W. J. HERDMAN & T. E. MOLDON.

AUTOMATIC REFRIGERATING METHOD.

APPLICATION FILED OCT. 9, 1912. RENEWED DEC. 29, 1915.

1,233,056. Patented July 10, 1917.

3 SHEETS—SHEET 1.

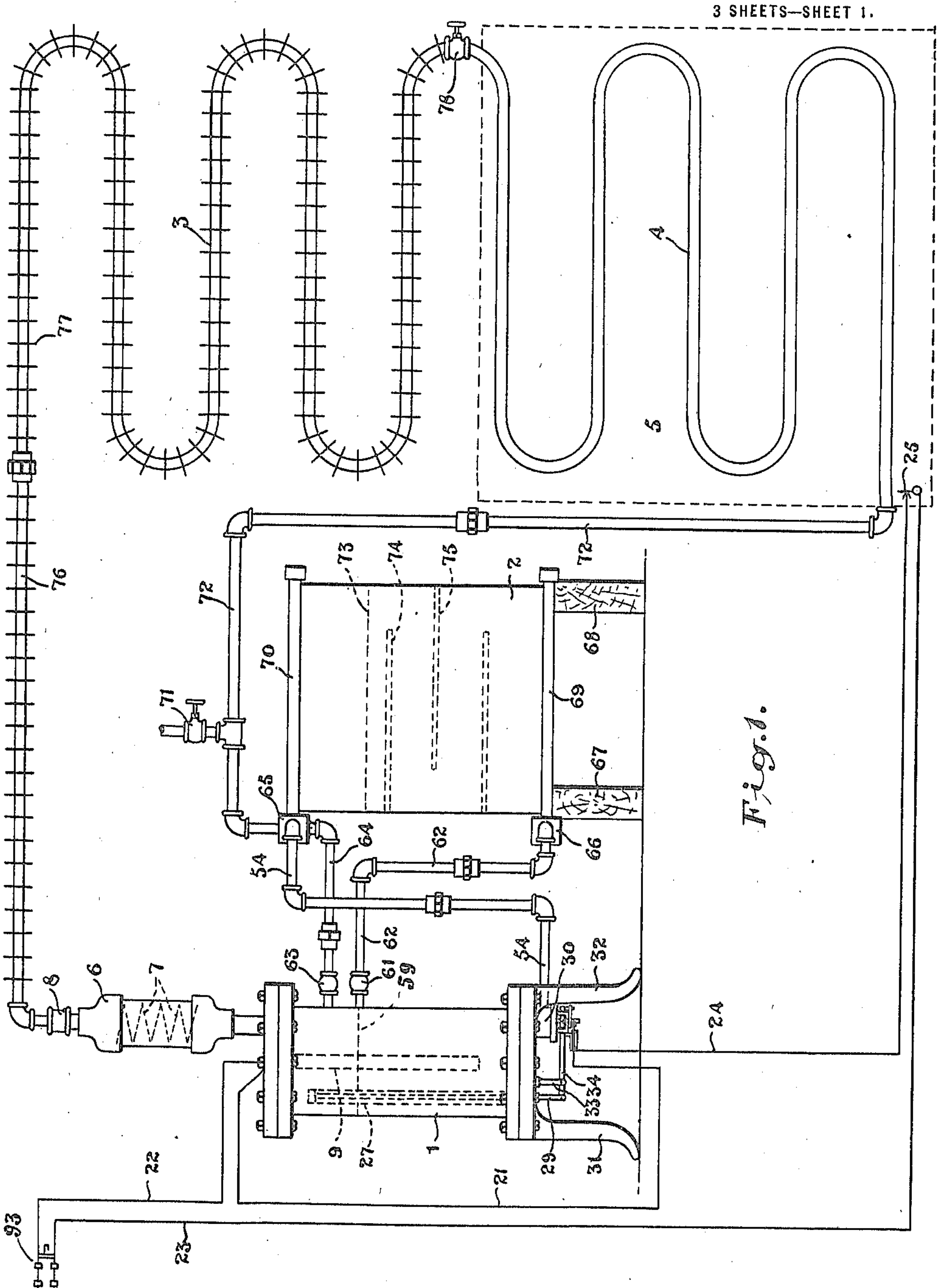

Fig. 1.

Witnesses.
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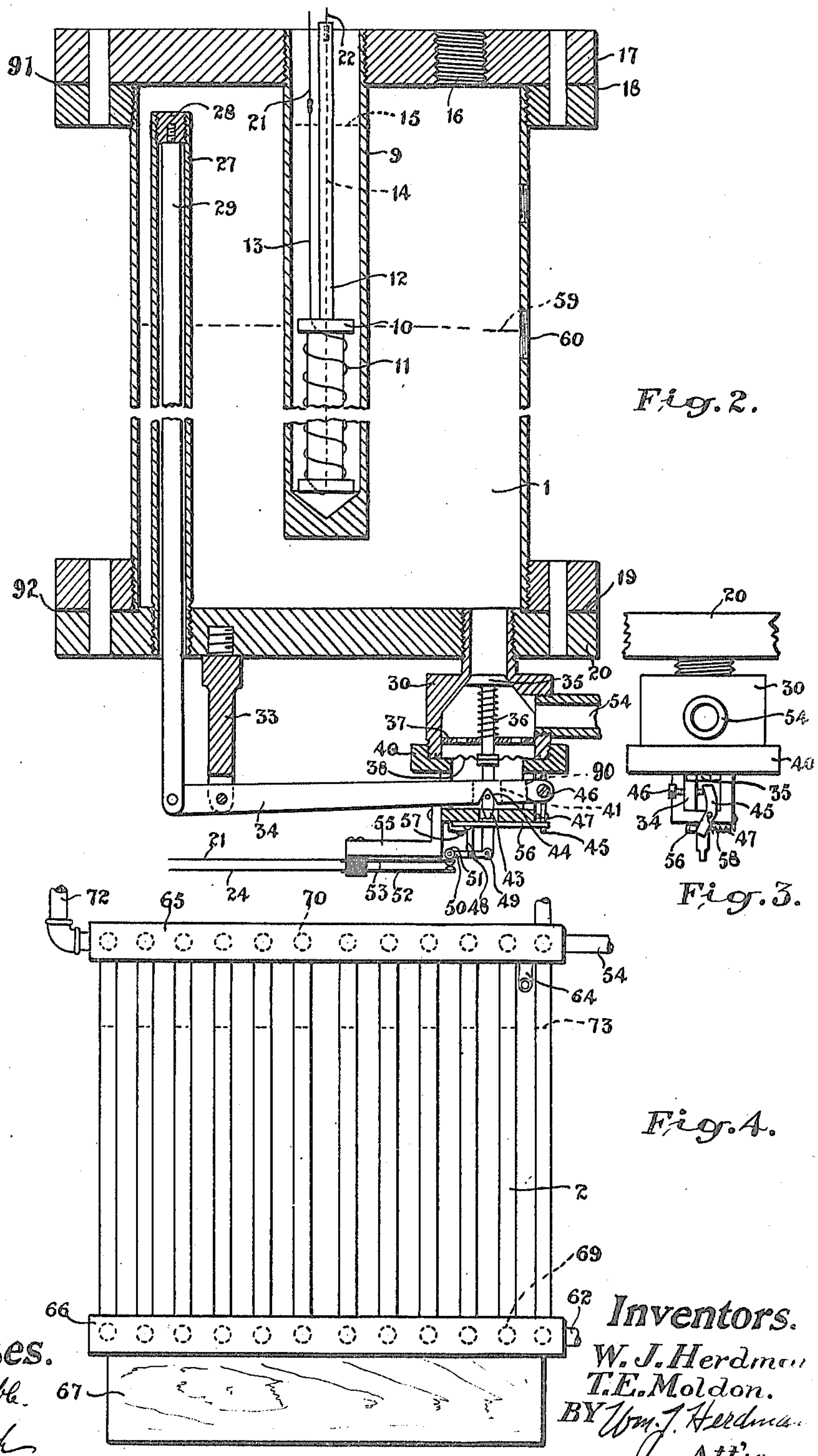

Witnesses.

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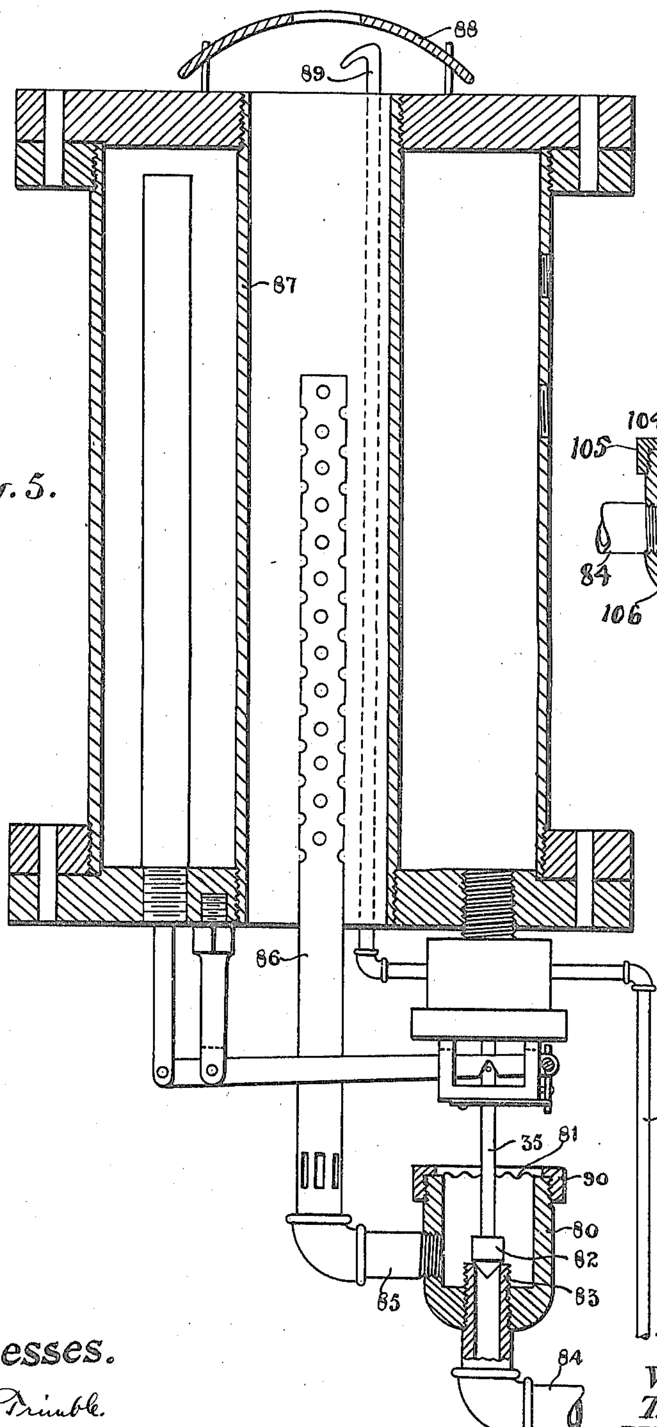

Fig. 5.

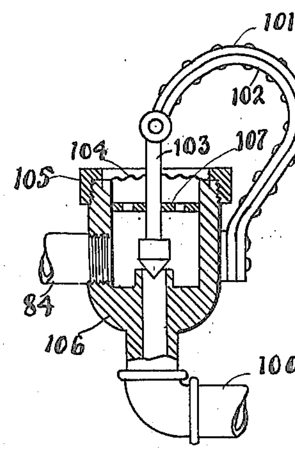

Fig. 6.

Witnesses.

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UNITED STATES PATENT OFFICE.

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AUTOMATIC REFRIGERATING METHOD.

1,233,056. Specification of Letters Patent. Patented July 10, 1917.

Application filed October 9, 1912, Serial No. 724,815. Renewed December 29, 1915. Serial No. 69,292.

To all whom it may concern:

Be it known that we, WILLIAM J. HERDMAN, a citizen of the United States of America, and THOMAS E. MOLDON, a citizen of the Dominion of Canada, both residents of Toronto, county of York, and Dominion of Canada, have invented a new and useful Improvement in Automatic Refrigerating Methods, of which the following is a specification.

Our invention pertains to methods of mechanical refrigeration, and relates especially to those methods of mechanically extracting heat in which the refrigerant, in a portion of the cycle of its operation, is absorbed by an absorbent from which it is thereafter expelled by heat.

The principal object of our invention contemplates a new and useful method of mechanical refrigeration of the class above noted, that while being adapted for general use in the art, is by reason of its automatic control, noiseless operation, and simplicity, especially applicable for use in household refrigerators in lieu of ice.

This and other desiderata we effect by employing novel means for utilizing the condensing pressure, resulting from the expulsion of the refrigerant from the absorbent, to transfer the weak absorbent from the heating chamber to the absorbing chamber, while further means is thereafter employed to utilize gravitation to effect a transfer of strong absorbent from the absorbing chamber to the heating chamber.

We eliminate the use of all rotating parts such as pumps, motors, etc., and through the use of a novel control system, produce a device entirely automatic in its operation and control, and one of extreme simplicity.

In the figures which accompany and form a part of this specification, and in which like reference numerals designate corresponding parts throughout:

Figure 1 is a diagrammatic view of our invention showing the operative relations of the various parts.

Fig. 2 is a sectional view of the heater of Fig. 1 and illustrates the details of the heating and control system.

Fig. 3 is an end view of the valve of Fig. 2.

Fig. 4 illustrates the details of the absorber of Fig. 1.

Fig. 5 is a sectional view of an alternative form of heater, showing partially in section the control mechanism, adapted for the use of gas as a heating means.

Fig. 6 is an elevation, partially in section, of the thermally controlled valve used, in the compartment to be cooled, when gas is used as a heating means.

The system of our invention, shown and described herein, may be used to refrigerate inclosures of indefinitely large size; but as the device is especially intended for small compartments, the drawings and descriptions are made appropriate to an ordinary household refrigerator.

The embodiment of our invention illustrated in Figs. 1 to 4 inclusively comprises, a heater 1, provided with supports as 31 and 32, and connected through a separator and rectifier 6, check valve 8, and pipe 76, with a condenser 3.

The lowest point of the condenser 3 is connected through an expansion valve 78 with the highest point of an expansion coil 4 which is convoluted in the upper portion of the food chamber of an ordinary refrigerator as indicated by the dotted inclosure 5. The lowest point of the expansion coil 4 is connected through a pipe 72 with the upper part of an absorber 2. In the actual construction of the device the expansion coil is so placed in its relation to the absorber that there is an incline from its connection with the expansion valve to its entrance to the absorber.

The absorber 2 is connected through three pipes with the heater 1. Pipe 62 connects the lowest point of the absorber 2 with the heater at a point near the top of the heater, the accurate location of which will be definitely disclosed hereinafter. Pipe 54 connects the lowest point of the heater 1 with the top of the absorber 2, while pipe 64 connects the top of the heater with the top of the absorber. The apparatus, with the exception of the expansion coil, is mounted on the outer walls of a refrigerator, or it may be placed in special compartments within the refrigerator, if such compartments be adapted to admit free circulation of air therethrough.

The system is designed to utilize air as a cooling means for the absorber and condenser, and for this reason the surface of the condensing pipes 3 is provided with a plurality of square or circular radiating vanes as 77, while the absorber 2, Fig. 4 comprises a plurality of flat chambers each of large surface and relatively small volume, in order that the condenser and absorber may radiate the heat, injected and generated therein, in a predetermined time interval, as hereinafter described. The absorber Fig. 4 is built up of a plurality of sheet iron pipes, flattened and soldered at both ends into pipes as 69 and 70, which are slotted for that portion of their length necessary to admit the flattened sheet iron pipes. The pipes as 69 and 70 are capped at one end and their remaining extremities are soldered into apertures in square headers as 66 and 65 respectively. The pipes connecting the absorber with the heater and the expansion coil are screwed into threaded apertures in the headers 66 and 65 as indicated. It is obvious from the above that both the absorber and condenser would, in consequence of the use of water as a cooling and condensing means, be much altered in design, but as such cooling means is well known in the art it is not deemed necessary to illustrate in this specification the methods of its utilization.

Check valve 8 admits gas from the heater 1, after its passage through the separator and rectifier 6, to the condenser 3, and closes with any pressure in the condenser which is in excess of a then existing pressure in the heater. Check valves 63 and 61 open with any pressure in the absorber which is in excess of a pressure in the heater. Further, as they are provided with springs which are sufficient to overcome the weight of the valve, and a pressure due to the maximum height of liquid in the pipe 54, as will be hereinafter more fully explained, they open against a pressure in the heater which is very slightly in excess of an existing pressure in the absorber.

The valve 30 is thermally controlled and operated to open at a predetermined high temperature of the heater contents, and allow communication between the heater and the absorber through the pipe 54 until the heater contents reaches a predetermined low temperature, whereupon the valve is operated to close.

Briefly our invention contemplates providing, in both the heater and absorber, a quantity of aqua ammonia which, when the apparatus is in a state of cold inaction, will fill both vessels to the same level. Thereafter heat is applied to the aqua ammonia in the heater to drive off ammonia gas which is confined in the condenser between the expansion valve 78 and the check valve 8, and condensed. A predetermined degree of heat operates valve 30 to open and allows the gas confined in the heater and separator by check valve 8, to drive off the weak hot solution through the pipe 54 to the top of the absorber 2, thus tending to equalize the pressures in the heater and absorber and allowing check valves 63 and 61 to open to equalize the pressures in the heater and absorber and the height of the aqua ammonia in both the heater and the absorber, upon the subsequent cooling of the heater. This subsequent cooling of the heater closes valve 30 and operates the heating means to again drive off gas, thus starting again the cycle of operation of the device.

Referring now especially to Fig. 2, the heater 1 shown in section, comprises a cylindrical vessel capped at both ends, in any suitable manner known in the art, that it may retain without loss a liquid subjected to a high pressure and raised to a high degree of heat. One method of accomplishing this result is shown and consists in providing on both ends of a short length of steel pipe, flanges 18 and 19 to which are bolted steel heads 17 and 20 with lead gaskets 91 and 92 therebetween. The head 17 is provided with a threaded opening 16 into which the nipple connecting the separator and rectifier 6 to the heater 1 is screwed. The construction of the separator and rectifier is indicated by the baffle plates 7. An iron or steel tube 9 closed at one end is threaded on the outside at its open end and screwed into a threaded central opening in the head 17.

An electrical heating element, is contained within the tube 9 and comprises a brass tube 12 over which is sleeved a porcelain or asbestos tube 10 provided with shoulders at both its extremities. The resistance wire 11 is wound on the tube 10 between the shoulders thereof, the shoulders serving to prevent the bare resistance wire from coming into contact with the inner surface of the tube 9. Terminal 14 of the heating coil 11 is insulated throughout its length and passes through the central portion of brass tube 12, while the remaining terminal 13 of the coil 11 is likewise insulated throughout its length and passes out of the heater through the opening in the tube 9. The tube 9 is filled to a point indicated by the dotted line 15 with an oil possessing a high flashing point, that the heat generated by the coil 11, may, without vaporization of the oil, be transmitted efficiently to the solution contained in the heater. This particular construction of the electrical heating means permits of the removal of the heating element, for repairs, without opening the piping system, or in any way disturbing a prearranged condition of the device.

The thermostat which controls the operation of valve 30 comprises a copper tube 27 threaded on the outside at one extremity and screwed into a threaded opening in the head 20 of heater 1. The other extremity of the tube 27 extends to within a short distance of the inner surface of the head 17 and is provided with an internal thread into which is screwed an iron plug 28 into which is threaded an iron rod 29 of smaller diameter than the internal diameter of the copper tube 27. This rod is maintained within the tube 27 and emerges from the heater therethrough. The tube 27 is electro plated with silver, or any other metal which is not affected by ammonia. The iron rod 29 of the thermostat is pivoted at its free extremity to the short arm of a lever 34 which is pivoted to a fulcrum stud 33 rigidly attached to the head 20. The valve 30 communicates with the heater through the head 20 being screwed into a threaded aperture therein, the center of which is located on a line passing through the center of the opening into which the thermostat tube 27 is screwed, and the vertical axis of the fulcrum stud 33. The valve chamber of valve 30 is sealed by means of a corrugated diaphragm 38 which is soldered to the walls of the valve chamber and is further held in place by means of the cap guide 40 which is internally threaded and engages an outside thread on the valve chamber. The stem of the valve plug 35 extends through a perforated guide 37 and thence through the diaphragm 38 to which it is firmly soldered. A spiral spring 36 is held under compression by the valve stem guide 37 and the under surface of the valve plug 35 and serves to maintain the plug in intimate contact with its seat. The portion of the stem of the valve plug 35 which extends beyond the diaphragm 38, passes through an elongated slot 41 in the lever 34 and thence through a guide aperture in the guide cap 40. A latch 56 is pivoted by means of the pin 57 to the under surface of the guide cap 40 and is held by the tension of spring 58 (Fig. 3) against the stem of the valve 30. An annular notch 43 is provided in the stem of the valve 30 and is so located thereon that when the valve 30 is opened to a predetermined limit, the latch 56 engages the notch 43 and maintains the valve 30 open. A latch tripping lever 45 is pivoted by means of a pin 47 to the side of the guide cap 40 and extends downwardly beyond the latch 56 and upwardly beyond the lever 34. A set screw 46 passes through a thinned portion of the lever 34, as indicated by the dotted line 90, and engages the edge of the tripping lever 45. The outline of the tripping lever 45 is such that the upper portion of the edge in contact with the set screw 46, inclines sharply toward the lever 34, the incline being so designed and placed with regard to its distance from the pivot point of the lever 45 and the adjustment of the set screw 46 being such that a predetermined upward excursion of the lever 34 rotates the tripping lever 45 to move the latch lever 56 out of engagement with the notch 43 in the stem of the valve 30, to allow the valve 30 to close under pressure of spring 36. While the spring 36 is designed to have a compression strength sufficient to maintain the valve plug 35 upon its seat against the highest probable compression pressure experienced in the use of the device, it is designed to allow the valve to open with excessive pressures and thus act as a safety valve. The pin 44 extends diametrically through the stem of the valve 30 and is engaged by a notch in the lever 34 as shown. The operation of the valve mechanism just described is as follows:

The copper thermostat tube 27 elongates with heat and as its coefficient of expansion is greater than that of the iron thermostat rod 29 the iron rod is drawn up into the heater 1, thus rotating the lever 34 about the fulcrum stud 33 to bring the notch in the lever 34 into engagement with the pin 44 in the stem of the valve 30. As the contents of the heater approaches a high temperature limit, the lever 34 begins, through its engagement with the pin 44, to lift the valve plug 35 from its seat, and upon the arrival of the contents of the heater at the high temperature limit, the valve plug has through the medium of the lever 34 been lifted sufficiently from its seat to allow a flow of the heater contents through the pipe 54. This pipe is designed with an internal cross sectional area less than that presented by the valve opening, and thus a back pressure is exerted on the diaphragm 38, which causes the diaphragm to move the valve stem sufficiently to allow the notch 43 in the valve stem to engage the latch 56. Upon the cooling of the heater the thermostat tube 27 contacts in excess of the iron thermostat rod 29 and the rod 29 is forced out of the heater, thus rotating the lever 34 about the fulcrum stud 33 to move the set screw 46 upward along the surface of the latch tripping lever 45. As the heater and its contents approaches a predetermined low temperature limit, the set screw 46 begins to bear upon the inclined portion of the outline of the latch tripping lever 45 and when a predetermined low temperature has been reached the latch tripping lever 45 has been rotated by means of the lever 34 sufficiently to move the latch lever 56 out of engagement with the notch 43 in the stem of the valve 30, whereupon the spring 36 acts to again seat the valve plug 35.

The diaphragm 38 is so designed, with regard to its area and flexibility, that the lowest back pressure experienced, due to the lowest probable compression pressure in the heater, when the valve 30 opens, will cause the diaphragm to move sufficiently to latch the valve 30 open.

The operation of the electrical heating element is controlled automatically, not only by the operation of the valve 30, but by the temperature variations in the chamber being cooled. Thus as shown in Fig. 1 one terminal of the electrical heating element is connected through conductor 22 and one blade of knife switch 93 with one side of a commercial current supply, while the other terminal of the heating element is connected through conductor 21 with spring contact 53 of an electrical switch controlled by the movement of valve plug 35. The other spring contact 52 of this switch is connected through conductor 24 with one terminal of a thermostat switch 25 located in the compartment to be cooled, while the other terminal of this thermostat switch is connected through conductor 23 and knife switch 93 to the remaining side of the commercial current supply source. Thus the heating element, valve controlled switch and thermostat switch are in series, and the operation of the heating element is under the control of both of these switches. The valve controlled switch and its control mechanism comprise a support 55 rigidly attached to the side of the guide cap 40, to which is attached as shown the two spring contacts 52 and 53, which are insulated from each other and from the support 55 by means of blocks of fiber as indicated. A support or fulcrum stud 48 is rigidly attached to the under surface of the guide cap 40 and supports by means of a pivot at its free extremity a lever 50 one extremity of which is attached by means of a pin 49 to the stem of the valve plug 35, while the other extremity extends over the free ends of the spring contacts 52 and 53 and bears a rubber or fiber roller 51. The lever 50 is so designed and its point of attachment to the stem of the valve plug 35 is such that it maintains the contacts 52 and 53 in contact with each other when the valve plug 35 is on its seat, and opens the contacts when the valve plug 35 begins to leave its seat.

The thermostat switch 25 in the cooling compartment 5 may be any one of a number known to the art, the only restriction being that it shall break contact upon an approach to a low temperature limit and make contact upon the approach to a high temperature limit. In the practice of our invention we employ a bi-metallic thermostat member carrying an adjustable contact point which maintains contact with a stationary contact point at all normal temperatures and breaks contact therewith as the temperature of the compartment approaches 35° F.

In the actual construction of our device we determine from the area of the inclosure to be cooled and the average temperature desired therein, the weight of liquid anhydrous ammonia that must pass through the expansion valve in a given time interval, and the expansion valve is then set to provide this flow under a pressure which is determined from the condensing pressure necessary to liquefy the ammonia at the average air temperature. The heater 1 is then designed to hold sufficient aqua ammonia to supply sufficient gas to require a predetermined time interval to pass through the expansion valve. The electrical heating element is given such dimensions as to heat this quantity of aqua ammonia to a degree which will remove substantially all of the ammonia gas therefrom in a time interval which is one fourth or one fifth the time interval required for the passage of the expelled gas through the expansion valve. We find that with a compression pressure of about 150 lbs., due to the average summer air temperature, a temperature of about 300° F. is sufficient to drive off substantially all of the ammonia gas, and we therefore design the thermostat in the heater and the lever 34 and its associated mechanism so that the valve plug 35 is started to move from its seat as a temperature of 300° F. is approached in the heater, and moved from its seat sufficiently to allow the action of the diaphragm to latch the valve 30 open, when a temperature of 300° F. is reached, as hitherto described herein.

The set screw 46 in the lever 34 is adjusted to trip the valve 30, to allow the same to close, at a temperature which is slightly higher than the highest probable temperature of the air surrounding the device.

The pipe 62 communicates to the heater 1 through an aperture in the heater placed about one third down from the top of the heater in order that the incoming cold solution may splash over the inner surface of the heater and thus cool the heater walls more advantageously. The pipe 64 which allows communication between the top of the heater and absorber is desirable in that it facilitates equalizing the pressure in the heater and absorber during the refilling process and thus hastens that process.

Before operating the device a measured quantity of aqua ammonia is introduced into the absorber 2 through the valve 71, the quantity being determined by the amount necessary to fill the heater and absorber to a level indicated by the dotted lines 73 and 59. This level being determined by the level of solution attained in the heater when the amount of solution necessary to give off a predetermined amount of liquid ammonia, as hitherto described, is introduced into the heater. The absorber 2 is maintained at such a height with the heater, by means of the supporting blocks 67 and 68 that the desired level of liquid in the heater and consequently in the absorber may be attained.

Assuming now that the system has been charged and that all the air has been exhausted from the entire system by any of the means well known in the art, and that the valve 71 is closed while the expansion valve 78 is opened to allow a predetermined flow of gas as hitherto explained; then, if the knife switch 93 be closed and the valve controlled switch and thermostat switch be closed, as will be the case if the heater is cold and the compartment to be cooled, warm respectively, the solution in the heater under the influence of the heat evolved from the electrical heating element, will begin to give off gas in large quantities which will pass through the separator and rectifier and be condensed in the condenser, for although the expansion valve is open the expulsion of gas is so much in excess of the amount which can pass through the expansion valve in the same time interval that a pressure will be generated in the condenser and the gas therein condensed. When the contents of the heater reaches 300° F. and substantially all of the gas has been expelled therefrom, the valve 30 opens and the gas in the heater confined by the check valve 8 expands and drives the weak hot liquid out of the heater through the pipe 54 to the top of the absorber 2. A series of baffle plates as 74 and 75 in the absorber 2 prevents this hot liquor from sinking quickly to the bottom of the absorber, and thus when the pressures in the heater and absorber have been nearly equalized the valves 63 and 61 open and allow an inflow of cold strong solution from the bottom of the absorber to the heater. As the heater walls are hot when this flow commences the incoming solution is thereby warmed and gas is given off therefrom, but as this gas is usually slowly evolved in comparison to that evolved by the action of the electrical heater, and as the valves 63 and 61 are designed with large area of plug and small lift so as to close with suddenly applied pressure and not with pressure gradually applied, they remain open and the level of the liquor in both heater and absorber is thus equalized. However, should the heater be sufficiently heated to quickly evolve gas from the incoming cold solution, and the valves 63 and 61 be thus closed, the pressure generated in the heater will tend to force the solution therein over into the absorber through the open valve 30 and thus tend to again equalize the pressures in the heater and absorber, to again allow valves 63 and 61 to open. Should the pressure in the heater not be sufficient to force all of the solution into the absorber, but be sufficient to force the pipe 54 full of solution, then the springs provided on the valves 63 and 61 are sufficient to overcome this excess pressure in the heater over that in the absorber and they therefore open to again equalize the pressures in the heater and absorber. This influx of cold solution results in cooling the heater and heater thermostat to the predetermined low temperature at which the valve 30 is closed and the electrical heating element again enlivened to again start the gas expulsion part of the cycle. As has been stated previously, sufficient gas is evolved at each expulsion to require four or five times the expulsion interval to pass through the expansion valve, thus sufficient time is provided to allow the level of the solution in the heater and absorber to equalize and the heater to cool to the predetermined low temperature limit and again start to expel gas before all of the previously expelled gas has passed through the expansion valve. Further the absorber and condenser are designed to cool to air temperature in this same time interval. Therefore upon the next expulsion of gas a pressure is present in the condenser and thus the condensation, expansion, and absorption is continuous. The absorber is designed to contain ten or fifteen times the quantity of solution heated at any one time and hence the hot liquor coming from the heater is met by a large quantity of cold liquor in the absorber which aids in quickly cooling the incoming liquor. Upon starting the device for the first time it will be noticed that the suction, or back pressure, is slightly higher than normal. This is due to the fact that the gas passed through the expansion valve during the heating of the solution, and before the opening of the valve 30, meets no weak solution in the absorber, but as the absorber is destined to maintain the solution therein at the air temperature, and as the weight of gas to be absorbed in the heating interval is extremely small compared to the quantity of solution in the absorber, a slight rise in back pressure only, is evidenced before absorption begins.

The cycle of operation of the device continues as just described herein until a temperature of about 35° F. is reached in the compartment to be cooled at which time the thermostat 25 operates to open the circuit of the electrical heater and the cycle of operation of the device is terminated until such time as the temperature of the compartment 5 reaches 40° F. at which time the thermostat 25 operates to close the circuit of the electrical heater and the cycle of operation of the device begins again.

It should be noted that the device is designed to utilize for cooling purposes only the weight of liquid ammonia that can be driven from the solution during a rise in temperature of the solution defined between the high temperature limit of about 300° F. and the low temperature limit of about 80° F. The low temperature limit of 80° F. is derived from the observed temperature of rooms in which household refrigerators are usually placed and is the highest temperature of the air surrounding the refrigerator in summer. Of course, this temperature limit will vary in different geographical locations and the device may be adjusted to meet the changed conditions by adjustment of the set screws 46 in the lever 34. Thus in machines destined for use in hot climates, the set screw 46 will be set to unlatch the valve 30 at higher temperature than is necessary in machines destined for use in cooler climates.

Referring now especially to Fig. 5, an alternative means of heating the solution is illustrated which comprises a heating chamber of the same general design as that formerly described herein, the heads of which are, however, provided with relatively large central openings into each of which is screwed one end of a pipe 87, in the axis of which is located a Bunsen gas burner 86, which communicates through a pipe 85 and valve 80 with a gas supply main 84. A pilot flame is fed from the gas supply main through a pipe 89, which passes upwardly on the outside of the heater. The tip or burner of the pilot pipe 89 projects over the top of the heater and is of such length as to bring the pilot flame over the opening in the central pipe 87. A perforated hood 88 is attached to the top of the heater and covers the opening in the central pipe 87, and the pilot burner. Thus a flow of live gas emanating from the Bunsen burner 86 meets the pilot flame near the top of the heater and the Bunsen burner is thus ignited. Again when the flow of gas through the Bunsen burner is cut off the pilot light is left burning near the top of the heater and the heat generated by this flame is carried upwardly without heating the walls of the heater.

The heater thermostat, valve which it controls, and latch mechanism, is the same as that formerly described for the electrical heater, the exception being that the electrical contacts and their operating mechanisms are omitted in this type of heater as they are unnecessary. The stem of the valve plug 35 passes through and is soldered in a diaphragm 81 which seals the opening of the gas control valve 80, and is further secured to the valve chamber by means of the cap 90 as indicated. A valve seat 83 is screwed into the valve 80 and likewise into the gas supply pipe 84. The stem of the valve plug 35 is provided with a valve plug 82 which seats on the valve seat 83 when the valve 30 allowing communication between the heater and absorber is open. Thus when the thermostat in the heater operates to open the valve 30 to allow the weak solution to be expelled from the heater, the valve plug 82 is likewise operated to seat on its seat 83 and thus cut off the supply of gas to the burner 86, and when the thermostat operates to close the valve 30 the valve plug 82 is lifted from its seat 83 to allow a flow of gas to the burner 86.

A thermally operated and controlled valve is likewise provided in the compartment to be cooled when gas is used as a heating means. This valve and its control mechanism is shown in Fig. 6 and comprises a valve chamber 106 provided with a valve plug 103 the stem of which extends through and is soldered in a diaphragm 104. This diaphragm seals the valve chamber 106 and is secured to the chamber by means of the cap 105. A perforated guide 107 serves to center the valve plug 103 over its seat. As indicated by the designating numerals this valve is placed in series with the valve 80, in that the pipe 84 leading from the seat of valve 80 enters the valve 106 above its valve seat while the gas supply main 100 enters the valve 106 below its seat. Thus if the valve 106 be closed the valve 80 may be opened without allowing gas to flow to the burner 86. A bimetallic thermostat member composed of a copper strip 102 riveted as indicated to a steel strip 101 is secured at one extremity to the side of the valve 106 and is curved to pivotally engage with its other extremity the stem of the valve plug 103, which projects beyond the diaphragm 104. This thermally controlled valve is so designed as to remain open as indicated at all normal temperatures and to close the valve upon a predetermined low temperature limit as 35° F. Its action is thus analogous to the thermo-electrical switch formerly described herein, as the pilot light tube 89 is connected to the gas supply main 100 and once lighted remains so irrespective of the action of the valves 80 and 106.

While we have illustrated and described one embodiment of our device, and an alternative form of heating means we desire that it shall be understood that we may make numerous changes in the design and details of our device without departing from the spirit or narrowing the scope of the invention.

Having thus described our invention what we claim as new and desire to secure by United States Letters Patent is as follows:

1. The method of successively expelling a gas from an absorbent automatically which comprises, applying heat to an absorbent to expel a gas until a maximum degree of temperature is attained for the absorbent, thereafter expelling all of the weak absorbent from the heating chamber to the absorbing chamber, and thereafter inducing a flow of absorbent from the absorbing chamber to and through the heating chamber to the absorbing chamber until a minimum temperature is attained in the heating chamber.

2. The method of successively expelling a gas from an absorbent automatically which comprises, applying heat to expel a gas from

an absorbent to create a difference of pressure on the absorbent in the heater over that in an absorber, equalizing this difference of pressure at intervals to induce a flow of absorbent from the absorber to and through the heater to the absorber, and finally equalizing the temperature of the heater and absorber to terminate such flow and to provide a fresh supply of absorbent in the heater.

3. The method of successively expelling a gas from an absorbent automatically which comprises, expelling a gas from a quantity of absorbent, expelling all of said absorbent from the heater after said gas expulsion; inducing a flow of absorbent from the absorber to and through the heater and to the absorber after said absorbent expulsion and providing a fresh supply of absorbent in the heater at the termination of said flow of absorbent.

4. In a refrigerating process the method of transferring absorbent which comprises, supplying absorbent to a heater from an absorber until the levels of the absorbent in the heater and absorber are equalized, applying heat to the absorbent in the heater to expel a refrigerant therefrom and to create a difference of pressure on the absorbent in the heater over that in the absorber, utilizing this difference of pressure to expel the absorbent from the heater to the absorber to unbalance the liquid levels in the heater and absorber, and thereafter equalizing the pressure between the heater and the absorber to allow gravitation to again equalize the liquid levels.

5. In a refrigerating process the method of transferring absorbent which consists in producing an excess pressure in one of two connected receptacles to cause a flow of liquid from one to a higher level in the other, in equalizing the pressures in the receptacles to cause a corresponding equalization of liquid levels in the same, and in controlling the relative pressures in the receptacles by heating to a maximum and cooling to a minimum temperature one of them.

6. An absorption refrigerating method which comprises, expelling a refrigerant from a quantity of absorbent, expelling all of said absorbent from the heater after said refrigerant expulsion, inducing a flow of absorbent from the absorber to and through the heater and to the absorber after said absorbent expulsion, providing a fresh supply of absorbent in the heater at the termination of the flow of absorbent, condensing, evaporating and thereafter re-absorbing the refrigerant.

Signed by us at Toronto, county of York and Province of Ontario, Canada, in the presence of two witnesses.

WILLIAM J. HERDMAN.
THOMAS E. MOLDON.

Witnesses:
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R. S. Chilton.