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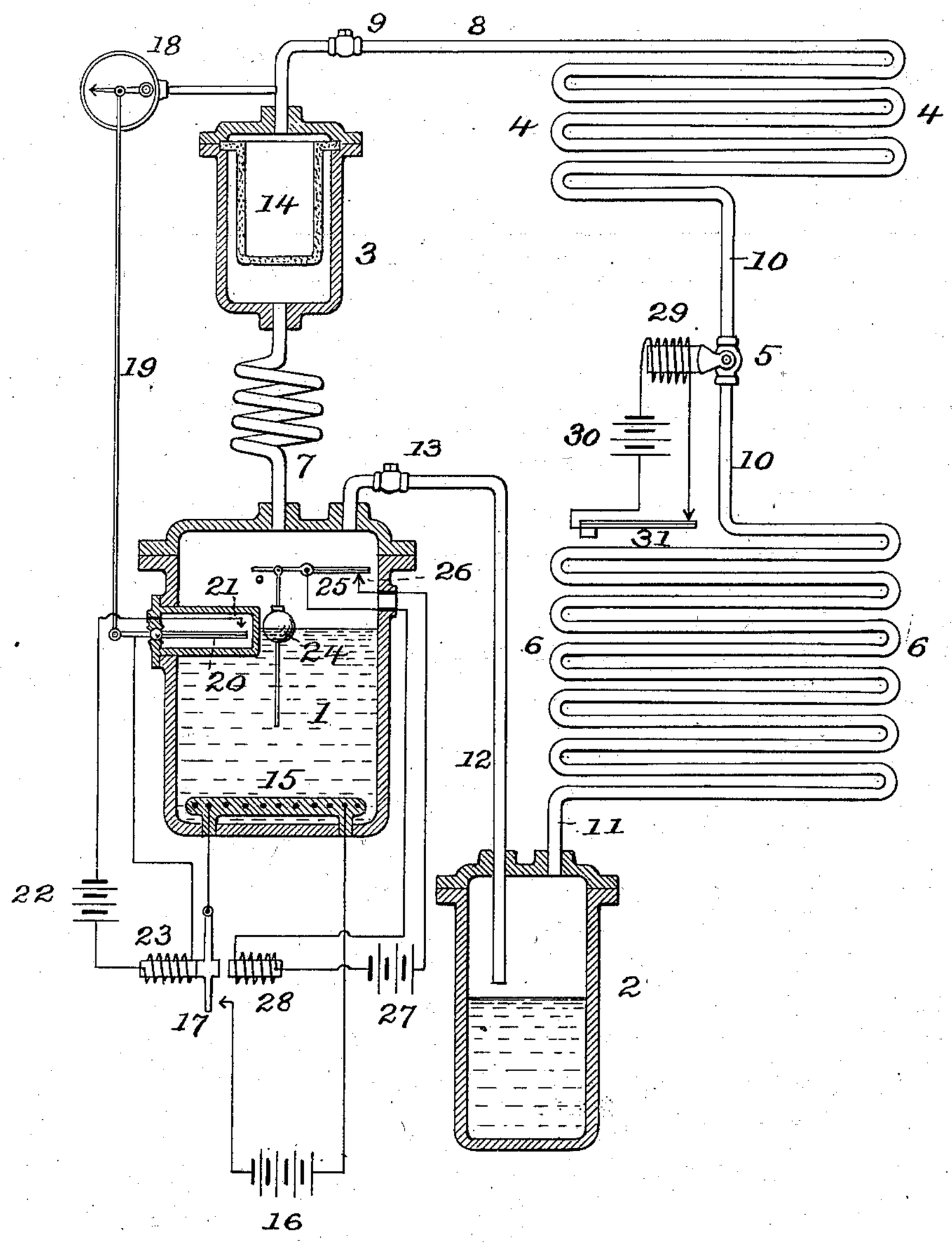
C. J. COLEMAN.

AUTOMATIC SYSTEM OF REFRIGERATION.

(Application filed June 24, 1899.)

(No Model.)



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AUTOMATIC SYSTEM OF REFRIGERATION.

SPECIFICATION forming part of Letters Patent No. 651,826, dated June 19, 1900.

Application filed June 24, 1899. Serial No. 721,773. (No model.)

To all whom it may concern:

Be it known that I, CLYDE J. COLEMAN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Automatic Systems of Refrigeration, (Case B;) and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawing, forming a part of this specification.

The present invention relates to the absorption system of refrigeration, and more especially to that type of such system in which the different operations succeed each other automatically and in recurring cycles.

The object of the present improvement is to provide a durable and effective system and apparatus in which the different steps or operations of the absorption system of refrigeration are caused to automatically succeed each other in recurring cycles, the one step or operation controlling the commencement of the next succeeding step or operation, all as will hereinafter more fully appear and be more particularly pointed out in the claims.

The accompanying drawing, illustrative of the present invention, is an elevation, partly sectional and partly diagrammatic, of an electrically-controlled automatic refrigerating apparatus embodying the present invention.

Referring to the drawing, 1 represents the combined absorption and generator chamber; 2, the auxiliary absorption-chamber; 3, the rectifier or water-separator; 4, the storage or condensing coils or chamber, in which the ammonia-gas in a liquid or highly-condensed state collects; 5, the automatic expansion-valve, and 6 the expansion chamber or coils, in which the condensed ammonia-gas from the storage-chamber 4 is expanded to effect the cooling step or operation of the system.

The above-described elements or members of the apparatus are usual to the present system of refrigeration and may be of any usual and approved construction and be connected together in the usual manner—to wit, the generator 1 by pipe connection 7 with the water-separator or rectifier 3, which in turn is connected by pipe 8 with the condensing or storage chamber 4, such pipe connection being provided with a check-valve 9 to prevent backflow into the rectifier and generator. The condensing-chamber 4 is connected to the expansion or cooling chamber 5 by a pipe connection 10, in which is arranged the expansion-valve 5, and the expansion or cooling chamber is in turn connected to the auxiliary absorption-chamber 2 by pipe connection 11, while such auxiliary absorption-chamber 2 is connected to the main generator 1 by a pipe connection 12, provided with a check-valve 13, to prevent backflow from the generator into the auxiliary absorption-chamber 2, and which pipe connection in the present improvement is extended down a distance into such auxiliary chamber, as shown and for the purpose hereinafter set forth in the operation of the present apparatus.

The first part of the present invention consists in means, in connection with the present system of refrigeration, for removing from the ammonia-gas after it leaves the generator any water or aqueous vapor which may be carried away from the generator by such gas and by so doing remove a very serious defect in the present system of refrigeration as heretofore carried on and which defect or obstacle to the successful and continued operation of the process was caused by the fact that water or aqueous vapor to a greater or less extent was carried over into the condensing or liquefying chamber, with the subsequent results of a clogging up of the expansion-valve and the expansion or cooling chamber or coils by the congelation of such water therein and so cause a material reduction in the efficient and economical action of the system, and which reduction would be further augmented by a reduction in the volatility of the ammonia-gas due to the presence of such aqueous vapor. In the present invention such difficulties are avoided by the provision within the rectifying-chamber 3 of a partition or diaphragm 14, of a porous nature, that will admit of the passage of a gaseous body, such as ammonia-gas, but will prevent the passage of water or aqueous vapor. Such nature I find is afforded by an unglazed and highly-vitrified porcelain and also by an ordinary porous battery-cup that has been

treated with some antihygroscopic material, such as paraffin. In use any required shape may be imparted to such diaphragm 14, preference being given to the cup or pot shaped formation shown in the drawing as affording a maximum area, with cheapness and simplicity of construction.

Another part of the present invention consists in the provision, in connection with an intermittent distillation and absorption system of refrigeration, of a system of control in which the cutting off or stoppage of the heating apparatus of the generating-chamber is automatically controlled and regulated by the combined action of temperature within said generating-chamber and pressure in the liquefying-chamber or the connections leading thereto, the turning on or starting of the heating apparatus being in like manner controlled by the combined action of temperature and the height or volume of aqua-ammonia in the generator-chamber.

To such ends the construction and arrangement of parts will be as follows:

15 is an electrical heating apparatus of any usual and approved construction and which is so arranged, preferably within the generator 1, as shown, as to heat the contents of such generator. The operating-circuit of such heating apparatus will embrace, in addition to the battery 16 or other source of electric energy, a switch mechanism 17, adapted to open and close said circuit, as hereinafter described, and so pivoted that it will have more or less friction on its pivotal bearing, and thus remain in the position to which it may be set until positively moved from such position.

18 is a pressure gage or motor located in the pipe connection 8, leading from the rectifier 3 to the storage tank or coil 4 to indicate the pressure within such coil or tank and in addition thereto impart movement in unison with the pressure in said storage-tank to a connecting rod or link 19, that has operative connection to the pivoted thermostat 20, usually of the bimetallic formation illustrated in the drawing, the connections being such that with variations of pressure in the storage tank or coil 4 the thermostat will be correspondingly moved toward or away from the contact-point 21. The operating-circuit controlled by said thermostat will, in addition to the battery 22 or other source of electric energy, include the operating-electromagnet 23, by which the switch mechanism 17 is operated to break or open the circuit of the heating apparatus 15.

24 is a float arranged within the interior of the generator 1 and having operative connection with a pivoted thermostat 25, usually of the bimetallic formation illustrated in the drawing, the connection being such that with the final upward movement of the float the thermostat 25 will be moved toward the contact-point 26, so as to complete the circuit. The operating-circuit controlled by such mechanism, in addition to the battery 27 or other source of electric energy, will include the operating-electromagnet 28, by which the switch mechanism 17 is operated to close the circuit of the heating apparatus.

In the present apparatus, 29 is an electromagnet adapted to open the expansion-valve 5. The operating electrical circuit of this magnet, in addition to the battery 30 or other source of electric energy, will embrace a thermostat 31 within the influence of the expansion or cooling chamber 6 of the system and adapted to maintain the temperature within such expansion-chamber constant.

The operation of the present apparatus is as follows: Starting with the combined generator and absorber 1, charged with a saturated solution of aqua-ammonia, and the float 24 in its extreme upper position, to close through the pivoted thermostat 25 and contact-point 26 the circuit of the electromagnet 28, which in turn brings the circuit of the heating apparatus 15 into a closed condition in order that such heating apparatus will effect distillation. The ammonia-gas arising from the solution in the main generator 1 passes through pipe connection 7 into the rectifier 3, where the aqueous vapor is separated. From thence the ammonia-gas passes into the liquefying chamber or coils 4 to assume a highly-compressed or liquid condition. At a degree of temperature within the generator, combined with a like degree of pressure in the liquefying-chamber and corresponding with an approximate completion of the distillation, the thermostat 20 operates the switch 17 of the heating apparatus to open the circuit thereof and prevent a further heating of the same.

The operation of the thermostat 20 with the compensating pressure-motor 18 is as follows: Whenever the pressure in the cooling-coil 4 is greatest, (owing to a rise in atmospheric temperature or other causes,) the pressure-motor operates the thermostat so that a greater temperature will have to be attained in the generator in order that it may operate the thermostatic controlling-circuit. Under such conditions this increased temperature in the generator will be required to approximate a complete distillation of the ammonia-gas from the generator, and, conversely, should the temperature for any reason become reduced in the liquefying-coil, and consequently the pressure required to maintain the ammonia-gas liquefied under such conditions correspondingly reduced, the pressure-motor (on account of being connected with the same) will, by means of its connection with the thermostat, advance said thermostat toward its contact-point, so that a lesser rise of temperature in the generator will cause the thermostat to act and arrest the further heating of the generator. Otherwise with this reduced temperature the liquefying-chamber, and consequently a lesser pressure being required under such condi-

tions, not only would the ammonia-gas, but also a large percentage of water be distilled over should the temperature effect not be compensated for and prevent the temperature in the generator from being as great as would be required where the temperature and corresponding pressure are greater in the liquefying-coil.

With the present apparatus the cooling or refrigerating action of the expansion or cooling chamber 6 is substantially continuous, in that during the distilling operation above described and during the subsequent period of time in which the generator is cooling down, so as to commence reabsorption, a continued expansion of the ammonia-gas takes place in such expansion or cooling coils under a gradually-increasing back pressure, due to the gradual saturation of the liquid in the auxiliary absorption-chamber 2 under the effects of such gradually-increasing pressure.

With the cooling down of the main generator reabsorption of the ammonia-gas commences therein, and with the gradual absorption of the ammonia the liquid-line therein gradually rises and elevates the float 24 to finally close the circuit of the operating-electromagnet 28 of the switch mechanism 17 to close the heating-circuit of the heating apparatus 15 and cause a recommencement of the distillation, when a new cycle of operations will again commence.

The thermostat 25 is arranged so that a rise in temperature will cause it to advance or bend toward contact-point 26, which compensates for a decreased level of the aqua-ammonia on account of this corresponding rise of temperature, preventing the water from absorbing its usual percentage of ammonia-gas, thus failing to operate the float sufficiently.

With the present apparatus the excess of ammonia-gas absorbed by the auxiliary absorber 2 while under pressure is with the removal of such pressure again given off to be absorbed by the main generator, and the construction of such auxiliary absorber is such that any excess of water collecting in the same will be automatically forced over into the main generator through the pipe connection 12.

Having thus fully described my said invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination with the generator and liquefier of an absorption system of refrigeration, of a rectifier provided with a porous diaphragm, adapted to permit the passage of the refrigerant gas, and exclude the absorbent medium, substantially as set forth.

2. The combination with the generator and liquefier of an absorption system of refrigeration, of a rectifier provided with a porous diaphragm, having a cup or pot shape, adapted to permit the passage of the refrigerant gas, and exclude the aqueous vapor, substantially as set forth.

3. In an automatic absorption system of refrigeration, the combination of a generating and absorbing chamber, a liquefying-chamber, an expansion-chamber, and an auxiliary absorption-chamber, between the expansion-chamber and the generating and absorbing chamber and connected in series therewith and adapted to continue the cooling operation of the expansion-chamber, during the heating and cooling operations of the generator, substantially as set forth.

4. In an automatic absorption system of refrigeration, the combination with a generating-chamber, a liquefying-chamber and an expansion-chamber, of a heater for the generating-chamber, a thermal device associated with the generating-chamber and arranged to control the temperature of the generator, and a pressure-motor communicating with the generating-chamber and coöperating with the thermal device to control the duration of the distillation period in the generator.

5. In an automatic absorption system of refrigeration, the combination with a generating-chamber, a liquefying-chamber and an expansion-chamber, of an electric heater for the generating-chamber, an electromagnetic switch for the heater, a thermostat associated with the generating-chamber and included in circuit with said electromagnetic switch and a pressure-motor communicating with the generating-chamber and mechanically connected with the thermostat.

6. In an automatic absorption system of refrigeration, the combination with a generating-chamber, a liquefying-chamber and expansion-chamber, of a heater for the generating-chamber, a thermal device associated with the generator and arranged to control the heater, and a pressure-motor tending to operate the thermal device by an increased pressure in the generator in an opposite manner to the operation of the thermal device by an increase of temperature.

7. In an automatic absorption system of refrigeration, the combination with a generating-chamber, a liquefying-chamber and an expansion-chamber, of an electrical heater for the generating-chamber, a thermal device associated with the generator and arranged to control the heater, and a pressure-motor tending to operate the thermal device by an increased pressure in the generator in an opposite manner to the operation of the thermal device by an increase of temperature.

8. In an automatic absorption system of refrigeration, the combination of a generating and absorbing chamber, a liquefying-chamber, an expansion-chamber, a thermostat in the generating-chamber, an electrical circuit controlled by said thermostat, an electromagnet arranged in said circuit, and adapted to control the heating apparatus of the generator; and a pressure-gage connected with the liquefying-chamber and adapted to regulate the movement of the thermostat, substantially as set forth.

9. The combination with the generator and liquefier of an absorption system of refrigeration, of a rectifier provided with a porous diaphragm adapted to permit the passage of refrigerant gas and exclude aqueous vapor, and an electric heater associated with the generator for heating the same.

10. The combination with the generator and liquefier of an absorption system of refrigeration, and an electric heater associated with the generator for heating the contents thereof, of a rectifier provided with a porous diaphragm having a cup or pot shape, adapted to permit the passage of the refrigerant gas and exclude the aqueous vapor.

11. The combination with a generator and liquefier of an absorption system of refrigeration, of a rectifier provided with a porous diaphragm treated with antihygroscopic material.

12. In an electrical system of automatic control for refrigerating apparatus, the combination of a generating and absorbing chamber, a liquefying-chamber, an expansion-chamber, a thermostat in the generating-chamber, an electrical circuit controlled by said thermostat, an electromagnet arranged in said circuit, and adapted to control the heating apparatus of the generator, and a float within the generator adapted to regulate the movement of said thermostat, and close such circuit, substantially as set forth.

13. In an electrical system of automatic control for refrigerating apparatus, the combination of a generating and absorbing chamber, an electrical heating apparatus for the same, an electrical circuit embracing said heating apparatus, a liquefying-chamber, an expansion-chamber, a thermostat in the generating-chamber, an electrical circuit controlled by said thermostat, an electromagnet in said circuit adapted to open a switch in the heating electrical circuit, and a pressure-gage connected to the liquefying-chamber and adapted to regulate the movement of the thermostat, substantially as set forth.

14. In an electrical system of automatic control for refrigerating apparatus, the combination of a generating and absorbing chamber, an electrical heating apparatus for the same, an electrical circuit embracing said heating apparatus, a liquefying-chamber, an expansion-chamber, a thermostat in the generating-chamber an electrical circuit controlled by said thermostat, an electromagnet in said circuit adapted to close a switch in the heating electrical circuit, and a float in the generating-chamber adapted to regulate the movement of the thermostat, substantially as set forth.

In testimony whereof witness my hand this 14th day of June, 1899.

CLYDE J. COLEMAN.

In presence of—

ROBERT BURNS,

JAMES LAVALLIN.