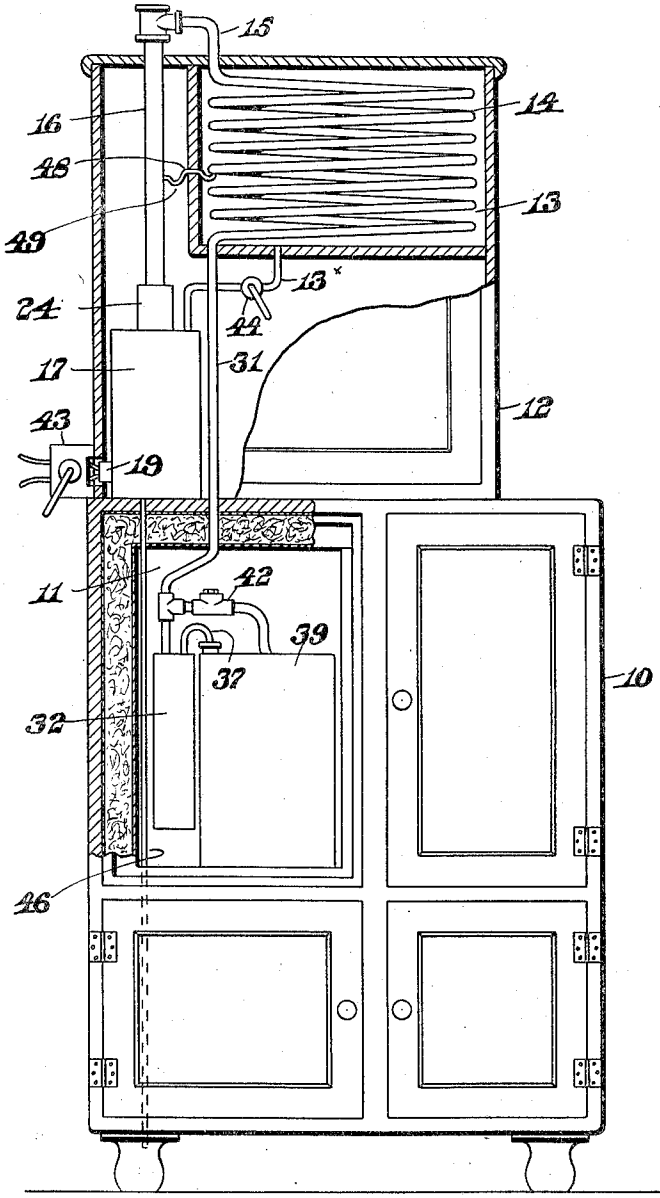
Oct. 21, 1924. 1,512,623

C. E. MAXWELL

REFRIGERATING APPARATUS

Filed Sept. 17, 1921 2 Sheets-Sheet 1

Fig. 1.



Inventor:
Charles E. Maxwell,
by Walter G. Lombard.
Atty.

Oct. 21, 1924. 1,512,623

C. E. MAXWELL

REFRIGERATING APPARATUS

Filed Sept. 17 1921 2 Sheets-Sheet 2

Fig. 2.

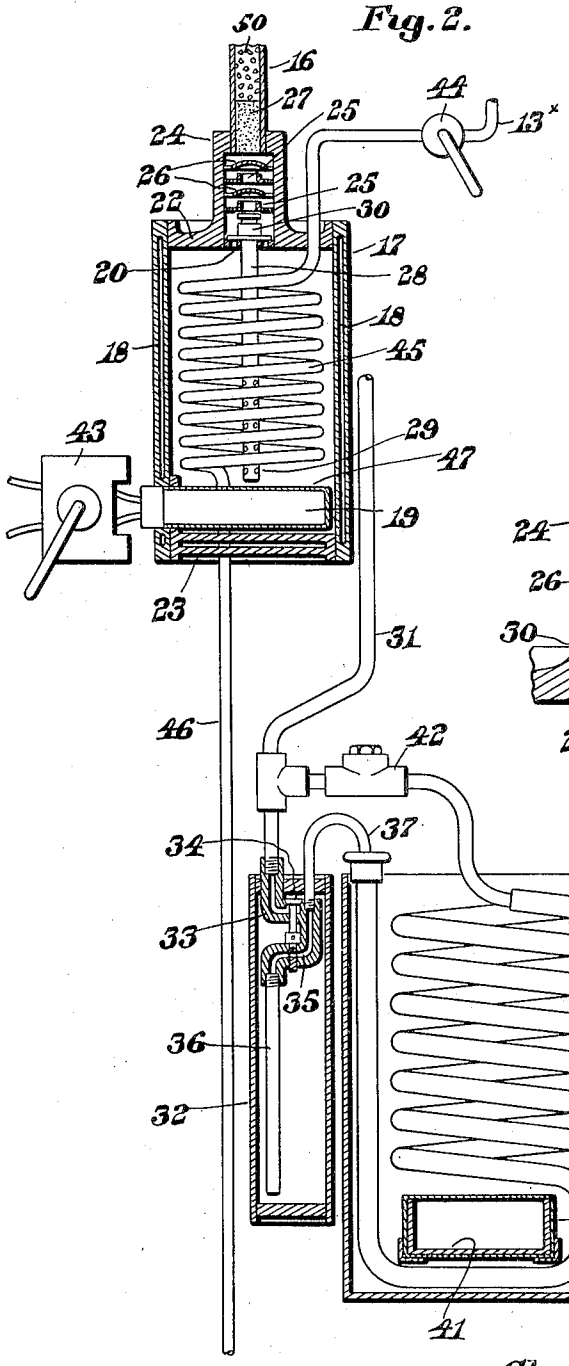
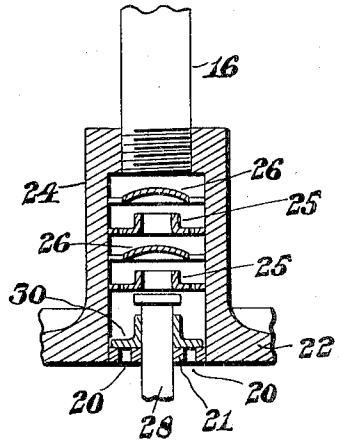


Fig. 3.



Inventor:
Charles E. Maxwell,
by Walter E. Lombard.
Atty.

Patented Oct. 21, 1924. 1,512,623

UNITED STATES PATENT OFFICE.

CHARLES E. MAXWELL, OF BRIGHTON, MASSACHUSETTS.

REFRIGERATING APPARATUS.

Application filed September 17, 1921. Serial No. 501,484.

To all whom it may concern:

Be it known that I, CHARLES E. MAXWELL, a citizen of the United States of America, and a resident of Brighton, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Refrigerating Apparatus, of which the following is a specification.

This invention relates to refrigerating devices and particularly to devices of this character which are adapted to be installed in conjunction with the ordinary household refrigerators to keep the interior of said refrigerators at a predetermined temperature without the use of ice.

The invention consists primarily of an apparatus in which the generation of ammonia gas and its absorption is completed in the same receptacle and in which all water or watery vapor is eliminated from the gas prior to the admission of said gas to the cooling coil.

The invention further consists in certain novel features of construction and arrangement of parts which will be understood readily by reference to the description of the drawings and to the claims to be hereinafter given.

For the purpose of illustrating the invention, one preferred form thereof is illustrated in the drawings, this form having been found to give satisfactory and reliable results although it is to be understood that the various instrumentalities of which the invention consists can be variously arranged and organized and the invention is not limited to the precise arrangement and organization of these instrumentalities as herein shown and described except as required by the scope of the appended claims.

Of the drawings—

Figure 1 represents a front elevation of a refrigerator partially in section and showing applied thereto, a refrigerating apparatus embodying the principles of the present invention.

Figure 2 represents a vertical section of said refrigerating apparatus drawn to an enlarged scale, and

Figure 3 represents an enlarged sectional detail to be hereinafter referred to.

Similar characters indicate like parts throughout the several figures of the drawings.

In the drawings, 10 is a refrigerator of any well-known construction and provided with the usual ice compartment 11.

Superimposed upon the refrigerator 10 is a cabinet 12 in the tank 13 of which is installed the condensing coil 14, said tank 13 being filled with water.

The upper end 15 of the coil 14 communicates with the pipe 16 extending upwardly from the generator 17 installed in said cabinet 12.

This generator 17 is surrounded by a vacuum jacket 18 to conserve the heat supplied by the heating unit 19.

The generator 17 is partially filled with aqua ammonia and when in operation the heating unit 19 will cause the aqua ammonia to give forth ammonia gas which will rise in the generator chamber and pass through openings 20 in the perforated plate 21 set into the bottom face of upper head 22 of the generator, the lower end of which is closed by the head 23.

The head 22 is provided with a tubular extension 24 in which is positioned a plurality of perforated baffle plates 25 above each of which is positioned a curved baffle plate 26 extending over the openings in the plates 25 and causing the rising gases to be deflected into irregular paths until said gases rise through the plug 27 of mineral wool in the lower end of the pipe 16.

The impinging of the gas upon the baffle plates 25, 26 and the passing thereof through the plug 27, tend to hold the water carried up by the gas which rises through the pipe 16 to the condensing coil 14 in the water tank 13.

Depending from the head 22 is a pipe 28 which is perforated at the lower end, as at 29, while the upper end of said pipe 28 extends through said head 22 and is surrounded by a valve 30 which normally rests upon the perforated plate 21 and closes the openings 20 therein.

The upper end of said pipe 28 is provided with a flange which limits the upward movement of said valve 30.

When the gas in the chamber of the generator 17 reaches a given pressure, it will lift the valve 30 thereby permitting the gas to enter the tubular extension 24 and pass therefrom through the plug 27 into the pipe 16 and finally into the condensing coil 14.

The gas, under pressure generated in the generator 17, upon entering the condensing

coil 14, is changed from a gas to a liquid, viz: anhydrous ammonia and this passes down through pipe 31 to the receiver 32.

This anhydrous ammonia passing from the pipe 31 under pressure enters a valve casing 33 and raises the valve 34, the stem of which has an opening therethrough normally registering with the passage 35 in said casing 33.

When the valve 34 is raised, the opening in its stem will be moved out of register with the passage 35 and said passage will be closed and when the pressure in the pipe 31 is lowered sufficiently to permit said valve 34 to close by gravity, the opening in the valve stem will again be brought into register with the passage 35.

One end of said passage 35 has a pipe 36 leading therefrom to the bottom of the receiver 32 while the opposite end of said passage 35 has a pipe 37 leading therefrom to the freezing coil 38 in the tank 39 which is filled with brine.

The action of the brine on the anhydrous ammonia entering the freezing coil 38, will change this liquid into dehydrated ammonia gas which will rise in said coil 38 to pass therefrom in the manner to be hereinafter referred to.

Under the body of the freezing coil 38 is a closed chamber 40 in which a drawer 41 is adapted to be positioned and this drawer may be filled with water which by the action of the apparatus will be frozen forming cakes of ice to be used as desired.

The upper end of the freezing coil communicates with the pipe 31 and in this upper end is a check valve 42 which prevents any liquid from entering the upper end of the freezing coil 38 from the condensing coil 14 but permits the dehydrated ammonia gas formed in the freezing coil 38 to pass in the opposite direction to the condensing coil 14.

When the ammonia gas is distilled in the generator 17, the pressure will have arrived in the machine to a point where it is necessary to cut off the current to the heating unit 19 and this is accomplished by the operator actuating a suitable regulating device indicated diagrammatically in the drawing at 43.

As many well-known regulating devices may be used for this purpose, it is believed to be unnecessary to illustrate the same in detail.

When this regulator 43 is actuated, the operator also actuates the valve 44 in the pipe 13^{x} leading from the tank 13 to the coil 45 in the generator 17, the lower end of which is provided with a discharge pipe 46.

When the valve 44 is open the water in the tank 13 may flow downwardly through the generator coil 45 thereby cooling the weak liquor in the generator 17 and gradually bringing the temperature back to normal.

When the passage 35 is closed, the anhydrous ammonia will be retained in the receiver 32 until the pressure in the generator 17 is removed by cutting out the heating unit 19 and cooling the generator which is accomplished by the regulator 43 which is regulated in accordance with the varying pressure in the generator 17.

When the pressure exceeds a predetermined point, the regulator will be actuated to cut off the current and open the valve 44 thereby allowing the water in the tank 13 to flow down through the generator coil 45 and bring the pressure back to normal.

When the pressure in the generator 17 becomes normal, the valve 34 will close and open passage 35 thereby permitting the anhydrous ammonia in the receiver 32 then to pass through the pipe 36, passage 35, and pipe 37 into the freezing coil 38 in the brine tank 39 where it expands producing a chilling of the brine in said tank.

The anhydrous ammonia upon entering the freezing coil 38, will extract heat from the brine and form ammonia gas which will rise in the coil 38 and then will pass through the check valve 42 to the condensing coil 14 through the pipes 16 and 28 thereby admitting said gas into the bottom of the generator 17 beneath the weak liquor and causing a quick absorbtion of the gas.

The heating unit 19 is positioned in a closed pocket 47 in the generator 17 thereby separating the unit from the liquor within the generator.

From a predetermined point in the condensing coil 14 a small pipe 48 leads to the pipe 16 said pipe 48 having a bend 49 therein forming a trap.

When the gas in the coil 14 condenses, the water generated will pass through the pipe 48 and trap 49 into the pipe 16 and thence to the generator 17.

The particular point of connection of the pipe or tube 48 with the coil 14 must be determined by experiment as it must be connected to the coil at a point where the temperature and pressure combine to form a dew point as at this point any water remaining in the coil 14 will drip therefrom through the tube or pipe 48 into the pipe 16 the trap 49 preventing any anhydrous ammonia gas passing from the pipe 16 through the tube 48 into the coil 14.

In the operation of the apparatus, the generator 17 is partially filled with aqua ammonia and current is then supplied to the heating unit 19 thereby heating the aqua ammonia and forming ammonia gas.

This gas will rise in the generator 17 and open the valve 30 thereby permitting the gas to escape through the openings 30 into the tubular extension 24 where the greatest

portion of the water remaining in the gas will be removed therefrom by contact with the baffle plates 25, 26.

If any water remains in the gas after the latter has passed said baffle plates, the most of it will be removed therefrom when the gas percolates through the plug 27 of mineral wool or some similar substance.

When the gas enters the condensing coil 14 it is nearly free from water and under pressure generated in the generator but in passing through said coil 14 it reaches a point where the temperature and pressure causes the gas to liquify, forming a liquid, viz: anhydrous ammonia, which passes to the receiver 32.

When this anhydrous ammonia enters the valve casing 33 in the receiver 32, it will raise the valve 34 and close the passage 35, the anhydrous ammonia escaping into the receiver 32 from which there is no outlet when the passage 35 is closed.

At this time the excessive pressure in the generator 17 will cause the automatic regulator to shut off the current and open the valve 44 permitting water from the tank 13 to enter the coil 45 in generator 17 and by cooling the liquid therein to bring the temperature back to normal.

This will permit the valve 34 to close and again open the passage 35 thereby permitting the anhydrous ammonia in the receiver 32 to enter the freezing coil 38 in the brine tank 39 and expand causing the brine to be chilled.

As soon as the anhydrous ammonia enters the freezing coil 38, and is relieved from the pressure generated in the receiver 32, it will extract heat from the brine and become ammonia gas.

This ammonia gas will then travel from the freezing coil 38 through the condensing coil 14 and back to the generator 17 into which it is admitted at a point beneath the weak liquor in said generator, thereby causing the gas to be absorbed quickly.

It is obvious therefore that the generation of the ammonia gas and its absorbtion are both produced in the same vessel.

As far as is known, the machines previously constructed have a very slow action and therefore a lower efficiency while the amount of water carried over in the gas is excessive causing inferior results to be obtained.

To overcome this objection in the present invention, means is provided such as baffle plates and percolator plugs to more thoroughly eliminate the water before the gas reaches the condensing coil 14 and said coil is provided with an outlet at a predetermined point whereby any water dripping from the gas while in the condenser coil 14 may be returned to the generator through the U-tube 48.

While not essential to proper operation of the apparatus, it is preferred to fill the pipe 31 with terra cotta clay 50 and bake it so that the gas passing through the pipe may be more thoroughly dehydrated.

The water tank 13 is kept filled with water at all times by means of an inlet pipe having a controlling valve actuated by a ball cock but as this means of supplying the tank constantly with water is well-known in practice, it is believed that the illustration of these devices is unnecessary.

This makes a very efficient and comparatively inexpensive apparatus for producing refrigeration.

It is believed that the operation and many advantages of the invention will be understood without further description.

Having thus described my invention, I claim—

1. In an apparatus of the class described, a generator adapted to contain aqua ammonia; a heating unit therefor; a condensing coil; a tubular extension to said generator; a pipe leading therefrom to said condensing coil; a pipe extending from said extension to the bottom of the generator and communicating therewith at its lower end; and a valve surrounding said downwardly extending pipe and adapted to normally close a passage between said extension and generator.

2. In an apparatus of the class described, a generator adapted to contain aqua ammonia; a heating unit therefor, a condensing coil; a tank therefor containing water; a tubular extension to said generator; a pipe leading therefrom to said condensing coil; a coil in said generator; a pipe leading therefrom to the bottom of said tank; a pipe extending from said tubular extension to the bottom of said generator and having a discharge opening in its lower end; and a valve surrounding the upper end of said downwardly extending pipe and normally adapted to close passages between said extension and generator.

3. In an apparatus of the class described, a generator adapted to contain aqua ammonia; a heating unit therefor; a condensing coil; a pipe leading from said generator to said coil; and a tube leading from said coil to said pipe.

4. In an apparatus of the class described, a generator adapted to contain aqua ammonia; a heating unit therefor; a condensing coil; a pipe leading from said generator to said coil; and a tube leading from said coil to said pipe having a trap therein.

5. In an apparatus of the class described, a generator adapted to contain aqua ammonia; a condensing coil communicating with said generator; a receiver communicating with said condensing coil; a freezing coil; and a valve in said receiver permitting the anhydrous ammonia to be admitted to

said receiver from said condensing coil and during such admission preventing the escape of said anhydrous ammonia into said freezing coil.

6. In an apparatus of the class described, a generator adapted to contain aqua ammonia; a condensing coil communicating with said generator; a receiver communicating with said condensing coil; a freezing coil; a valve casing in said receiver having a passage therethrough; a slidable valve in said casing having an opening through the stem thereof adapted to register with said passage under normal conditions; and a pipe leading from said passage to said freezing coil.

7. In an apparatus of the class described, a generator adapted to contain aqua ammonia; means for forming ammonia gas from said aqua ammonia by heating the same; a condensing coil; a water tank in which said coil is positioned; a pipe connecting said generator and said coil; a depending pipe in said generator having openings in the bottom thereof and the upper end of which communicates with said connecting pipe; openings in the head of said generator surrounding said depending pipe communicating with said connecting pipe; and a valve also surrounding said depending pipe normally closing said openings and adapted to be raised by the pressure created in said generator.

8. In an apparatus of the class described, a generator adapted to contain aqua ammonia; means within the generator for heating the aqua ammonia and forming ammonia gas; a condensing coil to which the gas is conducted; means for liquefying said gas in said coil and forming anhydrous ammonia; a freezing coil; a receiver between said freezing coil and said condensing coil in which said anhydrous ammonia is adapted to be stored prior to its discharge into said freezing coil; means whereby the dehydrated gas formed in the freezing coil may be returned to the generator through said condensing coil and the pipe supplying ammonia gas to said condensing coil; and means within said generator for absorbing the ammonia gas returned thereto.

Signed by me at 294 Washington St., Boston, Mass., this 30th day of August, 1921.

CHARLES E. MAXWELL.

Witnesses:
WALTER E. LOMBARD,
NATHAN C. LOMBARD.