a solution in the absorber, conducting said solution from the absorber into the evaporator due to said force, circulating a solvent for one of the solution substances into and out of the evaporator and returning the other to the absorber due to said force while maintaining said system under substantially uniform pressure throughout.

37. That improvement in the art of refrigeration through the agency of an absorption system including a generator, an absorber and an evaporator which consists in conducting fluid from both the generator and the evaporator to the absorber, forming a solution in the absorber, conducting the solution to the evaporator and transporting one of the solution substances from the evaporator to the generator by absorption fluid circulation.

38. That improvement in the art refrigeration through the agency of an absorption system including a generator, an absorber and an evaporator which consists in conducting fluid from both the generator and the evaporator to the absorber, forming a solution in the absorber, conducting the solution to the evaporator and transporting one of the solution substances from the evaporator to the generator by absorption fluid circulation while maintaining a substantially constant pressure throughout the system.

39. That improvement in the art of refrigerating through the agency of an absorption system including interconnected evaporator and absorber which consists in introducing a plurality of substances in solution form into the evaporator, introducing an absorbent for one of said substances into the absorber, generating force within the system and circulating fluid between the absorber and evaporator due to said force.

40. Refrigerating apparatus comprising a generator, an evaporator, two absorbers, conduits forming cycles of circulation between the evaporator and one absorber, between the generator and said one absorber and between the evaporator and the other absorber, and a vapor connection between said generator and said other absorber.

41. Refrigerating apparatus of the continuous operating absorption type, characterized by the fact that the apparatus contains three substances all of which pass through the evaporator and all of which pass through continuous cycles.

42. The process of refrigerating with an absorption system which comprises evaporating a liquid cooling agent in the presence of an auxiliary agent inert to the cooling agent and thereby producing a gaseous mixture of the vapor of the cooling agent and the auxiliary agent, creating a slight pressure difference within the system, conducting said gaseous mixture under the influence of said pressure difference into the presence of an absorption liquid, absorbing the cooling agent in the absorption liquid, withdrawing the absorption liquid from the presence of the auxiliary agent, returning the auxiliary agent into the presence of the cooling agent under the influence of said pressure difference, heating the absorption liquid and expelling the cooling agent from solution, returning the absorption liquid into the presence of the gaseous mixture, converting the cooling agent to more dense phase and returning the densified cooling agent into the presence of the auxiliary agent, these several steps of the process taking place in an apparatus open to the pressure of the atmosphere.

43. The improvement in the process of refrigerating by the aid of a system including a chamber wherein a refrigerant may be evaporated and a chamber wherein a refrigerant may be absorbed which consists in diffusing a cooling agent in the presence of an auxiliary agent in the evaporation chamber, and circulating the auxiliary agent through the evaporation chamber and the absorption chamber, these several steps of the process taking place with the chambers open to the influence of the atmosphere.

44. The improvement in the process of refrigerating by the aid of a system including an evaporator and an absorber which consists in diffusing a cooling agent in the presence of an auxiliary agent in the evaporator, and circulating the auxiliary agent through the evaporator and the absorber exclusively by slight pressure differences created in the system, while maintaining the evaporator and the absorber open to the influence of atmospheric pressure.

45. The process of refrigerating with an absorption system which comprises evaporating a liquid cooling agent in the presence of an auxiliary agent inert to the cooling agent at substantially atmospheric pressure and thereby forming a gaseous mixture of vapor of the cooling agent and the auxiliary agent, creating a slight pressure difference within the system, conducting said gaseous mixture under the influence of said pressure difference into the presence of an absorption liquid at substantially atmospheric pressure, absorbing the cooling agent in the absorption liquid, withdrawing the absorption liquid from the presence of the auxiliary agent, returning the auxiliary agent into the presence of the cooling agent under the influence of said pressure difference, heating the absorption liquid and expelling the cooling agent from solution, returning the absorption liquid into the presence of the gaseous mixture, converting the cooling agent to more dense phase at substantially atmospheric pressure, and returning the densified cooling agent into the presence of the auxiliary agent.

46. The process of refrigerating with an absorption system which comprises evaporating a liquid cooling agent in the presence of an auxiliary

agent inert to the cooling agent and thereby producing a gaseous mixture of the vapor of the cooling agent and the auxiliary agent, conducting said gaseous mixture into the presence of an absorption liquid, absorbing the cooling agent in the absorption liquid, withdrawing the absorption liquid from the presence of the auxiliary agent, returning the auxiliary agent into the presence of the cooling agent, heating the absorption liquid and expelling the cooling agent from solution, returning the absorption liquid into the presence of the gaseous mixture, converting the cooling agent to more dense phase and returning the densified cooling into the presence of the auxiliary agent, these several steps of the process taking place in an apparatus open to the pressure of the atmosphere.

47. The improvement in the process of refrigerating by the aid of a system including an evaporation chamber and an absorption chamber which consists in diffusing a cooling agent into air in the evaporation chamber, and circulating the auxiliary agent through the evaporation chamber and the absorption chamber, while maintaining the chambers open to the influence of atmospheric pressure.

48. In an absorption refrigerating system having separate vessels constituting an evaporator and an absorber, the improvement which consists in flowing a cooling agent downwardly through the evaporator by gravity, generating a slight pressure difference within the system due to heat, circulating an auxiliary agent through the evaporator and the absorber due to said pressure difference, the auxiliary agent flowing upwardly in the evaporator, and retaining said cooling agent in the evaporator in a plurality of bodies of extended surface.

49. In an absorption refrigerating system having separate vessels constituting an evaporator and an absorber, the improvement which consists in flowing a cooling agent downwardly through the evaporator by gravity, generating force within the system and circulating an auxiliary agent upwardly through the evaporator and upwardly through the absorber due to said force.

50. In an absorption refrigerating system having separate vessels consituting an evaporator and an absorber, the improvement which consists in applying heat to the system, flowing a cooling agent downwardly through the evaporator by gravity, and circulating an auxiliary agent through the evaporator and the absorber due to the heat applied to the system, the flow of the auxiliary agent being upwardly through the evaporator.

51. Absorption refrigerating apparatus including an evaporator, an absorber, a plurality of conduits connecting said evaporator and said absorber to form a circuit for the circulation of an inert gas through the evaporator and absorber, means for supplying absorption liquid to said circuit, means for withdrawing absorption liquid from said circuit, whereby some inert gas may be carried away from said circuit by the liquid leaving said circuit, means for expelling inert gas so carried from the absorption liquid, means for receiving the gas expelled from the liquid, a connection for the flow of liquid from the receiving means to the evaporator extending downwardly and upwardly to form a liquid seal, and means to vent the inert gas from said receiving means back into said inert gas circuit.

52. Absorption refrigerating apparatus including a resorber, an evaporator, an absorber and a boiler, means for conveying refrigerant vapor to said resorber, means for circulating an absorption liquid through and between the resorber and the evaporator and for causing the refrigerant supplied to the resorber to be absorbed by the absorption liquid and be conveyed by the absorption liquid to the evaporator, means using an inert gas for causing the refrigerant to evaporate out of the absorption liquid in the evaporator and flow into the absorber, means for circulating an absorption liquid through and between the absorber and the boiler and for causing the refrigerant flowing from the evaporator to the absorber to be absorbed thereby and conveyed to the boiler and means for causing the refrigerant to evaporate out of the absorption liquid in the boiler.

53. In an absorption apparatus, an expeller for expelling a gaseous working agent, a second expeller, an ascending pipe, pipes connecting said first expeller with said second expeller so that the gaseous working agent expelled in the first expeller is adapted to convey the weak solution coming from the second expeller through said ascending pipe and a cooled chamber at the upper end of said ascending pipe in which the absorption solution again absorbs the working agent.

54. A heat transfer system including two expellers, an absorber and a device for changing a gas, as a refrigerant gas to a more dense fluid phase, means for conducting a gas from one expeller to said device, means for conducting a liquid from said device to the other of said expellers, means for conducting the gas from the last named expeller to the absorber and means for circulating a liquid between the absorber and the first named expeller, the entire system being so arranged that the various parts operate at substantially the same total pressure except for differences due to liquid columns.

55. A device as described in claim 54 in which the second named expeller and the absorber contain an inert auxiliary pressure equalizing agent such as air.

56. An absorption refrigerating system including a boiler, a resorber, an evaporator and an absorber, means for conducting refrigerant gas from said boiler to said resorber, means for circulating an absorption liquid between said resorber and said evaporator to convey refrigerant from the resorber to the evaporator, means using an inert gas for conducting refrigerant gas from the evaporator to the absorber and means for circulating absorption liquid between the absorber and the boiler to convey the refrigerant from the absorber to the boiler.

57. An absorption refrigerating system including a boiler, a resorber, an evaporator and an absorber, means for conducting refrigerant gas from said boiler to said resorber, means for circulating an absorption liquid between said resorber and said evaporator to convey refrigerant from the resorber to the evaporator, means for conducting refrigerant gas from the evaporator to the absorber and means for circulating absorption liquid between the absorber and the boiler to convey the refrigerant from the absorber to the boiler, said evaporator and said absorber containing an inert auxiliary pressure equalizing agent.

58. An absorption refrigerating system including a boiler, a resorber, an evaporator and an absorber, means for conducting refrigerant gas from said boiler to said resorber, means for circulating an absorption liquid between said resorber and

said evaporator to convey refrigerant from the resorber to the evaporator, means for conducting refrigerant gas from the evaporator to the absorber and means for circulating absorption liquid between the absorber and the boiler to convey the refrigerant from the absorber to the boiler, the various parts of said system being arranged to operate at approximately the same total pressure except for differences due to liquid columns.

59. An absorption refrigerating system including a boiler, a resorber, an evaporator and an absorber, means for conducting refrigerant gas from the boiler to the resorber, means utilizing the lifting action of the refrigerant passing from the boiler to the resorber for circulating an absorption liquid between the resorber and the evaporator to convey refrigerant from the resorber to the evaporator, means for conducting refrigerant gas from the evaporator to the absorber and means for circulating absorption liquid between the absorber and the boiler to convey the refrigerant from the absorber to the boiler.

60. An absorption refrigerating system including a boiler, a resorber, an evaporator and an absorber, means for conducting refrigerant gas from the boiler to the resorber, means for circulating an absorption liquid between the resorber and the evaporator to convey refrigerant from the resorber to the evaporator, means for conducting refrigerant gas from the evaporator to the absorber and means for circulating absorption liquid between the absorber and the boiler to convey refrigerant from the absorber to the boiler, said last mentioned means utilizing the lifting action of the refrigerant passing from the absorber to the boiler.

61. In an absorption apparatus, a system in which a gaseous working agent is expelled from an absorption solution and again absorbed by the solution, a second system in which the expelled gaseous working agent is changed to a more dense fluid phase and again converted into the gaseous form, and an ascending pipe through which liquid is conveyed by the gaseous working agent developed in one of said systems for the purpose of maintaining the circulation of the liquid in the other of said systems.

62. In an absorption apparatus, a system in which a gaseous working agent is expelled from an absorption solution and again absorbed by the solution, a second system in which the expelled gaseous working agent is changed to a more dense fluid phase and again converted into the gaseous form, and means adapted to enable the gaseous agent developed in one of said systems to effect the circulation of the liquid in this system as well as in the other system.

63. The improvement in the process of refrigerating by the aid of a system including a part wherein a refrigerant may be evaporated and a part wherein a refrigerant may be absorbed which consists in diffusing a cooling agent in the presence of an auxiliary agent in the evaporation part and circulating the auxiliary agent through the evaporation part and the absorption part, these several steps of the process taking place substantially at the same pressure as that of the atmosphere.

64. The process of refrigerating with an absorption system which comprises evaporating a liquid cooling agent in the presence of an auxiliary agent inert to the cooling agent at substantially atmospheric pressure and thereby forming a gaseous mixture of vapor of the cooling agent and the auxiliary agent, generating force within the system, conducting said gaseous mixture under the influence of said force into the presence of an absorption liquid at substantially atmospheric pressure, absorbing the cooling agent in the absorption liquid, withdrawing the absorption liquid from the presence of the auxiliary agent, returning the auxiliary agent into the presence of the cooling agent under the influence of said force, heating the absorption liquid and expelling the cooling agent from solution returning the absorption liquid into the presence of the gaseous mixture, converting the cooling agent to more dense phase at substantially atmospheric pressure, and returning the densified cooling agent into the presence of the auxiliary agent.

65. Refrigerating apparatus of the absorption type including a gas and liquid separation member, a plurality of vertically extending coils arranged at about the same elevation, and means for circulating liquid between and through said gas and liquid separation member and said coils including means for causing lifting of liquid by vaporous fluid in said coils.

66. Refrigerating apparatus of the absorption type including a gas and liquid separation member, a plurality of thermosiphon lift members, and connections forming a circulation circuit through said members in which circulation is produced by the lifting action of vaporous fluid in said thermosiphon members.

67. Absorption refrigerating apparatus including a generator, an evaporator, an absorber, conduits forming a circulation circuit for absorption liquid between said generator and said absorber, conduits forming a circulation circuit for inert gas between said evaporator and said absorber, and means for draining excess liquid from the evaporator including a conduit separate from said gas circulation conduits.

68. Absorption refrigerating apparatus including a generator, an evaporator, an absorber, conduits forming a circulation circuit for absorption liquid between said generator and said absorber, conduits forming a circulation circuit for inert gas between said evaporator and said absorber and extending above the bottom of the evaporator, and means for draining excess liquid from the evaporator to the liquid circulation circuit including a conduit separate from said gas circulation conduits.

69. Absorption refrigerating apparatus including a generator, an evaporator, an absorber, conduits forming a circulation circuit for absorption liquid between said generator and said absorber, conduits forming a circulation circuit for inert gas between said evaporator and said absorber and extending above the bottom of the evaporator, and means for draining excess liquid from the evaporator through the gas circulation circuit into the liquid circulation circuit including a conduit separate from said gas circulation conduits.

70. In the art of refrigerating with a system employing a refrigerant, an absorption liquid and an inert gas and having a liquid circulation circuit including a generator and an absorber, and having a gas circulation circuit including an evaporator and said absorber, the improvement which consists in draining excess liquid from the evaporator into the liquid circulation circuit without passing through the absorber.

71. In the art of refrigerating with a system employing a refrigerant, an absorption liquid and an inert gas and having a liquid circulation cir-

cuit including a generator and an absorber, and having a gas circulation circuit including an evaporator and said absorber, tthe improvement which consists in draining excess liquid from the evaporator into the gas circulation circuit to evaporate therein and thence to the generator without passing through the absorber.

72. Refrigerating apparatus containing a refrigerant, absorption liquid and an inert gas and including an evaporator, an absorber, members forming a liquid circulation circuit, conduits connecting the evaporator and absorber to provide vertical flow of inert gas therethrough in the same direction, and means actuated by force within the apparatus for causing said flow to take place in a predetermined direction.

73. Refrigerating apparatus containing a refrigerant, absorption liquid and an inert gas and including an evaporator, an absorber, members forming a liquid circulation circuit, conduits connecting the evaporator and absorber to provide vertical flow of inert gas therethrough in the same direction, and means actuated by force within the apparatus for causing said flow to take place upwardly through the evaporator and upwardly through the absorber.

74. A refrigerating system including a vessel adapted to contain a liquid and wherein a gas may be formed from the liquid upon the application of heat thereto, a second vessel also adapted to contain a liquid and wherein a gas may be formed from the liquid upon the application of heat thereto, an absorber, conduits connecting the first mentioned vessel to said absorber to form a circuit for flow of absorption liquid between said first mentioned vessel and said absorber, and means to conduct gas out of one of said vessels and into a portion of said absorption liquid circuit outside of said first mentioned vessel to promote the flow of absorption liquid over said circuit.

75. A refrigerating system having an absorption liquid circuit including a first vertically extending branch containing liquid and a second vertically extending branch containing liquid, connections for flow of fluid between said branches, a generator, and means to conduct gaseous fluid from said generator and introduce the same into said first branch to lighten the fluid therein and cause circulation upwardly in said first branch and downwardly in said second branch.

76. That improvement in the art of refrigerating thrcugh the agency of an absorption system including a generator, an evaporator and an absorber, said system containing a cooling agent and an auxiliary agent in the presence of which the cooling agent evaporates, which consists in building up a liquid column pressure gradient and circulating said auxiliary agent between the absorber and evaporator due to said liquid column pressure gradient.

77. That improvement in the art of refrigerating through the agency of an obsorption system including a generator, an evaporator and an absorber, said system containing a cooling agent and an auxiliary agent in the presence of which the cooling agent evaporates, which consists in building up a liquid column pressure gradient, circulating said auxiliary agent between the absorber and evaporator due to said liquid column pressure gradient and circulating dissolved cooling agent between the generator and absorber.

EDMUND ALTENKIRCH.

CERTIFICATE OF CORRECTION.

Patent No. 1,976,593. October 9, 1934.

EDMUND ALTENKIRCH.

It is hereby certified that error appears in the heading to the printed specification of the above numbered patent requiring correction as follows: Line 7, date of filing, after "Serial No. 101,745" insert the words In Germany April 23, 1925; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 5th day of February, A. D. 1935.

(Seal)

Leslie Frazer

Acting Commissioner of Patents.

cuit including a generator and an absorber, and having a gas circulation circuit including an evaporator and said absorber, tthe improvement which consists in draining excess liquid from the evaporator into the gas circulation circuit to evaporate therein and thence to the generator without passing through the absorber.

72. Refrigerating apparatus containing a refrigerant, absorption liquid and an inert gas and including an evaporator, an absorber, members forming a liquid circulation circuit, conduits connecting the evaporator and absorber to provide vertical flow of inert gas therethrough in the same direction, and means actuated by force within the apparatus for causing said flow to take place in a predetermined direction.

73. Refrigerating apparatus containing a refrigerant, absorption liquid and an inert gas and including an evaporator, an absorber, members forming a liquid circulation circuit, conduits connecting the evaporator and absorber to provide vertical flow of inert gas therethrough in the same direction, and means actuated by force within the apparatus for causing said flow to take place upwardly through the evaporator and upwardly through the absorber.

74. A refrigerating system including a vessel adapted to contain a liquid and wherein a gas may be formed from the liquid upon the application of heat thereto, a second vessel also adapted to contain a liquid and wherein a gas may be formed from the liquid upon the application of heat thereto, an absorber, conduits connecting the first mentioned vessel to said absorber to form a circuit for flow of absorption liquid between said first mentioned vessel and said absorber, and means to conduct gas out of one of said vessels and into a portion of said absorption liquid circuit outside of said first mentioned vessel to promote the flow of absorption liquid over said circuit.

75. A refrigerating system having an absorption liquid circuit including a first vertically extending branch containing liquid and a second vertically extending branch containing liquid, connections for flow of fluid between said branches, a generator, and means to conduct gaseous fluid from said generator and introduce the same into said first branch to lighten the fluid therein and cause circulation upwardly in said first branch and downwardly in said second branch.

76. That improvement in the art of refrigerating thrcugh the agency of an absorption system including a generator, an evaporator and an absorber, said system containing a cooling agent and an auxiliary agent in the presence of which the cooling agent evaporates, which consists in building up a liquid column pressure gradient and circulating said auxiliary agent between the absorber and evaporator due to said liquid column pressure gradient.

77. That improvement in the art of refrigerating through the agency of an obsorption system including a generator, an evaporator and an absorber, said system containing a cooling agent and an auxiliary agent in the presence of which the cooling agent evaporates, which consists in building up a liquid column pressure gradient, circulating said auxiliary agent between the absorber and evaporator due to said liquid column pressure gradient and circulating dissolved cooling agent between the generator and absorber.

EDMUND ALTENKIRCH.

CERTIFICATE OF CORRECTION.

Patent No. 1,976,593. October 9, 1934.

EDMUND ALTENKIRCH.

It is hereby certified that error appears in the heading to the printed specification of the above numbered patent requiring correction as follows: Line 7, date of filing, after "Serial No. 101,745" insert the words In Germany April 23, 1925; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 5th day of February, A. D. 1935.

(Seal)

Leslie Frazer

Acting Commissioner of Patents.