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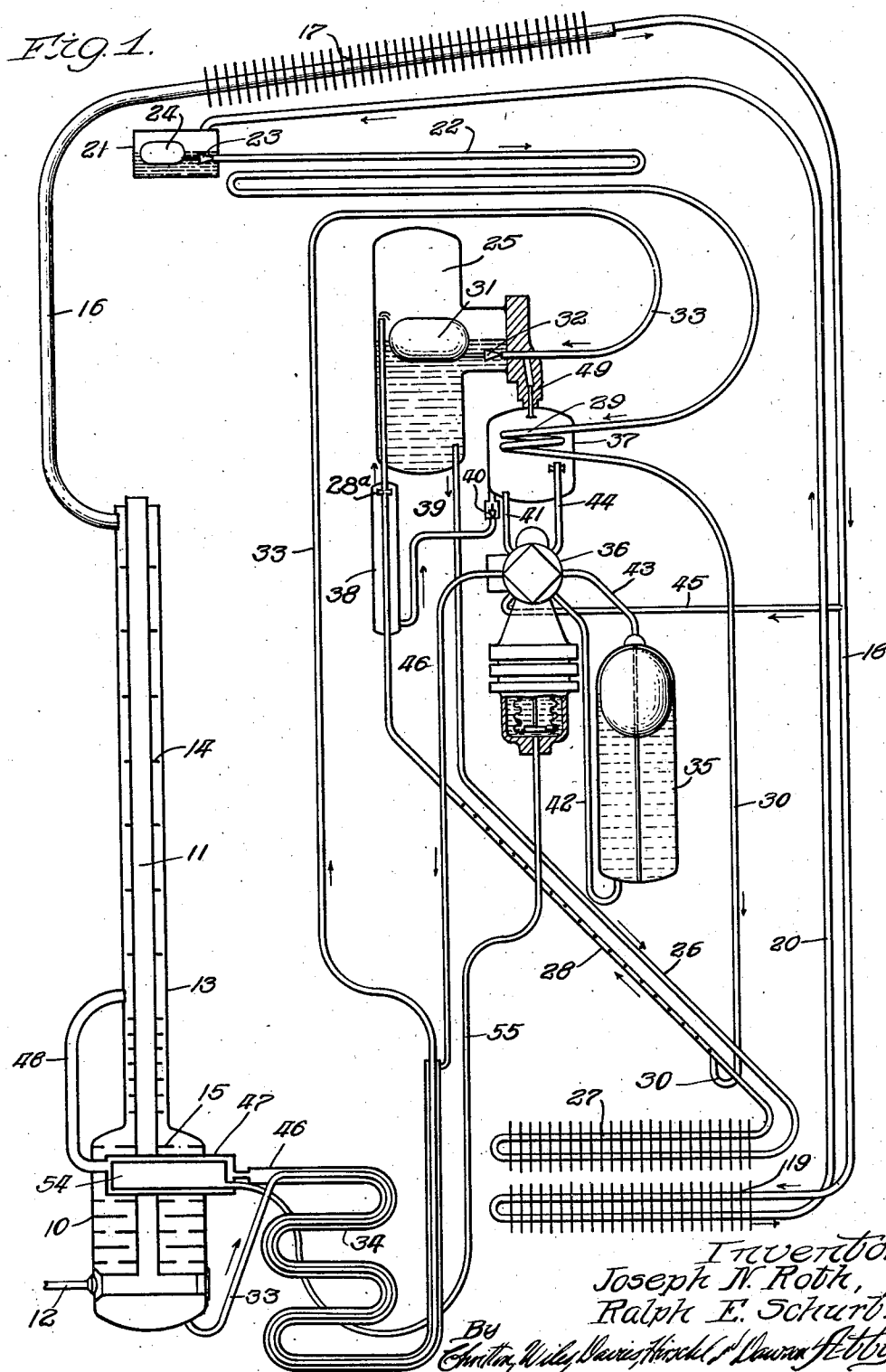
J. N. ROTH ET AL

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ABSORPTION REFRIGERATION APPARATUS

Filed Oct. 5, 1939

3 Sheets-Sheet 1



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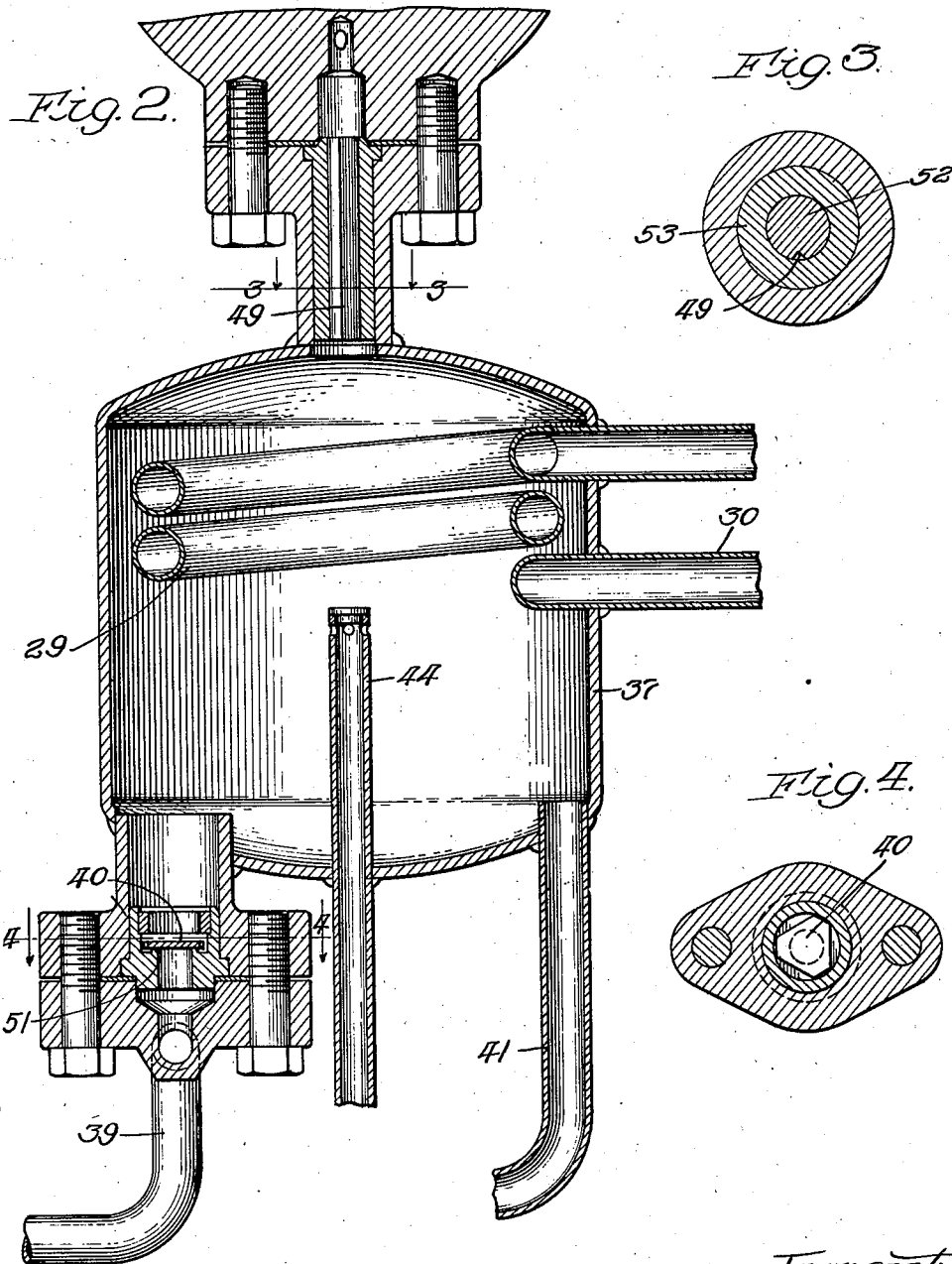
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3 Sheets-Sheet 2



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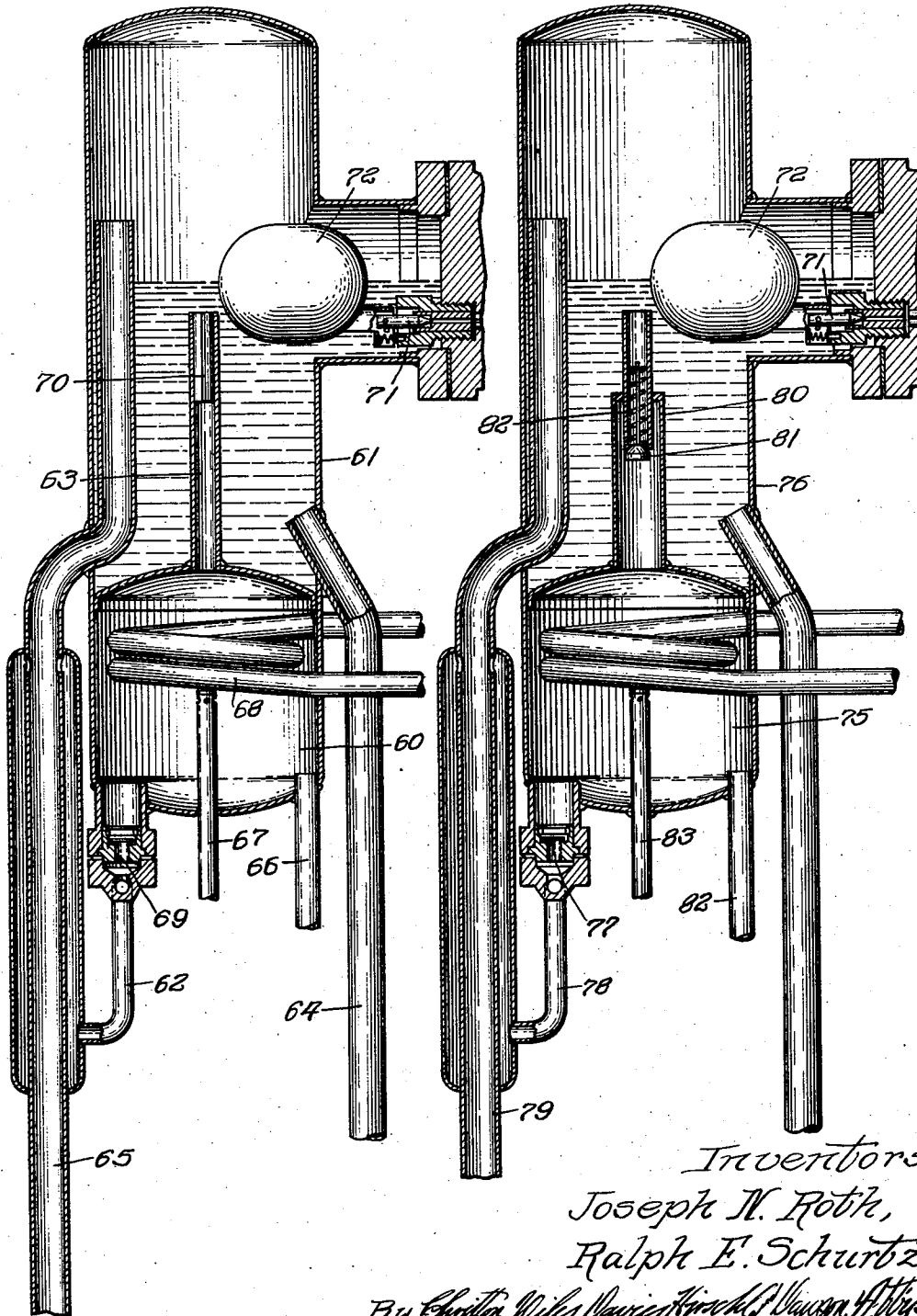
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Fig. 5.

Fig. 6.



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UNITED STATES PATENT OFFICE

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ABSORPTION REFRIGERATION APPARATUS

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Application October 5, 1939, Serial No. 298,110

20 Claims. (Cl. 62—5)

This invention relates to absorption refrigeration apparatus, and more particularly to a system adapted to maintain the still at a high pressure and the absorber at a low pressure and to effect return of liquor from the absorber to the still through an intermediate transfer chamber.

One feature of this invention is that improved transfer means for returning the rich liquor to the still is provided; another feature of this invention is that it provides considerable improvement in operation in a system of the type wherein the transfer chamber is alternately connected to a high pressure portion of the system and to a low pressure portion; a further feature is that means are provided for subduing the rush of fluid from the transfer chamber when it is connected to the low pressure portion of the system after it has been connected to the high pressure portion; yet another feature of this invention is that it provides more positive movement of fluid from the absorber to the transfer chamber; and still another feature of this invention is that it causes the valve means associated with the transfer chamber to withstand the full pressure differential in the system for only a brief period. Other features and advantages of this invention will be apparent from the following specification and the drawings, in which:

Figure 1 is a schematic or diagrammatic showing of refrigeration apparatus embodying this invention; Figure 2 is a detail sectional view of the pressure chamber; Figure 3 is a fragmentary sectional view along the line 3—3 of Figure 2; Figure 4 is a detail sectional view of the check valve, along the line 4—4 of Figure 2; Figure 5 is a vertical sectional view of a modified arrangement of absorber and pressure chamber; and Figure 6 is a vertical sectional view of still another modification of this invention.

In the particular embodiment of our invention described herewith, the system in general comprises a still adapted to have a mixture of refrigerant and absorbent, as ammonia and water, boiled therein by the application of heat; a condenser connected by a vapor conduit to the still to liquefy the refrigerant vapor delivered thereby; an evaporator or cooling unit in which the liquefied refrigerant is permitted to vaporize, the evaporator having restricted connection with the condenser; an absorber in which the gas from the evaporator is reabsorbed in liquid; and means for effecting flow of weak liquor from the

bottom of the still to the absorber and flow of rich liquor from the bottom of the absorber to the still. This latter means includes a transfer chamber intermediate the absorber and the still and a valve arrangement whereby the chamber is selectively connected to the absorber or to the still.

Referring more particularly to a specific system schematically or diagrammatically illustrated in Figure 1, the still 10 is adapted to contain a mixture of water and ammonia. A flue 11 is provided within the still and heat delivered thereto by the combustion of gas or some other fuel delivered by the burner 12. An analyzer tower 13, in the form of a long cylindrical tubing enclosing the flue 11, rises from the upper part of the still, which is a vertical cylindrical vessel. Both the analyzer tower and the still are provided with baffle plates, as 14 and 15, these plates serving to stratify the liquid in the still and to improve the efficiency of the apparatus.

Rich ammonia vapors boiled off the liquor in the still pass upwardly through the analyzer tower 13 and then through the pipe connection 16 to the rectifier 17, a finned inclined tube at the top of the system. From there the ammonia vapors, any entrained water vapor having been removed by the rectifier, pass down through the connection 18 to a condenser 19 at the lower end of the apparatus. This condenser comprises one or more loops of piping, finned to increase the heat radiation. The ammonia vapor is here condensed into liquid ammonia, and then elevated by the vapor pressure behind it through the connection 20 to the receiver 21.

The amount of ammonia boiled off and liquefied is a function of the concentration of the liquor in the still and of the amount of heat supplied to it, so that if the concentration of liquor is kept relatively constant the rate of delivery of liquid ammonia to the receiver 21 will be practically a direct function of the amount of heat supplied to the still. The amount of fuel delivered to the burner 12, and thus the amount of heat supplied and the rate of delivery of liquid ammonia to the receiver, can be regulated in any desired manner, as by a valve (not here shown) actuated in conventional manner by a thermostat in the cooling chamber of the refrigerator.

Liquid ammonia passes from the receiver 21 to the dry evaporator 22, preferably comprising several coils of piping, through the restriction interposed by a valve 23 controlled by the float 24. The float and valve are so arranged that, as more liquid ammonia is delivered to the receiver, the

valve opens further to permit increased flow to the evaporator to maintain the level of liquid in the receiver substantially constant.

Absorbing apparatus is provided in the form of an upper chamber or vessel 25 having extending downwardly therefrom a cooling and absorption loop. This loop is formed by a pipe 26 extending down from the bottom of the absorber vessel; the absorber cooling coil 27, finned for better heat radiation; and the upwardly extending pipe or leg 28, terminating in the vessel 25 slightly above the level of absorption liquid therein.

Expanded ammonia vapor from the evaporator 22 first passes through a small loop or coil 29, the purpose of which will be hereinafter explained, then through the pipe 30 into the rising leg 28 of the absorber loop, near the lower part thereof. The incoming vapor creates bubbles in the leg 28 of the absorber loop which provide a liquid lift or pump insuring circulation of absorption liquid through the loop. Inasmuch as the liquid in this rising leg is at all times the weakest liquor in the absorber, and cool as a result of passing through the coil 27, all absorption takes place in the pipe 28 under normal conditions, the liquid flowing out of the top of this pipe being quite rich.

The level of liquid in the absorber vessel 25 is maintained by a float 31 and valve 32 controlling delivery of weak liquor from the still. The pipe 33 leads from the lower end of the still (where the liquor is weakest) through a heat exchanger 34 and then on up to open into the absorber, the flow into the absorber being controlled by the valve 32, which opens whenever the level of liquid in the vessel 25 drops below a desired point.

The means for returning rich liquor from the absorber to the still comprises as its principal parts a transfer chamber 35, a valve assembly 36, a pressure chamber 37 and associated operative interconnections. A flow connection is provided from the leg 28 of the absorber loop, out of the short open-ended cross tube 28a, through the jacket 38, pipe 39, and check valve 40, into the pressure chamber 37. When the valves are set in a certain position a flow path is provided from the pressure chamber, and thus from the absorber, through the pipe 41, the valve mechanism, and the pipe 42 to the bottom of the transfer chamber 35; any vapor therein being vented through the pipe 43 and the pipe 44 (interconnected by the valve assembly) into the pressure chamber.

When the valve device is actuated, in accordance with a condition of the system, to move the valves to another position, the pipe 43 is connected to the pipe 45 which is open to high pressure vapor in the pipe 18; and the pipe 42 is connected to the pipe 46, connected through the heat exchanger 34, to a jacket 47 around a thermostat bulb in the still, and then through a pipe 48 into the analyzer tower. The transfer chamber and connecting pipes now being at high pressure, the rich liquor therein flows into the analyzer tower and thence to the still until the valves are again moved to the position first described above.

When the interconnection between the pressure chamber and the transfer chamber is again provided there is, of course, a rush of high pressure vapor through the pipes 43 and 44 to the chamber 37. The check valve 40, however, prevents these vapors from getting back into the low pressure side of the system; and the liquid in the chamber 37, cooled by the coil 29, rapidly absorbs

the vapor, assisted in this respect by a fine stream of weak liquor bled into the chamber 37 through the conduit 49 branching from the weak liquor pipe 33. The rapid absorption of rich ammonia vapor causes the pressure in the chambers 35 and 37 to drop below the pressure in the absorber 25 for a brief time, so that there is a positive pressure-driven flow of rich liquor from the absorber to completely refill the chambers 35 and 37. When these are completely filled with liquid the weak liquor entering through the branch pipe 49 immediately starts to raise the pressure therein, the check valve 40 closing; and shortly the chambers 35 and 37 will again stand at high pressure. There is thus only a brief interval during which the valves in the assembly 36 must withstand the full difference of pressure between the high and low sides of the system.

While the continuously operating absorption refrigeration apparatus above described contains a number of inventions and improvements over other known systems, this present application is particularly concerned with the pressure chamber and its associated parts and functions. Other improvements in the system are being made the subject matter of the earlier filed Roth application Serial No. 296,995 and other co-pending applications by the present inventors, both jointly and severally.

We have found that refrigerating apparatus adapted to maintain the still at high pressure and the absorber at low pressure and to return liquor to the still by alternately connecting a transfer chamber first to the absorber and then to the still, particularly when designed in a size adapted for use in the domestic refrigerator, is open to several undesirable objections.

In the first place, the pressure in the high side of the system is frequently 200 or 250 pounds per square inch, while that in the low side is in the neighborhood of atmospheric pressure. When the transfer chamber, after having been connected to a high pressure portion of the system, is connected to a low pressure portion thereof, there is an initial rush of fluid, in the form of refrigerant vapor, from the transfer chamber into the low pressure side of the system. This is highly undesirable for a number of reasons. It causes a loud hissing or rushing noise, objectionable in a domestic refrigerator, for example; discharges ammonia vapor at high pressure into the absorber, which should only have to carry the load of absorption of vapor from the evaporator; and otherwise disturbs the smooth and efficient operation of the system. Moreover, vertical space in a domestic refrigerator is limited, and it is sometimes difficult to secure the desired flow of liquid from the absorber to the transfer chamber while at the same time having the transfer chamber high enough above the still to maintain a good delivery head. Moreover, it is preferable to have the transfer chamber disconnected from the high pressure side of the system for a period several times as long as it is connected thereto, as for example in the ratio of about eight to one. Under these circumstances, the valves associated with the transfer chamber have heretofore had to maintain across themselves the full pressure differential of the system for considerable periods of time.

We have obviated these and other objections in continuous absorption refrigeration apparatus of the type herein disclosed by providing a pressure chamber in the connection between the absorber and the transfer chamber. We so arrange mat-

ters that the pressure chamber is normally filled with liquid; and its connection to the absorber includes a check valve, so that the initial rush of fluid from the transfer chamber when it is connected to the pressure chamber is subdued, and prevented from passing on into the absorber or other low pressure portions of the systems. After the initial rush of fluid the pressure in the pressure chamber drops, by reason of absorption therein, to a pressure lower than that existing in the absorber, so that flow of liquid from the absorber to the pressure chamber and thus to the transfer chamber, is positive. Immediately after the transfer chamber and pressure chamber have refilled with rich liquor from the absorber the pressure in the pressure chamber starts to rise, and shortly equals that in the high side of the system. The valves associated with the transfer chamber thus need maintain the full pressure differential of the system thereacross for only a brief part of the total period of time that the transfer chamber is disconnected from the still.

Referring more particularly to the particular embodiment of our invention illustrated in Figures 1 to 4, it will be seen that a liquid flow path is provided from the absorber through its cooling loop, through the casing 38, the pipe 39, and the check valve 40 into the pressure chamber 37; and that this liquid flow path continues on into the transfer chamber when the valve mechanism is so arranged as to connect the pipes 41 and 42. Vapor from the top of the transfer chamber is vented through the pipe 43 and the pipe 44 into the pressure chamber. The check valve 40 is here shown as a small plate urged by gravity against its seat 51; and so arranged that liquid can flow from the absorber to the pressure chamber, but cannot flow in the reverse direction. The by-pass or bleeder conduit 49 branching from the weak liquor pipe 33 is here shown in one convenient form of construction wherein it has a portion with a very small opening. This is attained by grooving a plug 52 and driving it into the bore of a cooperating cylindrical member 53.

When the transfer chamber has been connected to the still and delivered most of the liquor therein to it, the pressure in the actuating bulb drops, and the pressure differential acts through the liquid actuating leg 55 to throw the valves in the valve assembly 36 to a position disconnecting the pipes 45 and 46 and connecting the transfer chamber to the pressure chamber, and thus through it to the absorber. That is, in this position the ends of pipes 45 and 46 are blocked; pipe 43 is connected to pipe 44; and pipe 41 is connected to pipe 42. Since the transfer chamber is filled with fluid at high pressure there is an initial rush of ammonia vapor into the pressure chamber 37. The pressure chamber 37 is, however, full of liquor at high pressure which has been held in it while the transfer chamber was connected to the still. The initial rush of fluid from the transfer chamber is thus subdued by absorption in a solid body of liquid in a chamber which is at high pressure.

Inasmuch as the transfer chamber was largely filled with vapor at the time of its connection to the pressure chamber 37, the pressure in the two chambers starts to drop by reason of the absorption of the vapor by the liquid. After the initial rush, liquid starts to drain from the pressure chamber through the pipe 41 to the transfer chamber, vapor from the transfer chamber filling the space in the pressure chamber above the liquid. The surface of the liquid is not the only

means provided for absorbing this vapor; absorption being greatly accelerated by the small stream of weak liquor flowing in through the bleeder or by-pass orifice 49 whenever the pressure in the pressure chamber is below that in the high side of the system. This bleeder orifice or conduit has a portion in it so small that the volume of liquid delivered is not sufficient to create any considerable change in the volume of liquid in the pressure chamber, the restricted portion of the conduit, in one refrigerator we have built, having a diameter of only .006 inch. The weak liquor sprayed in through this orifice, however, greatly accelerates the absorption of ammonia vapor, so that in a matter of seconds after the initial rush the pressure in the chambers 35 and 37 has dropped to perhaps five pounds or more below the pressure in the absorber.

As soon as this occurs there is a positive pressure driven flow of liquid from the absorber past the check valve 40 into the pressure chamber, and then down through the pipe 41 to the transfer chamber, until both the transfer chamber and the pressure chamber are again completely refilled with liquid, any traces of ammonia vapor which would otherwise be trapped at the top being absorbed by the fine stream of weak liquor entering through the conduit 49. As soon as the chambers and connecting pipes are again completely filled with liquid, the continued admission of weak liquor begins to have an appreciable effect. This stream of weak liquor causes the pressure in the pressure chamber and transfer chamber to rise, the check valve 40 preventing any flow of fluid from the pressure chamber to the absorber. In a matter of seconds after the chambers are completely filled with liquid the pressure in them has risen substantially to that in the high side of the system, so that the valves in the valve assembly 36 no longer have the complete pressure differential of the system across them. Instead, both sides of the valves are now at substantially equal high pressure; and the pressure difference between the high and low sides of the system is across the check valve 40. There is, of course, no difficulty in assuring the desired seal and long life of the check valve 40; but movable valves of the kind in the valve assembly 36, whether of the plunger or slide type, have excessive wear and wire drawing if the full pressure difference is maintained across them. Moreover, the frictional wear caused by movement of the slide valve, for example, and the resistance which it interposes to the actuating mechanism, is greatly reduced by the fact that the pressure on both sides is practically equal whenever there is movement of the valve.

The transfer chamber and pressure chamber thus stand at high pressure for the remainder of the period that the transfer chamber is disconnected from the still. When the liquid in the still has boiled down to a predetermined concentration which, by means of the actuating bulb 54, effects movement of the valves in the assembly 36, the transfer chamber 35 is again connected to the still. That is, pipe 42 is connected to pipe 46; pipe 43 is connected to pipe 45; and pipes 41 and 44 are blocked. High pressure vapor entering through the pipe 45 insures complete equalization of pressure in the still and transfer chamber while the liquid therein flows through the pipes 42 and 46, the heat exchanger 34, the jacket 47 around the actuating bulb, and the pipe 48 into the analyzer tower 13, and thus into the

still. The arrangement is preferably such that the transfer chamber drains fairly rapidly, and after about two-thirds of the liquid therein has passed into the still, as for example in about 45 seconds, the position of the valves is changed and the transfer chamber reconnected to the pressure chamber. The initial rush of vapor, the drop in pressure below the absorber pressure, the flow of liquid from the absorber until the chambers are again completely filled, and the rise in pressure, all take place in less than a minute, although in normal operation of the system the transfer chamber is not again connected to the still for seven or eight minutes.

In the modified form of our invention illustrated in Figure 5, the pressure chamber 60 lies within the shell of the absorber 61, although it is connected to it only by the liquid connections 62 and the riser 63, being otherwise completely sealed from the remainder of the absorber. As in the preceding form of structure, circulation of absorption liquid is maintained at all times during evaporation down through the pipe 64, through the absorber cooling coil, not shown, and up again through the pipe 65. The pipes 66 and 67 opening into the pressure chamber 60 correspond with the pipes 41 and 44 described in the structure shown in Figures 1 to 4. Cooling of the fluid in the pressure chamber is again achieved by passing vapor, on its way from the evaporator to the absorber, through the cooling coil 68. A check valve 69 is provided in the pipe 62, so that liquid can flow only from the rising leg of the absorber coil into the pressure chamber; and cannot flow in the reverse direction. The riser pipe 63 extending upwardly from the pressure chamber has in the upper portion thereof a restricted or capillary conduit 70, preferably terminating about a half-inch below the level at which the liquid is maintained in the absorber by the valve 71 and float 72.

In this form of our invention the pressure chamber is again filled with liquid at the time when the transfer chamber is connected to it; and flow of fluid from the pressure chamber to the absorber is restricted by the check valve 69 and the capillary orifice 70. The high pressure vapor from the transfer chamber thus again strikes a solid body of liquid which almost immediately jumps to high pressure, thus subduing the rush. In this form the pressure in the transfer chamber is reduced by absorption therein, and by bleeding of the gas through the capillary 70 into the absorber proper. The fact that the pressure chamber is cooled to a temperature lower than that of the absorber causes the pressure in it to drop below that in the absorber upon substantially complete absorption of the vapor; and flow of liquid then takes place past the check valve 40 until the pressure and transfer chambers are completely refilled. Any residual vapor is bled off through the conduit 70; and any gas or vapor is prevented from being trapped by the fact that there is such a slight head of liquid thereabove.

In the further form of our invention shown in Figure 6, the pressure chamber 75 again lies within the shell of the absorber 76, although it is connected to the remainder of the absorber only through two connections, each having valves therein. One connection is past the check valve 77 and through the pipe 78 to the rising leg 79 of the absorber cooling loop; and the other connection is through the riser 80 and past the valve 81. This valve is normally pressed down away

from its seat by the spring 82, preferably so arranged as to keep the valve open whenever the pressure in the pressure chamber is not more than ten pounds above that in the absorber. Pipes 82 and 83 again correspond to pipes 41 and 44 in the modification of this invention first described.

In this form of our invention the initial rush of vapor into the pressure chamber closes the check valve 77 and the valve 81, so that a solid body of liquid is again interposed against the rush of vapor from the transfer chamber. When the pressure in the transfer chamber has dropped, by absorption of vapor, to within about ten pounds of that in the absorber, the valve 81 is opened by the spring 82, and the pressures in the pressure chamber, transfer chamber, and absorber, thereupon equalized. Flow of liquid thereupon takes place into the pressure chamber, both through the pipe 78 and through the riser 80. In all of these forms, of course, the level of liquid in the absorber proper is maintained by the float controlled valve which admits weak liquor from the still whenever the liquid level in the absorber drops.

While we have shown and described certain embodiments of our invention, it is to be understood that it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made without departing from the spirit and scope of the invention as disclosed in the appended claims.

We claim:

1. Absorption refrigeration apparatus of the character described adapted to provide continuous refrigerating effect, including: a still; a condenser, the still and condenser being adapted to operate at high pressure; an evaporator; an absorber, the evaporator and absorber being adapted to operate at low pressure; a transfer chamber adapted to be connected alternately to the still and to the absorber to effect return of liquor from the latter to the former; a pressure chamber in the connection between the transfer chamber and the absorber for subduing the rush of fluid from the transfer chamber when it is connected to the absorber; and operative connections between the elements of the apparatus.

2. Absorption refrigeration apparatus of the character described adapted to provide continuous refrigerating effect, including: a still; a condenser, the still and condenser being adapted to operate at high pressure; an evaporator; an absorber, the evaporator and absorber being adapted to operate at low pressure; a transfer chamber adapted to be connected alternately to the still and to the absorber to effect return of liquor from the latter to the former; a pressure chamber in the connection between the transfer chamber and the absorber adapted to be filled with liquid when the connection of the transfer chamber to the absorber is effected to subdue the rush of fluid from the transfer chamber; and operative connections between the elements of the apparatus.

3. Absorption refrigeration apparatus of the character described adapted to provide continuous refrigerating effect, including: a still; a condenser, the still and condenser being adapted to operate at high pressure; an evaporator; an absorber, the evaporator and absorber being adapted to operate at low pressure; a transfer chamber adapted to be connected alternately to the still and to the absorber to effect return of liquor from the latter to the former; a pressure

chamber in the connection between the transfer chamber and the absorber adapted to be filled with liquid when the connection of the transfer chamber to the absorber is effected to subdue the rush of fluid from the transfer chamber; a connection between the absorber and the pressure chamber for a flow of liquid from the former to the latter, but wherein a check-valve prevents flow in the other direction; and operative connections between the elements of the apparatus.

4. Apparatus of the character claimed in claim 1, including means for introducing weak liquor into the pressure chamber.

5. Apparatus of the character claimed in claim 3, including means for supplying a small stream of weak liquor to the pressure chamber when the pressure therein is below that in the still.

6. Apparatus of the character claimed in claim 3, including a second restricted connection between the pressure chamber and absorber.

7. Apparatus of the character claimed in claim 3, including a second connection between the pressure chamber and absorber having a valve therein adapted to close when the pressure in the pressure chamber is materially higher than that in the absorber.

8. Apparatus of the character claimed in claim 3, including a second connection between the pressure chamber and absorber having a portion of very small diameter.

9. Apparatus of the character claimed in claim 3, including means for supplying a small stream of weak liquor to the pressure chamber when the pressure therein is below that in the still and means for cooling the pressure chamber.

10. Apparatus of the character claimed in claim 2, including means for passing at least a portion of the refrigerant fluid in heat exchange relation with the contents of the pressure chamber.

11. Absorption refrigeration apparatus of the character described adapted to provide continuous refrigerating effect, including: a still; a condenser, the still and condenser being adapted to operate at high pressure; an evaporator; an absorber, the evaporator and absorber being adapted to operate at low pressure; a transfer chamber; valve means having a movable valve member adapted to stand in either of two positions, the valve means in one position connecting the transfer chamber to the absorber and blocking connection to the still and in the other position connecting the transfer chamber to the still and blocking connection to the absorber, to effect return of liquor from the absorber to the still; means between the valve means and the absorber so constructed and arranged that the full pressure drop between the still and the absorber exists across the valve means for only a brief period; and operative connections between the elements of the apparatus.

12. Absorption refrigeration apparatus of the character described adapted to provide continuous refrigerating effect, including: a still; a condenser, the still and condenser being adapted to operate at high pressure; an evaporator; an absorber, the evaporator and absorber being adapted to operate at low pressure; a transfer chamber; valve means for alternately connecting the transfer chamber to the still and blocking connection to the absorber, and vice versa, to effect return of liquor from the absorber to the still; a pressure chamber in the connection between the valve means and the absorber; means for raising the pressure in the pressure chamber, shortly after connection of the transfer chamber to the ab-

sorber, to that of the still; and operative connections between the elements of the apparatus.

13. Absorption refrigeration apparatus of the character described adapted to provide continuous refrigerating effect, including: a still; a condenser, the still and condenser being adapted to operate at high pressure; an evaporator; an absorber, the evaporator and absorber being adapted to operate at low pressure; a transfer chamber; valve means for alternately connecting the transfer chamber to the still and blocking connection to the absorber, and vice versa, to effect return of liquor from the absorber to the still; a pressure chamber in the connection between the valve means and the absorber, the connection between the pressure chamber and the absorber including a check-valve preventing flow of fluid from the former to the latter; means for supplying a small stream of fluid from a high pressure portion of the apparatus to the pressure chamber to raise the pressure therein, shortly after connection of the transfer chamber to the absorber, to that of the still; and operative connections between the elements of the apparatus.

14. Apparatus of the character claimed in claim 12, wherein the transfer chamber is disconnected from the still for a period several times that during which it is connected thereto.

15. Absorption refrigeration apparatus of the character described adapted to provide continuous refrigerating effect, including: a still; a condenser, the still and condenser being adapted to operate at high pressure; an evaporator; an absorber, the evaporator and absorber being adapted to operate at low pressure; a transfer chamber; valve means for alternately connecting the transfer chamber to the still and blocking connection thereto; means between the valve means and the absorber so constructed and arranged that the full pressure drop between the still and the absorber exists across the valve means for only a brief period; and operative connections between the elements of the apparatus.

16. Absorption refrigeration apparatus of the character described adapted to provide continuous refrigerating effect, including: a still; a condenser; the still and condenser being adapted to operate at high pressure; an evaporator; an absorber, the evaporator and absorber being adapted to operate at low pressure; a transfer chamber; a connection between the transfer chamber and the absorber; valve means for alternately connecting the transfer chamber to the still and blocking connection thereto; means for first lowering the pressure in the transfer chamber and then raising the pressure and blocking the connection to the absorber shortly after the connection to the still is blocked, whereby the full pressure drop between the still and the absorber exists across the valve means for only a brief period; and operative connections between the elements of the apparatus.

17. Absorption refrigeration apparatus of the character described adapted to provide continuous refrigerating effect, including: a still; a condenser, the still and condenser being adapted to operate at high pressure; an evaporator; an absorber, the evaporator and absorber being adapted to operate at lower pressure; transfer means; conduits having positively operated transfer valve means therein for alternately connecting the transfer means to the still and for closing such connections; a connection between the transfer means and the absorber including a check valve preventing flow of fluid from the former to the latter; a conduit for supplying a

small stream of weak liquor from a high pressure portion of the apparatus to the transfer means, this conduit being unrestricted except at its point of connection to the transfer means; and actuating means including a thermally responsive element in heat exchange relation with the contents of the still and connected to the positively operated valve means for shifting the latter in response to change in a condition in the still; whereby the stream of weak liquor, after the positively operated connections are closed, first causes the pressure in the transfer means to drop below that in the absorber to fill the transfer means with liquor from the absorber, and then raises the pressure in the transfer means substantially to that in the still to prevent application of the full pressure differential in the system to the positively operated valve means for long periods while it maintains the connections closed; and operative connections between the elements of the apparatus.

18. Absorption refrigeration apparatus of the character described adapted to provide continuous refrigerating effect, including: a still; a condenser, the still and condenser being adapted to operate at high pressure; an evaporator; an absorber, the evaporator and absorber being adapted to operate at low pressure; means adapted to be connected alternately to a high pressure portion and a low pressure portion of the apparatus; a body of liquid at high pressure; means for providing connection between the first mentioned means and the body of liquid and isolating both from the remainder of the apparatus before completing the connection to the low pressure portion, whereby vapor at high pressure in the first mentioned means is absorbed, rather than released to the low pressure portion; and operative connections between the elements of the apparatus.

19. Absorption refrigeration apparatus of the character described adapted to provide continuous refrigerating effect, including: a still; a condenser, the still and condenser being adapted to operate at high pressure; an evaporator; an absorber, the evaporator and absorber being adapted to operate at low pressure; a transfer chamber

adapted to be connected alternately to the still and to the absorber to effect return of liquor from the latter to the former; a pressure chamber in the connection between the transfer chamber and the absorber, normally filled with liquid at high pressure; means for blocking connection between the transfer chamber and the still and connecting the transfer and pressure chambers; means for subsequently completing connection of the transfer chamber to the absorber; and operative connections between the elements of the apparatus.

20. Absorption refrigeration apparatus of the character described adapted to provide continuous refrigerating effect, including: a still; a condenser, the still and condenser being adapted to operate at high pressure; an evaporator; an absorber, the evaporator and absorber being adapted to operate at low pressure; transfer means adapted to be filled with liquor from the absorber; means connecting the transfer means to the absorber, including a check valve permitting flow only to the transfer means; conduits having positively operated valve means incorporated therein for providing liquor and vapor connections between the transfer means and the still to deliver liquor thereto, and for closing such connections; means for delivering a fine stream of weak liquor at substantially still pressure to the transfer means; and actuating means including a thermally responsive element in heat exchange relation with the contents of the still and connected to the positively operated valve means for shifting the latter in response to change in a condition in the still; whereby the stream of weak liquor, after the positively operated connections are closed, first causes the pressure in the transfer means to drop below that in the absorber to fill the transfer means with liquor from the absorber, and then raises the pressure in the transfer means substantially to that in the still to prevent application of the full pressure differential in the system to the positively operated valve means for long periods while it maintains the connections closed.

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