No. 666,223. Patented Jan. 15, 1901.

A. SHEDLOCK.

REFRIGERATING APPARATUS.

(Application filed Dec. 1, 1898.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.

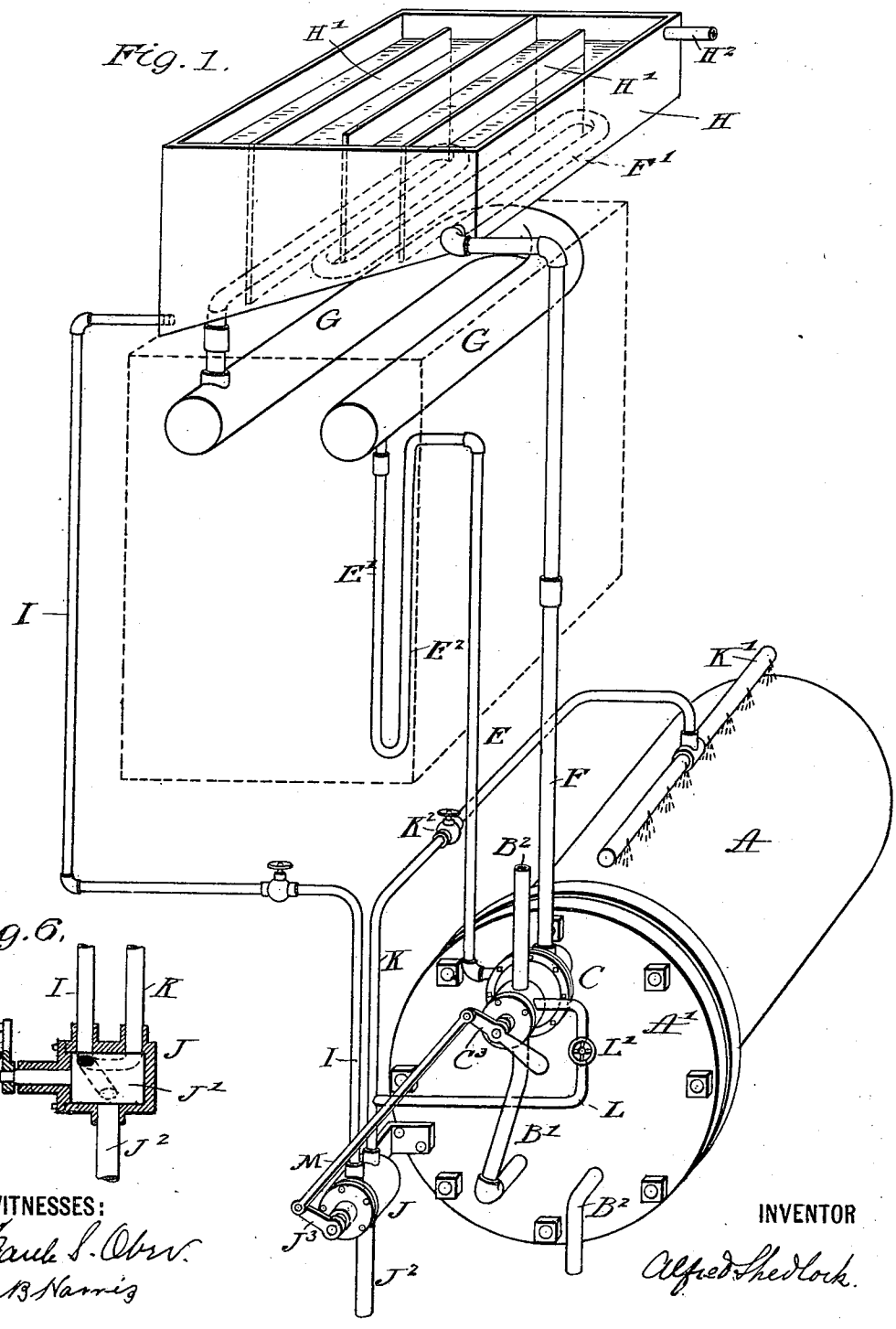

Fig. 6.

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(No Model.) 3 Sheets—Sheet 2.

Fig. 2.

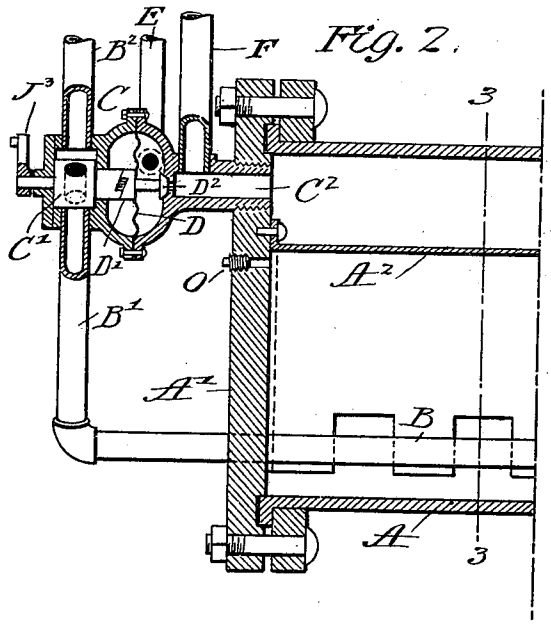


Fig. 3.

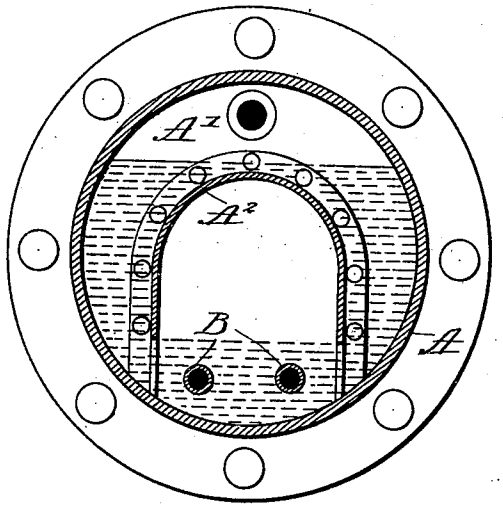


Fig. 4.

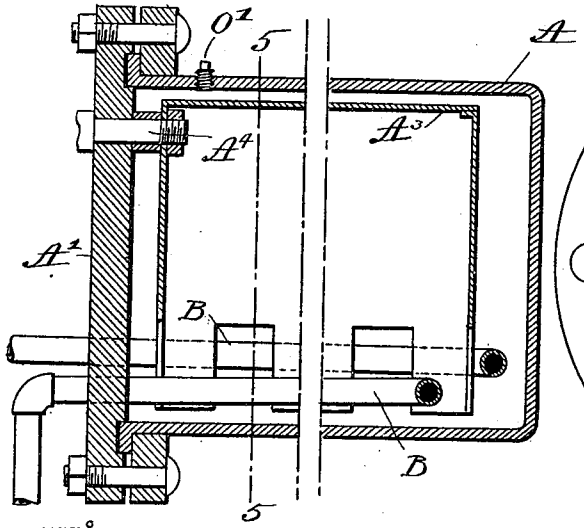
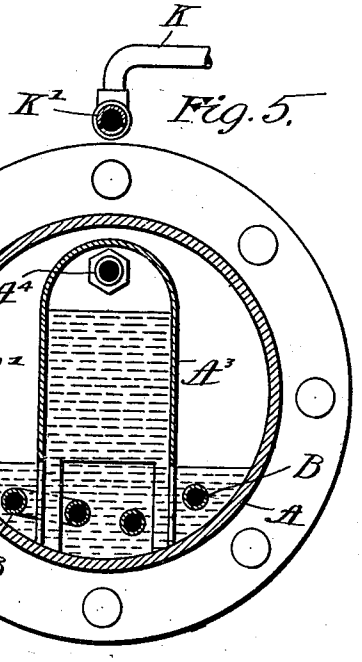


Fig. 5.



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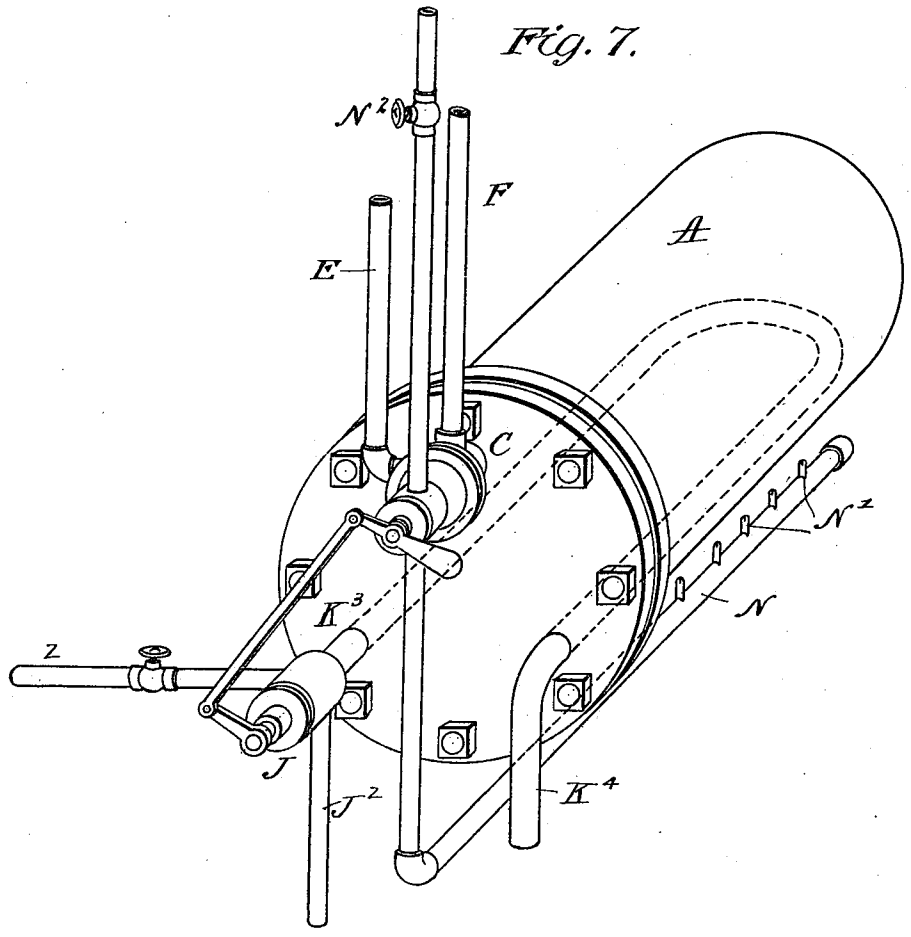
(No Model.) 3 Sheets—Sheet 3.

Fig. 7.



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UNITED STATES PATENT OFFICE.

ALFRED SHEDLOCK, OF JERSEY CITY, NEW JERSEY.

REFRIGERATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 666,223, dated January 15, 1901.

Application filed December 1, 1896. Serial No. 614,067. (No model.)

To all whom it may concern:

Be it known that I, ALFRED SHEDLOCK, a citizen of the United States, residing at Jersey City, in the county of Hudson and State of New Jersey, have invented certain new and useful Improvements in Refrigerating Apparatus, of which the following is a specification.

This invention relates to refrigerating apparatus involving the alternating-absorption principle. A gaseous active agent held in solution by a suitable solvent is first freed from the solvent by heat applied thereto and is then by its own pressure and a reduction of temperature condensed into liquid form in a suitable receptacle. The liquid active agent is then allowed to evaporate in the receptacle, thus abstracting heat from the chamber or material to be cooled, and returning by the same path to the solvent, which has now been cooled, is again absorbed by it, thus completing the cycle of operation. In absorption refrigerating apparatus of this class a certain percentage of the solvent from the still or gas-separator is condensed with the active agent and passes with it into the liquid-receiver, and if allowed to accumulate therein will in a short time impair or totally destroy the operativeness of the apparatus.

My invention consists in a novel construction and relation of parts of the apparatus whereby this difficulty is obviated and in certain details of construction, all as hereinafter set forth.

Now this invention provides for the application of a solvent-return-pipe connection between the refrigerant-receptacle and the still that will admit of the still being placed in any position and at any distance below the refrigerant-receptacle, thus providing for the installation of the apparatus in any locality.

One part of the invention, designed to improve the apparatus in the latter respect, consists of a simple valve device adapted to close the solvent-return pipe and connected to and operated by the valve or device which controls the source of heat-supply to the still in such manner that the solvent-return pipe is open during the whole time that heat is being applied to the still, and the still is under its greatest pressure and closed when the heat is shut off and the active agent is evaporating in the refrigerant-receptacle and is again being absorbed by the solvent in the still, so that with the gas-pipe connection between the still and the refrigerant-receptacle the apparatus is under the condition of an open continuous pipe-circuit throughout when the still is being heated. I thus avoid all danger of explosion through overheating or a too-extended heating of the still, prevent any of the active agent passing back to the still except by expansion directly from the refrigerant-receptacle through the gas-pipe connection, and utilize the whole of the refrigerating effects from the evaporation of the active agent in the box or room in which the refrigerating-receptacle may be placed. In the arrangement of the solvent-return pipe from the refrigerant-receptacle to the still the pipe drops down from the lowest part of the refrigerant-receptacle and rises again, so as to provide an overflow from the level of where it passes from the refrigerant-receptacle or a little below this level and from this overflow extends downwardly to the still, wherever it may be placed, the point of overflow in this pipe being connected with the gas-space of the apparatus. This allows for the return to the still of the solvent that may be in the refrigerant-receptacle when all or practically all of the active agent therein has evaporated and passed back to the still through the gas-pipe or connection, and when the heat-applying device is operated to heat the still to again drive off the active agent from the solvent therein, for before the still and its contents become heated and pressure is produced in the still the whole apparatus will be under a uniform pressure, and such solvent as may be in the refrigerant-receptacle will flow freely back to the still through the solvent-return pipe. As soon, however, as hot gases pass off from the still and are cooled in the condenser and pass in a liquid condition into the refrigerant-receptacle there will be a slight increase of pressure at the still end of the apparatus, sufficient to depress the column of solution in the upturned part of the solvent-return pipe extending from the refrigerant-receptacle and hold back and retain the active agent in the refrigerant-receptacle as it accumulates therein until all of the active agent that is available has been

expelled from the solvent in the still and condensed in the receptacle, at which time the source of heat should be cut off from the still and the absorption of the active agent be permitted to commence.

Another advantage of the valve in the solvent-return pipe operated as described is that the active agent which accumulates in the refrigerant-receptacle during the initial working of the apparatus to bring it into good operative condition, it being then practically free of the solvent, would flow freely back into the still and greatly reduce the refrigerating effect if this pipe were not closed while the active agent is being reabsorbed.

In the accompanying drawings, Figure 1 represents an apparatus embodying my improvement in refrigerating devices, omitting unnecessary details of construction. Fig. 2 is a part longitudinal section of the still. Fig. 3 is a transverse section of the same taken on the line 3 3 of Fig. 2. Fig. 4 is a longitudinal section of a modification of the still. Fig. 5 is a transverse section of the same on the line 5 5 of Fig. 4, showing the spraying-pipe for cooling off the still. Fig. 6 is a sectional elevation of the water-supply-controlling valve, and Fig. 7 represents some modifications of construction.

The still may be a horizontal cylinder A, permanently closed at one end and covered at the other end by the cap A′, which is provided with a suitable packing and secured by bolts to a flange on the end of the cylinder. In this cylinder, at the lower part thereof, is located a coil of pipe B, the ends of which pass through the head A′ of the cylinder. This pipe is the heating-pipe, and the heating agent may be steam or hot water, the inlet of the pipe being B′ and the outlet B^2. In the cylinder, extending the length thereof, is secured a hood A^2 in the form of an inverted trough, one end of which, in the modification Fig. 2, is shown secured to the head A′ and the other end closed. In the modification Fig. 4 the hood A^3 is shown as an inverted trough with closed ends, the upper part of one end being secured to the head A of the cylinder by the internally-projecting end of the gas-pipe connection A^4 and a nut screwed on the end of said connection. The lower edges of these hoods A^2 A^3 are shown notched or cut away, the upper edges of the notches being above the heating-pipes B, so that said pipes will always be covered by the solution in the still under all conditions of operation, as hereinafter described. The valve device C for controlling the supply of the heating agent and for closing the pipe connection from the still to the lower part of the refrigerant-receptacle is shown in perspective, Fig. 1, and in sectional view, Fig. 2. It consists of a rotating valve or cock C′, fitted in the end of the case and provided with openings for opening communication between the parts B′ and B^3 of the steam or hot-water pipe. The end of the rotating valve or cock projects into a chamber which is divided by the flexible metallic diaphragm D, and this projecting end is provided with screw-threads or formed into inclined planes D′ to act against a plug attached to the diaphragm D, correspondingly screw-threaded or having counterpart inclined planes. The other side of this diaphragm carries a valve D^2, arranged to close an opening into this side of the chamber from the gas-space of the still A. This device C is provided with a neck C^2 at this side of the chamber, which screws into an opening in the upper part of the head A′ of the still A. The construction of the valve or cock and its connecting and operating device D′ for the valve D^2 is such that when the valve C′ is turned to open the pipe B′ B^2 the valve D^2 is also opened, thus providing communication between the pipe E and the gas-space of the still A, and when the valve C′ is turned to cut off the supply of the heating agent from the still the valve D^2 is also pressed into its seat and closes communication between the pipe E and the still A.

When the form of hood A^3 is used, as shown in Fig. 4, then the neck of the valve device may extend into the cylinder and be secured to the hood, as shown at A^4, Fig. 4. The pipe F connects with the neck of the valve device C and extends upwardly and joins to or is a part of the coil of condenser-pipe F′. This condenser-coil has a slight downward inclination from where it joins the pipe F, and its other end extends down and is connected to the upper side of the refrigerent-receptacle G, and to the lower part of this refrigerant-receptacle is attached a continuation of the pipe E. The part E′ from the refrigerant-receptacle extends downwardly and is provided with a bend or continuation of the riser side E^2 of the pipe, and the upper end of this part E^2 being connected to the upper end of the pipe E, thus forming an overflow from the receptacle G to the still A at a level with or a little below the lowest part of the refrigerant-receptacle.

The condenser-coil F′ is placed in the bottom of the tank H, which is provided with alternately-arranged partitions H′, separating the water between the coils of the pipe and providing for the circulation of the water along the condenser-coil from its outlet end toward its inlet end, the bottom of said tank being inclined to correspond to the inclination of the condenser-coil and the supply-water entering it at its lower part through the pipe I. This tank H is of such capacity as to hold sufficient water to produce all the necessary cooling effects of the still A during the time that the solvent in the still is absorbing the active gas or agent, and this supply of water considerably exceeds the quantity necessary to cool the condenser-pipes during the time that the still is being heated and the gas cooled and condensed to enter the refrigerant-receptacle G in a liquid form; but the supply during this time is so regulated that

sufficient water will enter the tank H to provide for the proper cooling of the still A. The rate of flow of the water to the tank will be such as to cause the condenser-coil F′ to be immersed when the gas from the still is under sufficient pressure to cause its liquefaction. The tank is provided with an overflow H^2. A water-controlling device, consisting of a cylindrical body J and a rotating valve or plug J′, is connected to the water-supply pipe J^2, and the other end of the pipe I is also connected to this device, as is also a pipe K, which carries the water to the still A for cooling the same. This pipe K is in Fig. 1 shown connected to a spraying or sprinkling device K′, arranged above the still A, so as to provide a means for exteriorly cooling the still and its contents. Means are also shown in this view, Fig. 1, for interiorly cooling the still and its contents, consisting of the pipe shown by lines L, extending from the pipe K to the body of the device C and arranged to open communication with the pipe B′ when the valve or cock C′ is turned to cut off the steam or hot water from the pipe B′. The pipe K is provided with an adjustable valve K^2 and the pipe L with an adjustable valve L′. By the manipulation and proper setting of these valves the water from the tank H may be caused to flow either entirely over the outside of the still A or through the interior of the still by the pipe B B′, or it may be divided, so as to flow both over the outside and through the interior of the still. The flow of the water from the tank H to the still is controlled by the manipulation of the plug J′, which has ports or passages so arranged that when placed or turned in one position water flows from the supply-pipe J^2 through the pipe I to the tank H, and when turned in the other position the supply from the pipe J^2 is cut off and communication is made between the pipes I and K, thus allowing the water at this time to flow from the tank H to the still A. To lessen the work of the operator as much as possible and to insure the proper and timely flow of the water to the condenser F′ and to the still A, the spindle of the plug J′ is connected to the spindle of the valve or cock C′ of the steam or hot-water controlling device through the medium of the crank-arms J^3 and C^3 and the connecting-bar M, manipulation of such bar causing a simultaneous action of the heat and water controlling devices, for when moved in one direction to permit of the heating agent acting on the contents of the still the water from the supply J^2 is allowed to flow through the pipe I over the condensing-coil F′ and into the tank H, and when the bar M is moved in the other direction to cut off the supply of heat from the still the water-supply from the pipe J^2 is cut off and the water in the tank H allowed to flow to and cool off the still. By constructing the condensing-tank H in the manner described economy in the use of water is had without using special storage-tanks for the water.

In the refrigerating apparatus shown in Fig. 7 the general construction of the still A, refrigerant-receptacle G, condensing-tank H, and the connecting-pipes is the same as previously described, as is also the heat-controlling device C, one of the modifications being the substitution of a pipe N, provided with gas-burners N′ and a gas-supply pipe N^2 for the steam or hot-water pipes previously described, the operation of the device C being the same as already described, the only difference being that gas is allowed to flow to the burners N′ when it is desired to heat up the contents of the still A instead of steam or hot water to the internal pipes of the still, as in the previous case. The still is, however, provided with a coil of pipe in its interior through which water is allowed to flow when the contents of the still are to be cooled off, one end of said pipe being connected to the water-controlling device J in such manner, as will be well understood from the preceding description, that when the plug or cock of this device is turned in one direction water will flow from the supply-pipe J^2 to the tank H through the pipe I, and when turned in the other direction will flow from the tank H through the pipe K^3 K^4 by the pipe I, the supply from the pipe J^2 being at such time cut off.

It will be observed that by the arrangement of the hood A^2 in the still A, Figs. 2 and 3, the active agent, in gaseous condition, passes from the body of the still through the opening C^2 to the pipe F, the hood A^2 in this case having no communication with the gas-space of the apparatus except by its lower edge, which is always sealed by the solution in the still. To allow of the discharge of air from the hood upon the initial charging of the apparatus, a hole is formed in the head A′, which hole is upon the discharge of the air permanently closed by the plug O, and in the arrangement Figs. 4 and 5 the gas passes from the interior of the hood to the other parts of the apparatus through the connection A^4, the interior of the cylindrical body of the still in this case being closed to the other parts of the apparatus except by the sealed lower edges of the hood A^3, a plug O′ being provided to close an opening in the cylinder after the air has been expelled therefrom.

The operation is as follows: The still being charged with a solution of active agent and solvent in suitable proportions and all of the air expelled from the apparatus, so that the active agent in gaseous form fills the refrigerant-receptacle, the upper part of the still that is in direct communication with the gas-pipe and all of the connecting pipes, upon the simultaneous manipulation of the heat-controlling and water-supply devices heat is applied to the solution in the still, thereby disengaging or forcing the active agent therefrom and admitting water to the condenser-tank, which tank may at such time be entirely empty; but the flow of water therein will be

sufficiently rapid to cover the condensing-coil by the time the gas from the still has attained sufficient pressure, in conjunction with a reduction of its temperature as it passes through the coil, to cause it to be liquefied. As the gas is eliminated from the solvent by this application of heat the solution is forced out of the closed part of the still by the accumulation of the gas therein, which in the structure shown at Figs. 2 and 3 will be the hood, as shown at Fig. 3, and which in the structure shown at Figs. 4 and 5 will be the cylindrical body of the still, as shown at Fig. 5, thus causing the solution to be at a higher level in the part of the still connected to the refrigerant-receptacle by the gas-pipe than in the closed part of the still, thereby providing for the perfect ebullition or stirring up of the solution during the heating process. The active agent is thus transferred from the still to the refrigerant-receptacle, and during the time of this transference the connecting solvent-return pipe from the lowest part of the refrigerant-receptacle to the still is kept open. During the early part of this period, and before a difference of pressure in the still and refrigerant-receptacle is developed, such of the solvent as is in the refrigerant-receptacle will flow out through the solvent-return pipe, and as the operation proceeds and a preponderance of pressure at the still end of the apparatus is developed such pressure, acting upon the solution in the upturned end of the solvent-return pipe leading from the receptacle, will force down the level of such solution and prevent the escape of the liquefied active material from the refrigerant-receptacle. When the boiling operation is completed and all of the available active agent is in the refrigerant-receptacle, the heat to the still and the water-supply to the condenser and the connection between the lowest part of the refrigerant-receptacle and the still are simultaneously cut off, and at the same time the water contained in the condenser-tank is allowed to flow therefrom through or over the still or both through and over it, as may be desired, to cool the still and solvent or weak solution now contained therein. As the weak solution in the still becomes cooled it rises in the closed part of the still because of the absorption of the gas therein and falls in the open or gas-discharge part of the still, occupying reverse positions to those shown in Figs. 3 and 5, and as the gas in contact with the exposed surface of the solvent is absorbed this part of the solution becomes less dense and is displaced by the denser solution or solvent in the closed part of the still, thus insuring an active reabsorption of the active agent, the supply in the still being kept up by the evaporation of the liquid active agent in the refrigerant-receptacle in the vicinity of which the refrigerating effects are produced. By this construction a large surface for absorption is provided, said surface area comprising practically the length of the still by the width of the compartment to which the gas-pipe is attached, and a large extent of communication is provided between the two compartments for the escape of the gas from the closed compartment to the one provided with the gas-discharge pipe when the contents of the still are being heated and for the commingling of the solutions in the two compartments when the contents of the still are being cooled. In the initial operation of the machine about all that will pass over into the refrigerant-receptacle will be active material, and with this arrangement of the solvent-return pipe the liquid active agent would, when the pressure is the same in all parts of the apparatus, flow back to the still if this pipe were not closed during the reabsorption of the active agent and produce but little refrigerating effects in the refrigerant-receptacle, and when some of the solvent has passed into the refrigerant-receptacle and is in the solvent-return pipe as a saturated solution still some loss would occur due to the evaporation of the active agent from said pipe if it were left open.

When the active agent has been reabsorbed by the solvent in the still, the apparatus is in condition to be again operated, and such operation should be repeated at such intervals as are found necessary to produce the desired refrigerating effects.

In this apparatus the relative locations or levels of the still and refrigerant-receptacle should be such that under all conditions of the operation the liquid-level in the still shall be below the lowest part of the refrigerant-receptacle, and so far below that the preponderance of pressure that may be developed in the still during the heating operation cannot force the solution from the still over into the refrigerant-receptacle. As hereinbefore stated, however, the still may be placed at any lower point that may be required or desirable in the erection of the apparatus in any particular instance.

It will be observed that by the arrangement of the hood or inverted trough in the still and the functions performed by it of producing differences of level of the solution in the body of the still and in the hood when the solution is being heated and cooled both efficient heating of the solution to separate the gas therefrom and the efficient cooling of it to cause a reabsorption of the gas are brought about by the fact that all of the solution under all conditions remains in the body of the still and is subjected to heating effects when the gas is being driven therefrom and to cooling effects when the gas is being reabsorbed. It will also be observed that while the solution occupies different parts of the still under the two conditions, yet the level or the height of the solution is about the same under both circumstances. This change of position of the solution from one part of the still to another without leaving the body of the still, together with the extensive exposed

surface of the solution, insures rapid separation and combination of the solution and the gas. It will also be observed that for a given quantity of solution used in the still a minimum amount or extent of surface is exposed by the body of the still for the loss of heat by radiation and that by reason of the hood being entirely inclosed in the body of the still, and consequently surrounded by the gases and solution in the body and subjected to the temperature thereof, no loss can occur from the transference of heat to or from the contents of the hood.

I claim as my invention—

1. In a refrigerating apparatus, the combination of a still, a refrigerant-receptacle located at a higher level than the still, a gas-pipe connecting the still and receptacle, a condenser applied to the gas-pipe, and a solvent-return pipe extending downwardly from the lowest part of the receptacle and then upwardly to or below the level of the lower part of the receptacle, thence to the still, the point of overflow in the solvent-return pipe being in communication with the gas-space of the still end of the apparatus and located at such level that the preponderance of pressure in the still end of the apparatus will prevent the passage of the liquid active agent from the receptacle to the still.

2. In a refrigerating apparatus, the combination of a still, a refrigerant-receptacle located at a higher level than the still, a gas-pipe connecting the still and receptacle, a condenser applied to the gas-pipe, a solvent-return pipe extending downwardly from the lowest part of the receptacle and then upwardly to or below the level of the lower part of the receptacle, thence to the still, the point of overflow in the solvent-return pipe being in communication with the gas-space of the still end of the apparatus and located at such level that the preponderance of pressure in the still end of the apparatus will prevent the passage of the liquid active agent from the receptacle to the still, and means for maintaining the solvent-return pipe open while the still is being heated and closing it while the active agent is being reabsorbed.

3. In a refrigerating apparatus, the combination of a still, a refrigerant-receptacle located at a higher level than the still, a gas-pipe connecting the still and receptacle, a condenser applied to the gas-pipe, a solvent-return pipe extending downwardly from the lowest part of the receptacle and then upwardly to or below the level of the lower part of the receptacle, thence to the still, the point of overflow in the solvent-return pipe being in communication with the gas-space of the still end of the apparatus and located at such level that the preponderance of pressure in the still end of the apparatus will prevent the passage of the liquid active agent from the receptacle to the still, means for maintaining the solvent-return pipe open while the still is being heated and closing it while the active agent is being reabsorbed, means for at will applying heat to the still, and means for simultaneously operating the heat-applying device and opening the solvent-return pipe and simultaneously withdrawing the application of heat and closing the solvent-return pipe.

4. In a refrigerating apparatus, the combination of a still, a refrigerant-receptacle located at a higher level than the still, a gas-pipe connecting the still and receptacle, a condenser applied to the gas-pipe, a solvent-return pipe extending downwardly from the lowest part of the receptacle and then upwardly to or below the level of the lower part of the receptacle, thence to the still, the point of overflow in the solvent-return pipe being in communication with the gas-space of the still end of the apparatus and located at such level that the preponderance of pressure in the still end of the apparatus will prevent the passage of the liquid active agent from the receptacle to the still, a cock or valve in the solvent-return pipe, means for at will applying heat to the still, means for supplying water to the condenser, means for supplying cooling-water to the still, and means for simultaneously actuating the devices to apply heat to the still, water to the condenser, and open the cock in the solvent-return pipe, and then for simultaneously cutting off the heat from the still, closing the cock in the solvent-return pipe, stopping the supply of water to the condenser, and supplying cooling-water to the still.

5. In a refrigerating apparatus, the combination of a still, a refrigerant-receptacle located at a higher level than the still, a gas-pipe connecting the still and receptacle, a condenser applied to the gas-pipe, and having a water-storage tank, a solvent-return pipe extending downwardly from the lowest part of the receptacle and then upwardly to or below the level of the lower part of the receptacle, thence to the still, the point of overflow in the solvent-return pipe being in communication with the gas-space of the still end of the apparatus and located at such level that the preponderance of pressure in the still end of the apparatus will prevent the passage of the liquid active agent from the receptacle to the still, a cock or valve in the solvent-return pipe, means for applying at will heat to the still, means for supplying water to the condenser and directing the accumulated condensing-water from the storage-tank to the still, means for simultaneously applying heat to the still, opening the cock in the solvent-return pipe and supplying water to the condenser, and for simultaneously withdrawing the heat from the still, closing the cock in the solvent-return pipe, cutting off the supply of water to the condenser and directing the water from the condenser-tank to the still.

6. In a refrigerating apparatus, the combination of the still, means for heating it at will, means for cooling it at will by the application of water, a gas-pipe leading from

the still, a condenser-pipe applied to the gas-pipe for condensing the gases driven off from the still during the heating thereof, a tank at the bottom of which the condenser-pipe is placed; said tank having a storage capacity sufficient to hold the volume of water required for the cooling of the still, means for supplying from a main or suitable source such volume of condensing-water to the condenser-tank during the heating of the still, for cutting off such supply from said source when the distilling operation has been completed, and for then directing the volume of water in the condenser-tank to the water-cooling devices of the still.

7. In a reversible still or generator and absorber for an absorption refrigeration system, the combination of a shell or body and an inverted trough or vessel inclosed entirely within the still dividing the shell or body into two compartments, there being an opening or openings between the lower part or edges of the inverted trough and the bottom of the body and a gas-opening connected with the upper region of one of the compartments and serving alternately as a gas-inlet and a gas-outlet, means for applying heat to the contents of the still, and means for cooling the contents of the still, substantially as and for the purpose set forth.

8. In a refrigerating apparatus, the combination of a still provided with a heat-applying device, a valve device in which is included a flexible diaphragm, a solvent-return pipe connected to the gas-space of the still, a valve connected to the flexible diaphragm of the valve device and adapted to close the solvent-return pipe, a rotating valve or cock in this device adapted to control the supply of heat to the still, and an operative connection between the end of this heat-controlling valve and the diaphragm.

9. In a refrigerating apparatus, the combination of a still provided with a heat-applying device, a valve device in which is included a flexible diaphragm, a coil of pipe located in the still, one end of which joins the body of this valve device, a solvent-return pipe connected to the gas-space of the still, a valve connected to the diaphragm of the valve device adapted to close the solvent-return pipe, a valve in this device for controlling the opening of the coil of pipe in the still, and an operating connection between this valve and the diaphragm.

10. In a refrigerant apparatus, the combination of a still provided with a heat-applying device, an active-agent gas-pipe extending from the upper part of the still, a condenser connected to or included in this pipe, a refrigerant-receptacle to the upper part of which one end of the condenser is attached, a solvent-return pipe extending from the lowest part of the refrigerant-receptacle to the still, a valve device, the body of which includes a flexible diaphragm, a valve attached to this diaphragm adapted to close the solvent-return pipe, a coil of pipe in the still one end of which is connected to the body of the valve device, a valve fitted in this device to close the coil of pipe, and an operative connection between this valve and the diaphragm.

11. In a refrigerating apparatus, the combination of a still provided with a heat-applying device, a hood or inverted trough located in the still and dividing it into two parts from one of which only the gaseous active agent passes from the still, a gas-pipe for the conveyance of the gaseous active agent, a condenser connected to or included in this pipe, a refrigerant-receptacle attached at its upper part to the condenser, and a spraying device for applying cooling-water to the still.

12. In a refrigerating apparatus, the combination of a still provided with a heat-applying device, an active-agent gas-pipe extending from the gas part of the still, a condenser connected to or included in this gas-pipe, a water-tank in the lower part of which the condenser is placed, a refrigerant-receptacle attached at its upper part to the condenser, a spraying device for applying cooling-water to the still, a water-controlling device consisting of a body and a rotating valve having a two-way passage, a water-supply pipe attached to the body of the water-controlling device, a pipe connecting the body of this device to the condenser-tank, and a pipe from this body to the spraying device of the still.

13. In a refrigerating apparatus, the combination of a still provided with a heat-applying device, an active-agent gas-pipe extending from the gas-space of the still, a condenser connected to or included in this gas-pipe, a water-tank in the lower part of which the condenser is placed, a refrigerant-receptacle attached at its upper part to the condenser, a coil of pipe in the still for the passage of cooling-water, a water-controlling device consisting of a body and a rotating valve having a two-way passage, a water-supply pipe attached to the body of the water-controlling device, a pipe connecting the body of this device to the condenser-tank, and a pipe from this body to the coil of pipe in the still.

14. In a refrigerating apparatus, the combination of a still provided with a heat-applying device, an active-agent gas-pipe extending from the gas-space of the still, a condenser connected to or included in this gas-pipe, a water-tank in the lower part of which the condenser is placed, a refrigerant-receptacle attached at its upper part to the condenser, a spraying device for applying cooling-water to the still, a coil of pipe in the still for the passage of cooling-water, a water-controlling device consisting of a body and a rotating valve having a two-way passage, a water-supply pipe attached to the body of the water-controlling device, a pipe connecting the body of this device to the condenser-tank, and a pipe from this body to the spraying device and coil of pipe of the still.

15. In a refrigerating apparatus, the combination of a still provided with a heat-applying device, an active-agent gas-pipe extending from the gas-space of the still, a condenser connected to or included in this gas-pipe, a water-tank in the lower part of which the condenser is placed, a refrigerant-receptacle attached at its upper part to the condenser, a spraying device for applying cooling-water to the still, a water-controlling device consisting of a body and a rotating valve having a two-way passage, a water-supply pipe attached to the body of the water-controlling device, a pipe connecting the body of this device to the condenser-tank, a pipe from this body to the spraying device of the still, levers or crank-arms connected to the stems of the heat-applying and water-controlling valves, and a rod or bar connecting these levers together.

In testimony whereof I have hereunto subscribed my name.

ALFRED SHEDLOCK.

Witnesses:
FRANK S. OBER,
C. B. HARRIS.