May 10, 1927. 1,627,808

R. E. SCHURTZ

REFRIGERATION SYSTEM

Filed July 27, 1923 3 Sheets-Sheet 1

Fig. 1.

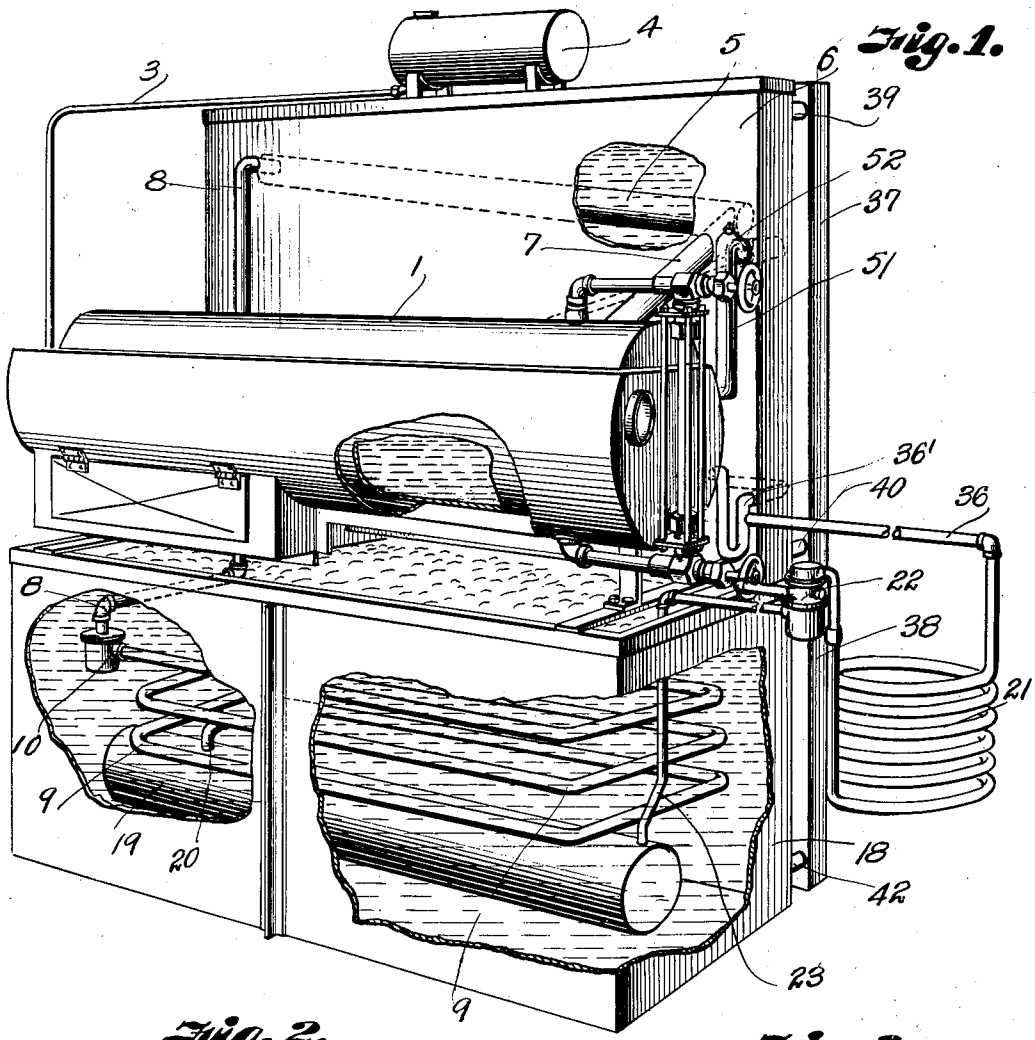


Fig. 2.

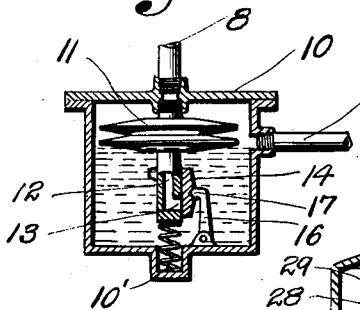


Fig. 3.

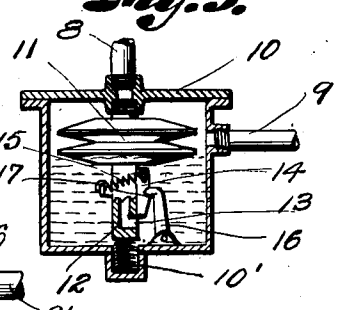
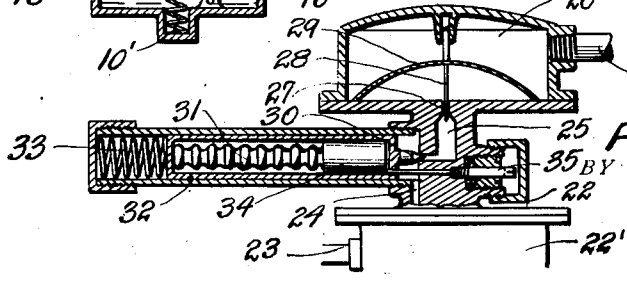


Fig. 4.



INVENTOR
Ralph E. Schurtz.
BY
Arthur Brown.
ATTORNEY

May 10, 1927. 1,627,808

R. E. SCHURTZ

REFRIGERATION SYSTEM

Filed July 27, 1923 3 Sheets-Sheet 2

Fig. 5.

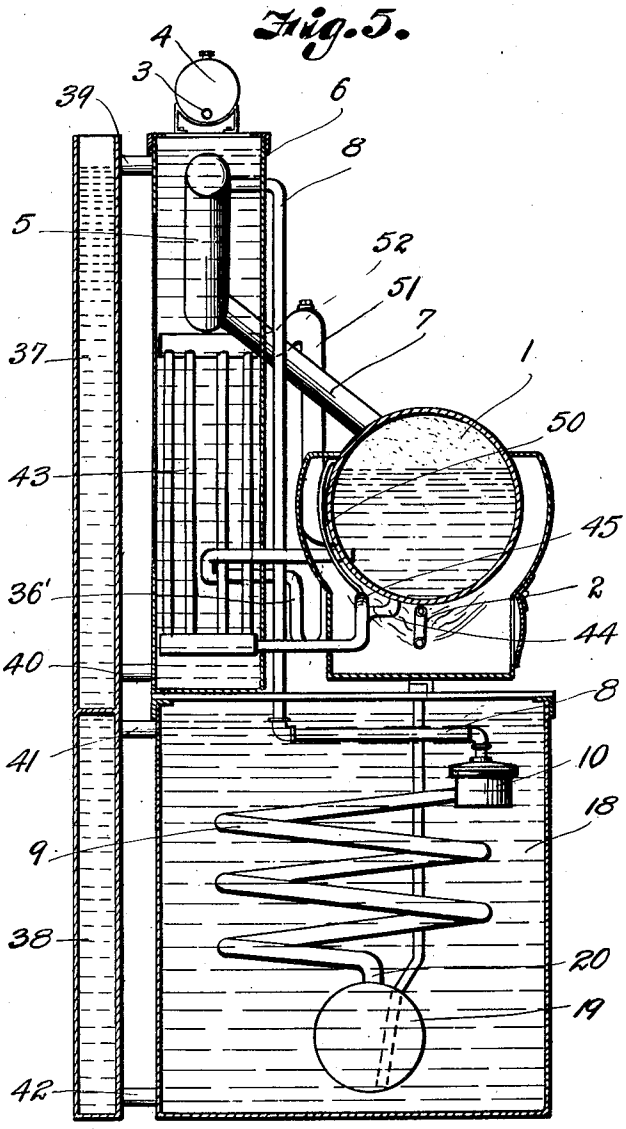


Fig. 6.

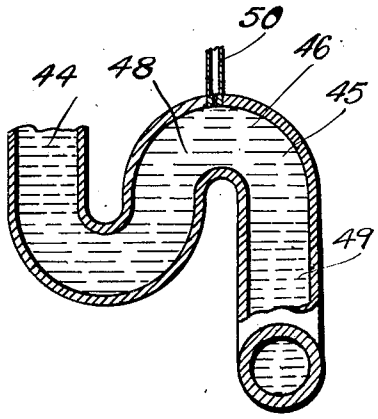
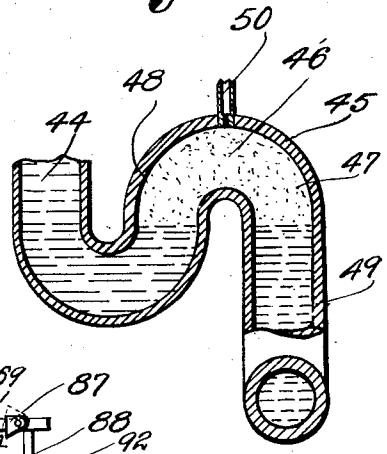


Fig. 7.



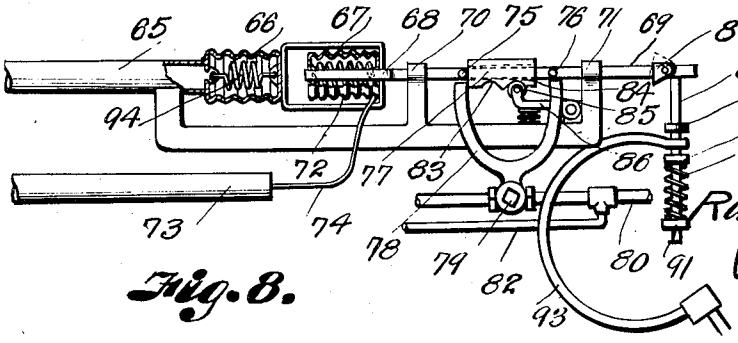


Fig. 8.

INVENTOR
Ralph E. Schurtz
ATTORNEY

May 10, 1927. 1,627,808

R. E. SCHURTZ

REFRIGERATION SYSTEM

Filed July 27, 1923 3 Sheets-Sheet 3

Fig. 10.

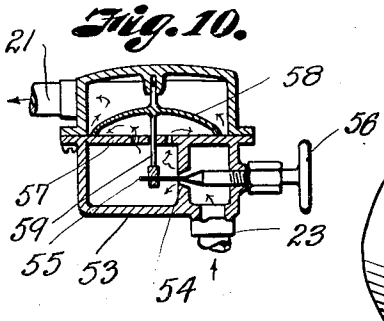


Fig. 9.

Fig. 11.

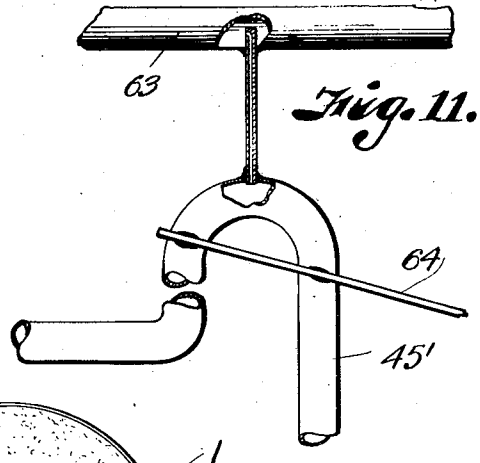
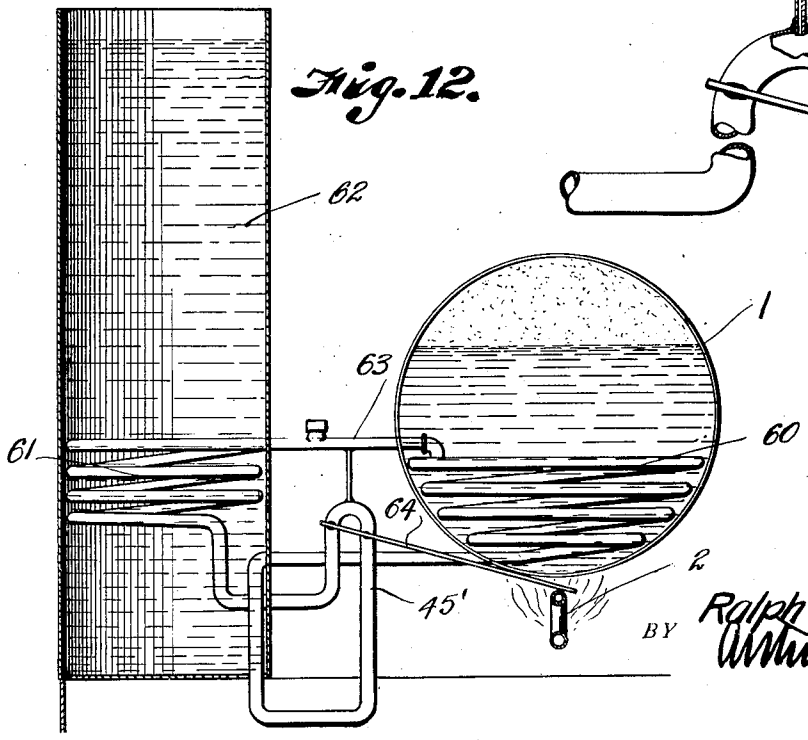


Fig. 12.



INVENTOR
Ralph E. Schurtz.
BY Arthur C. Brown
ATTORNEY

Patented May 10, 1927. 1,627,808

UNITED STATES PATENT OFFICE.

RALPH E. SCHURTZ, OF KANSAS CITY, MISSOURI.

REFRIGERATION SYSTEM.

Application filed July 27, 1923. Serial No. 654,180.

This invention relates to refrigeration and this application is a continuation in part of an application filed by me November 30th, 1921, Serial No. 518,834.

The primary object of the invention is to provide an improved refrigeration system of the absorption type in which the refrigerant can be automatically controlled so that the active or gaseous content may be separated from the inactive or liquid content and passed through an expansion coil or coils to reduce the temperature of the zone in which the coil or coils may be located.

The expanded active medium is then returned to an absorber where it is re-absorbed by the inactive content and intermittently re-passed to the expansion coil. The flow of the gaseous content from the refrigerant can be automatically controlled in a novel manner.

In absorption refrigerating systems aqua-ammonia is generally used so for the purpose of this description the ammonia will be considered the active content or absorbed medium and the water the inactive or absorbent content, and it is well to understand here that I do not wish to be limited to aqua-ammonia as the medium for effecting the refrigeration as the particular medium used is unimportant, the invention residing in the mechanism for effecting the refrigeration.

The system is shown as including a still-absorber, a rectifier, an accumulator, a non-return valve between the rectifier and the accumulator, an evaporator coil and a condenser.

If aqua-ammonia is used, the ammonia vapors are passed from the still-absorber to the rectifier where the ammonia vapors are dehydrated and led through a condenser coil to be condensed into liquid which now passes into an accumulator, from which the liquid is delivered to an evaporator coil, preferably submerged in a brine tank. From the evaporator coil the active content (ammonia) is re-delivered to the still-absorber to be absorbed by the water. The still is supplied with heat from any suitable source, the heat application being intermittent and between the intermittent applications of the heat, the liquid is passed from the still-absorber through a cooling coil to have its temperature reduced.

I have provided a novel form of flow interrupter in the liquor cooling coil so constructed that during the time heat is applied to the still-absorber, the cooling coil will be cut out of circulating communication with the still-absorber, but when the heat source is cut off or during the time it is not applied, there will be open communication between the still-absorber and the cooling coil to permit a thermo-siphonic circulation between the still-absorber and the cooling coil, and since the cooling coil is subjected to the influence of a cooling fluid, it will be apparent that between distilling operations the water liquor in the still-absorber can pass through the cooling coil to have its temperature reduced.

In order to interrupt the circulation of the water through the cooling coil, I take advantage of the fact that the liquor can be vaporized, so while the distilling operation is going on, I vaporize some of the water in the tubular port which connects the still-absorber to the cooling coil and by creating pressure in the tubular port I interrupt the line of flow therein. In order to do this, I have shown a goose-neck trap which may be subjected to heat during the time that the distilling operation is taking place, the heat being effective in vaporizing the liquor in the trap to form thereby a vapor space between the still and the cooling coil, the pressure being effective in preventing communication between the still-absorber and the cooling coil. When the distilling operation ceases, the heat will cease to be applied to the trap; consequently, the vapor will be reabsorbed or condensed, re-establishing communication between the still-absorber and the cooling coil so that thermo-siphonic circulation may take place between the still absorber and the cooling coil, and since the liquid in the still absorber will circulate through the cooling coil, it will be apparent that its temperature will be reduced low enough to render it effective as an absorber for the ammonia returned from the evaporator coil. Then the distilling operation will begin again, and with it, the liquid in the trap will be re-converted into vapor to cut off circulation between the cooling coil and the still.

There are other novel features of my in-

vention which are of importance, but these will all be specifically referred to hereinafter, reference being had to the accompanying drawings, in which:

Figure 1 is a perspective view of an intermittent absorption type of refrigeration system constructed in accordance with my invention, parts being broken away to illustrate other parts better;

Figure 2 is a sectional view through the non-return valve between the rectifier and the accumulator, the valve being shown in closed position;

Figure 3 is a similar view showing the valve in open position;

Figure 4 is a thermostatic control for the expansion valve between the accumulator and the expansion coil;

Figure 5 is a cross sectional view through the system or apparatus;

Figure 6 is a fragmentary, sectional view through the goose-neck showing the trap filled with water so that communication can be established between the still-absorber and the cooling coil;

Figure 7 is a similar view of the goose-neck showing the vapor generated in the trap so that communication is interrupted between the still-absorber and the cooling coil;

Figure 8 is a thermostatic fuel valve controlling mechanism;

Figure 9 is a fragmentary, perspective view of part of the weak liquor cooling means and the still-absorber;

Figure 10 is a modified form of expansion valve;

Figure 11 is a modified form of goose-neck for the cooling means; and

Figure 12 is a modified form of weak liquor cooling means.

Referring now to the drawings by numerals of reference:

1 designates a still-absorber or tank which is adapted to contain a refrigerant; for example, aqua-ammonia. The still-absorber or tank may be supplied with heat from a suitable burner 2, (see Fig. 5) the burner in turn being supplied with fuel through a pipe 3 communicating with a reservoir 4. The reservoir may be of such size as will contain a proper charge of liquid fuel to carry on distillation for a definite period; that is, for a period long enough to distill off practically all the ammonia vapors from the liquid within the still-absorber 1.

If the tank 4 is employed, it is obvious that a sufficient amount of fuel may be introduced into the tank to suffice for one charge so that it will not be necessary to control the burner because when the charge of fuel is used up, the burner will automatically cease to furnish heat to the still-absorber or tank 1. Under certain conditions, however, I may connect the burner to a gas line and thermostatically control it. The latter type of heat control will be described hereinafter.

The vapors distilled from the still-absorber tank 1 pass into a rectifier 5 subjected to a cooling fluid. In the present instance, I have shown the rectifier 5 in a cooling tank 6 adapted to contain water. The rectifier is inclined upwardly from its inlet to its outlet, and the discharge end of the still-absorber tank 1 is connected to the inlet end of the rectifier through a tube or pipe 7.

The aqua-ammonia vapors pass into the rectifier and since the condensation temperature of the water is considerably higher than that of the ammonia, the water vapors will be condensed in the rectifier and flow back into the still-absorber while the ammonia vapors will pass on to the outlet of the rectifier through a pipe 8.

The pipe 8 communicates with a condenser coil 9 through a non-return valve casing 10. The non-return valve casing contains a bellows 11 communicating with the pipe 8 and having a pipe 12 discharging into the casing 10. The pipe 12 has an outlet 13 surrounded by a valve seat adapted to slide on a flat valve 14, normally urged against the seat by a spring 15, the valve being positioned by a pivoted finger 16 secured to the bottom of the valve casing and having a projection 17 in the notch in the valve, as will be clearly seen by reference to Figs. 2 and 3. The action of the non-return valve mechanism will be more specifically referred to hereinafter.

The condenser coil 9 is subjected to a cooling fluid and as shown, it is submerged in a liquid tank 18, upon which the tank 6 is supported and the condenser coil communicates directly with an accumulator tank 19 at 20. The ammonia which passes from the rectifier 5 through pipe 8, non-return valve 10, condenser coil 9, reaches the accumulator 19 in a liquid state, and it is fed from the accumulator 19 to the expansion coil 21 through an expansion valve 22, the expansion valve communicating with the accumulator or receiver through a pipe 23.

The expansion valve is shown in detail in Figure 4. The liquid ammonia passes through the valve case 22 through a port 24 into a passageway 25 to the top chamber 26 of the expansion valve and then to pipe 21. The passageway 25 communicates with the chamber 26 through a restricted opening 27 in which is a needle 28 connected to a vibrator 29 which is shown as a concavo-convex member rigid with the needle so that as the ammonia passes through the expansion valve from the passageway 25 to the chamber 26, it will intermittently raise the vibrator 29 and allow it to drop so that there will be a reciprocatory movement imparted to the needle 29. This reciprocatory

movement will be effective in keeping the restricted opening 27 open; in other words, preventing it from clogging, and since the restricted opening 27 is the effective port area between the accumulator 19 and the expansion coil 21, it is apparent that liability of the line between the accumulator 19 and the expansion coil 21 becoming clogged will be prevented.

The amount of ammonia fed through the expansion valve can be controlled by a thermostatic valve 30, operating in response to a thermostat 31 subjected to temperature variations. The thermostat may take any form adapted to control the valve 30, but it is here shown as consisting of a bellows 31 filled with a fluid which expands and contracts, due to heat variation. The bellows or corrugated tubing 31 has a surrounding cylinder 32, normally urged in one direction by a spring 33.

On the end of the bellows 31 is a plug 34 adjacent to the end of the cylinder 32 on which the valve 30 is located. There is also an adjusting screw 35 extending through the expansion valve casting to contact with the plug 34 to determine the temperature at which the closing of movement of the cylinder 31 takes place. Therefore, the thermostatic device shown in Figure 4 can control the amount of active content or ammonia due to variations in temperature in the zone about the expansion coil, it being understood that the expansion valve is to maintain the temperature in the refrigerator or cooling compartment constant irrespective of variations in the temperature of outside atmosphere.

It has been heretofore explained that after the ammonia or active content of the refrigerant passes through the evaporator coil 21, it will be led back into the still-absorber to be re-absorbed by the water in the still-absorber or tank 1. The return pipe is designated 36, and it merges into a loop 36′ both ends of which are connected to the tank 1 so that a circulation can take place through loop 36′ and tank 1 so that any excess gas will pass to the still-absorber. Therefore, the rich liquor in the still will be ready to be re-distilled to be ready to drive off the ammonia content.

I may employ auxiliary tanks 37 and 38 for the tanks 5 and 18, if desired, so that additional cooling medium may be employed wherever necessary. I have shown the tank 37 connected thermo-siphonically to the tank 5 through pipes 39 and 40, and the auxiliary tank 38 is connected to tank 18 through pipes 41 and 42. This is clearly seen in Figs. 1 and 5.

As heretofore explained, after the ammonia content is distilled off from the rich liquor, the weak liquor or water remaining in the still-absorber would remain hot unless some means were provided for cooling it and, obviously, the hot water would not have the ammonia absorbent qualities that could be obtained by cool water. Therefore, I have provided means for cooling the water in the still-absorber 1.

This is accomplished by providing a cooling coil or manifold 43 in the tank 6. The manifold communicates with the still-absorber or tank 1 through a pipe 44 having a goose-neck or return bend 45 therein between the still-absorber and the manifold. The goose-neck or return bend provides a trap 46 which is so located with respect to the burner that when the burner is supplying heat to the still-absorber, it will heat the goose-neck 45 hot enough to vaporize liquid therein so that there will be a vapor space 47 formed in the goose-neck separating the liquor in the short leg 48 from the liquor in the long leg 49. Since the pressure in the chamber 46 will be great enough to maintain a separation between the liquor in the legs 48 and 49, it will be apparent that no flow can take place between the still-absorber and the cooling coil or manifold 43. Therefore, during the time that the distilling operation is being carried on, there can be no circulation of the water through the cooling coil. When the burner ceases to supply heat to the still-absorber, it will cease to supply heat to the goose-neck. Consequently, the vapor in the space or chamber 46 will be re-absorbed or condensed into liquid, and any pressure may be relieved through the constricted pipe 50. Therefore, liquid communication will be re-established between the legs 48 and 49 of the trap and thermo-siphonic circulation may be re-established between the bottom of the tank 1 and the bottom of the cooling coil through the pipe 44 and between the top of the cooling coil 43 and the side of the tank 1 through the pipe 51. The pipe 50 will always be in open communication with the space 46, and of course, during the time that the heat is applied to the goose-neck, some of the vapor will escape through pipe 50, but the escape of the pressure will not be in proportion to the rate at which the pressure is generated. However, when the heat ceases to be applied to the goose-neck, the pressure in the chamber 26 can readily escape through pipe 50 into the still-absorber with which the pipe 50 communicates so that the circulation can start up sooner than would be possible if no relief were provided for the chamber 46.

It will also be apparent that the pipe 51 has an upwardly and downwardly directed bend 52 where it is connected to the cooling coil 43. The advantage of this is that the heat in pipe 51, due to thermo-siphonic circulation of fluid therein, cannot be transmitted to the cooling medium. Attention is called to the fact that the leg 48 is shorter

than the leg 49 so that if the vapor has an abnormal expansion, it may be relieved into the tank rather than into the cooling coil, which obviously, would be objectionable.

Assuming the parts to be properly assembled and rich liquor to be in the still-absorber, for example, aqua-ammonia of about 40%, and assuming that it requires two hours to distill off enough ammonia to provide refrigeration for a given sized coil for twenty-four hours, the proper amount of liquid fuel can be introduced into the tank 1 and the burner lighted. The distillation will then begin. At the same time, vapor will be generated in the goose-neck so that there can be no circulatory communication between the cooling coil 43 and the still-absorber. The ammonia vapors will distill off during the time that the heat is applied, and they will pass through the rectifier where the water vapors will be separated from the ammonia vapors. The ammonia vapors will pass through the non-return valve until the pressure on the rectifier side of the valve drops. When this occurs, the spring 10', on the accumulator side of the valve will be sufficient to cause the pipe 12 to assume the position shown in Figure 2, closing off communication between the still-absorber and the condenser. Whenever the pressure on the rectifier and still-absorber side of the valve is greater than that on the accumulator and the condenser side of the valve, the valve will open to admit more ammonia vapors to the condenser. It will, therefore, be apparent that when the ammonia vapors have been distilled off and passed into the condenser and accumulator, they will be trapped against return to the still-absorber. They can then pass only to the vaporizing coil or evaporator 21.

When all the vapors desired have been distilled off, the water in the still will be hot, so it is necessary to reduce its temperature to render it available to absorb the incoming vapors from the evaporator coil 21. By the time practically all the ammonia vapors have distilled off, the rich liquor in the still-absorber 1, the supply of fuel in tank 4 will have become depleted so the heat will automatically shut off, allowing the vapor in chamber 46 to be absorbed or condensed into liquid. Any pressure will pass through pipe 50 into the still-absorber 1. Then a thermo-siphonic effect will take place through the loop formed by the still-absorber, pipe 51, cooling coil 43 and pipe 44, and as the hot liquor passes from the still through the cooling coil 43, its temperature will be reduced low enough to render it available as an absorbent for the incoming gases from the evaporator coil 21. Therefore, it will be seen that when the liquor is rich and the heat is applied to distill off the ammonia vapors, there can be no circulation through the loop just described but that when the distillation has ceased, and the liquor is weak, it can be cooled to an absorbing temperature, the cooling of the liquor and the distillation being alternatingly intermittent.

By reference to the drawings, it will be seen that a refrigerating apparatus or system constructed in accordance with my invention can be made absolutely tight since there are no valves or openings which can leak to atmosphere for the non-return valve can be sealed within the casing 10, and the thermostat shown in Figure 4 can be sealed against atmosphere. The trap has no communication with atmosphere so the system is quite self-contained with no chance of ammonia leakage; this being a very important feature in connection with absorption type machines because where valves are used whose stems are exteriorly operated, leakage takes place, but by sealing the entire system so that there are no movable parts accessible from the exterior, liability of leakage is entirely prevented. Such construction permits all joints to be welded and the interior of the system to be completely sealed off from outside atmosphere.

It is to be understood, of course, that the circulation through the loop continues as long as the temperature in the still-absorber is higher than the contents of the cooling tank. Since the pipe 51 is connected to the tank 1 below the liquid level, and since the temperature of the liquor in tank 1 is higher than that in the cooling coil, causing greater pressure in the tank, it will be apparent that the liquor will readily flow through the loop.

I prefer to arrange the apparatus so that the fuel may be supplied to the burner in charges; that is, with a sufficient amount of oil or fuel in the tank 4 to complete one cycle of operations, in other words, the tank 4 is preferably designed so that it will hold just enough fuel to distill off the vapors from the still-absorber 1. The advantage of this is that the burner can be lighted and allowed to burn until all the fuel is used. Therefore it is necessary only to fill the tank 4, light the burner, and then allow it to burn until all the fuel is consumed. The quantity of fuel in the tank 4 will be enough, ordinarily, to supply heat for the still-absorber to furnish refrigeration for at least twenty-four hours, under normal conditions.

In Figure 8, I have shown a modified form of heat supplying means for the still-absorber, which is particularly adaptable for use in connection with gas lines and the like.

The tube 65 contains an expansible medium, one end of the tube 65 communicating with a bellows shaped expansible and contractible chamber 66, which is connected to a loop 67, interlinked with a similar link 68 connected to one end of the bar 69, slidable in the guides 70 and 71. Between the

two loops 67 and 68 is an expansible and contractible chamber 72, communicating with tube 73 through a pipe 74, the tube 75, containing a contractible and expansible medium, and the tube 73 is located outside the still so as to be subjected to atmospheric variations; and since the temperature of the outside atmosphere is lower than that of the still-absorber, the chamber 72 will oppose the chamber 66.

The bar 69 has two lugs 75 and 76 between which is a slidable notched member 77 straddled by a forked lever 78, the lever 78 operating a valve 79 in the gas supply line 80, which supplies a burner 81, there being a pilot burner 82 constantly supplied from pipe line 80 (see Figs. 8 and 9). The notches 83 and 84 of the member 77 are adapted to be engaged alternately by the roller 85 on the end of the detent 86, pivoted to the bracket 71. On the free end of the bar 69 is a pivoted stop member 87 adapted to be engaged by spring urged bolt 88, the bolt being actuated in one direction by the expansion spring 89, one end of which bears against the fixed collar 90 on bolt 88. The other end of the spring bears against a fixed member 91, suitably supported, through which the bolt 88 slides. Spaced from the collar 90 is another fixed collar 92 on the bolt 88 and loose on the bolt 88 is one end of a Bourdon tube 93, the lower end of which is attached to the liquefied gas collector 19. When the collector 19 is empty, the pressure begins to fall, and when it has reached a low, predetermined point, the Bourdon tube will press down on the collar 90 to withdraw the end of the bolt 88 out of engagement with the catch member 87. The spring 94 will pull the bar 69 to the left fork of the lever 78 to open the port controlled by the valve 79. When the temperature in the still-absorber 1 is high enough, the bellows 66 will expand to move the rod 69 to the right to close the valve, the Bourdon tube at the same time bearing against the collar 92 to raise the upper end of the detent 88 in the path of the catch 87, which will ride over the free end and drop behind it. This movement will be effective in causing the lug 75 to move the member 77 against the right hand fork of the lever 78 to close valve 79. The detent 86 engages either of the two notches to hold the member 77 in its shifted position.

The purpose of the two chambers 65 and 73 is to provide a balance or equalization for variation in temperature so that the valve will open at a lower temperature, as in cool weather. That is to say, chamber 65 is within the still, where it will not be affected by atmospheric changes. Tube 73, however, is outside the still in the condenser cooling medium where it will be responsive to atmospheric changes. The valve movement will respond to the mean temperature between these two variable temperatures, so in colder weather the valve will open at a lower temperature than in hot weather.

In Figure 10, I have shown a modified form of expansion valve which is hand controlled although I reccommend the construction shown in Figure 4. In the construction shown in Figure 10, the casing 53 is provided with an effective port 54, through which may extend a needle valve 55 controlled by the stem 56. In the valve casing is a perforate deck 57 on which is supported an anti-clogging device or vibrator 58, having a depending arm 59 which is connected to the needle valve so that as the ammonia passes from pipe 23 through the expansion valve, it will lift the concavo-convex vibrator 48 and vibrate the needle valve so as to prevent the clogging of the port 54.

In Figure 12, I have shown a slightly modified form of liquid cooling means. Instead of circulating the weak liquor from the tank 1 through a cooling coil, I prefer to employ connected cooling coils 60 and 61 in the still-absorber 1 and in the tank, 62. The connected cooling coils 60 and 61 may contain a suitable fluid of low boiling point such as sulphuric ether. The loop formed by the two connected coils and the goose-neck trap 45′ will contain a sufficient amount of the fluid of low boiling point, but it will not be entirely filled. During the absorption period, the liquid will flow into the lower part of the coil 60 where it will evaporate and pass upward into the coil 61 to be cooled and condensed.

When the burner is started at the beginning of the distillation, the top of the goose-neck will be heated in the same manner as previously described, and the fluid will be depressed in both legs, thus cutting off the flow of the liquid from the coil in the water tank 62 to the coil in the still. After the burner ceases to operate, the flow will be substantially like that heretofore described, the one difference being, however, that the top of the goose-neck 45 will be connected to the connecting pipe 63 between the coils 60 and 61. Therefore, it will be apparent that the liquid in the tank 1 can be cooled by a double coil arrangement such as shown in Figure 12.

The goose-neck shown in Figure 10 is placed outside the burner housing, and a heat conducting rod, 64, preferably copper, conducts the heat from the burner to the top of the loop. This is done because it would not be feasible to subject the ether to the high temperature resulting from the direct application of the heat.

What I claim and desire to secure by Letters Patent is:

1. In a refrigerating machine, a still-absorber, a condenser, and an evaporator all

connected in an operative cycle, a return cooling conduit outside the still-absorber through which fluid from within the still-absorber circulates to reduce the temperature within the still-absorber, and thermal means for vaporizing the fluid in the return conduit to create local pressure in the conduit to interrupt the flow thereto.

2. In a refrigerating machine, a still-absorber, a condenser and an evaporator all connected in an operative cycle, and a weak-liquor return cooling conduit outside the still-absorber through which fluid from within the still-absorber circulates from and back to the still-absorber and means constituting a part of the conduit responsive to heat for interrupting the flow of fluid through the conduit.

3. In a refrigerating machine, a still-absorber, a condenser and an evaporator all connected in an operative cycle, a return conduit outside the still-absorber through which fluid from within the still-absorber circulates to reduce the temperature within the still-absorber and means in the conduit responsive to heat outside the conduit for locally vaporizing the fluid in the conduit to create local pressure in the conduit to interrupt the flow thereto.

4. In a refrigerating machine, a still-absorber, a condenser and an evaporator all connected in an operative cycle, a weak-liquor return cooling conduit outside the still-absorber through which fluid from within the still-absorber circulates from and back to the still-absorber and a fluid trap in the conduit comprising two tubular legs and a pressure generating chamber connecting them.

5. In a refrigerating machine, a still-absorber, a condenser and an evaporator all connected in an operative cycle, a weak-liquor return cooling conduit outside the still-absorber through which fluid from within the still-absorber circulates from and back to the still-absorber and a fluid trap comprising two tubular legs, the length of one being in excess of the other and a pressure chamber connecting the legs.

6. In a refrigerating machine, a still-absorber, a condenser and an evaporator all connected in an operative cycle, a weak-liquor return cooling conduit outside the still-absorber through which fluid from within the still-absorber circulates from and back to the still-absorber and a fluid trap comprising two tubular legs, a pressure generating chamber between them and a pressure relief pipe for the chamber.

7. A refrigerating machine, a still-absorber, a condenser and an evaporator all connected in an operative cycle, a cooling conduit outside the still-absorber through which fluid from within the still-absorber circulates to reduce the temperature within the still, a trap in the conduit and means for creating pressure in the trap to interrupt the flow of the fluid thereto.

8. In a refrigerating machine, a still-absorber, a condenser, and an evaporator all connected in an operative cycle, a cooling conduit outside the still-absorber through which fluid from the still-absorber circulates to reduce the temperature within the still-absorber and means in the conduit responsive to heat for intermittently interrupting the flow through the conduit.

9. In a refrigerating machine, a still-absorber, a condenser, and an evaporator all connected in an operative cycle, a cooling conduit outside the still-absorber through which fluid from within the still-absorber circulates and a heat controlled trap connecting the inlet end of the conduit to the still-absorber.

In testimony whereof I affix my signature.

RALPH E. SCHURTZ.