

Feb. 15, 1938.

E. E. ALLYNE ET AL

2,108,360

CONDENSER UNIT

Filed March 29, 1934

3 Sheets-Sheet 1

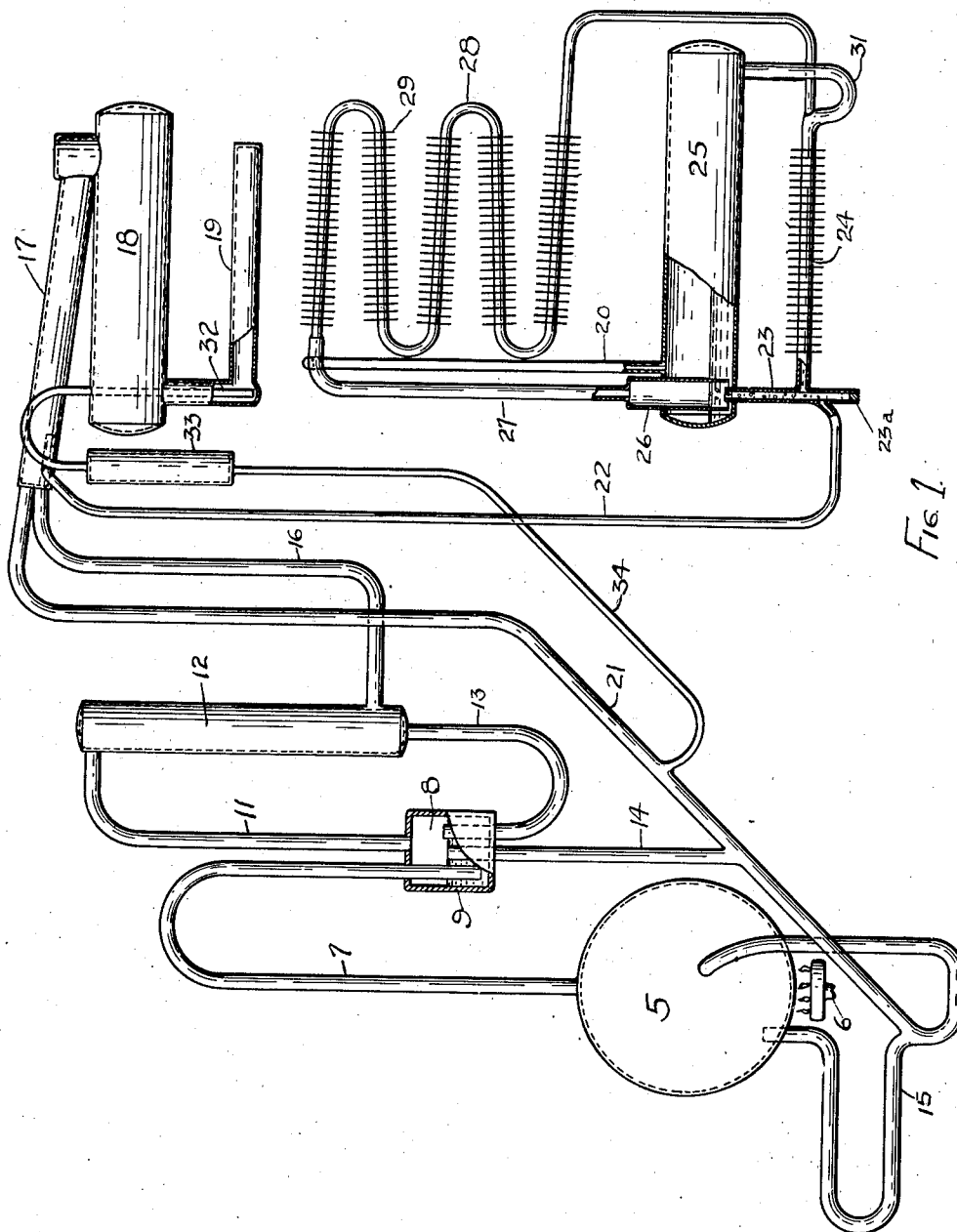


Fig. 1.

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3 Sheets-Sheet 2

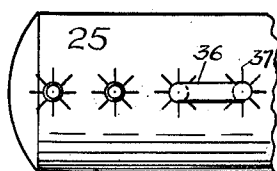


FIG. 3

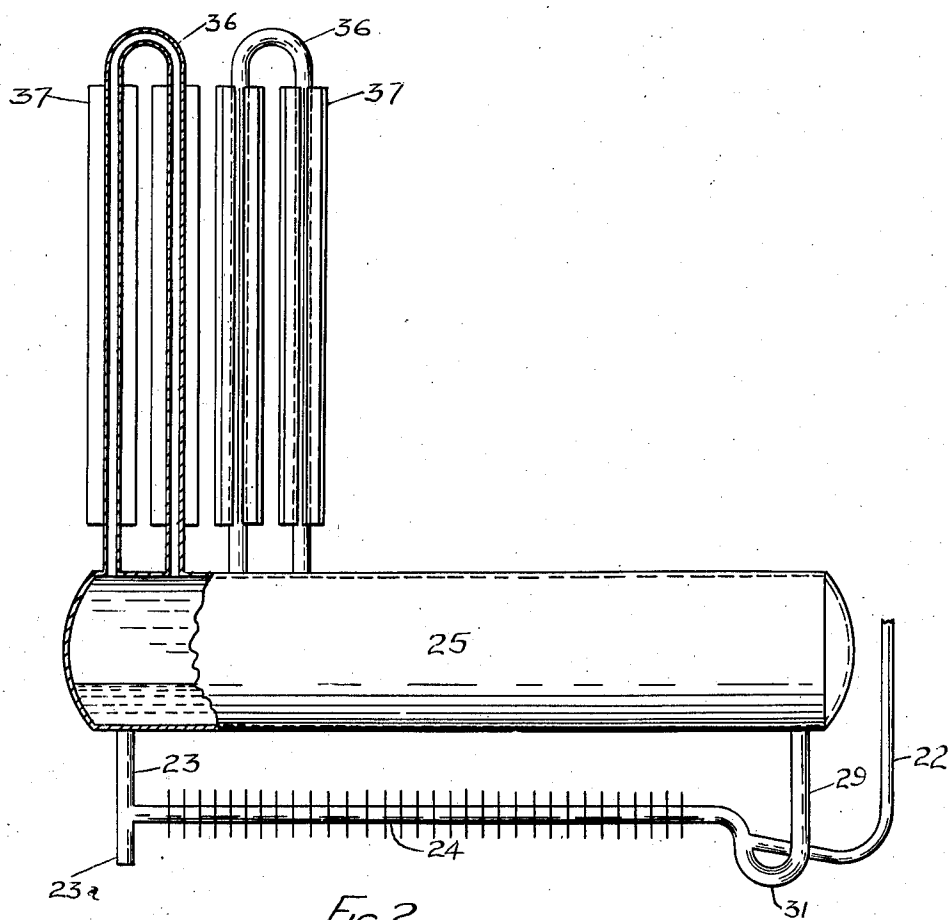


FIG. 2

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3 Sheets-Sheet 3

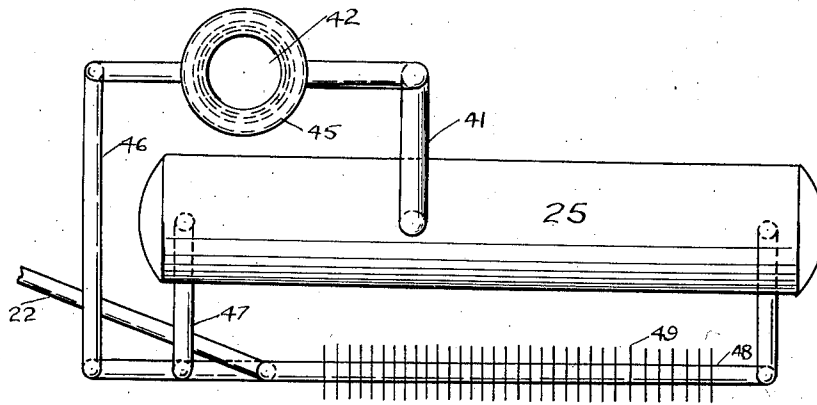


FIG. 5.

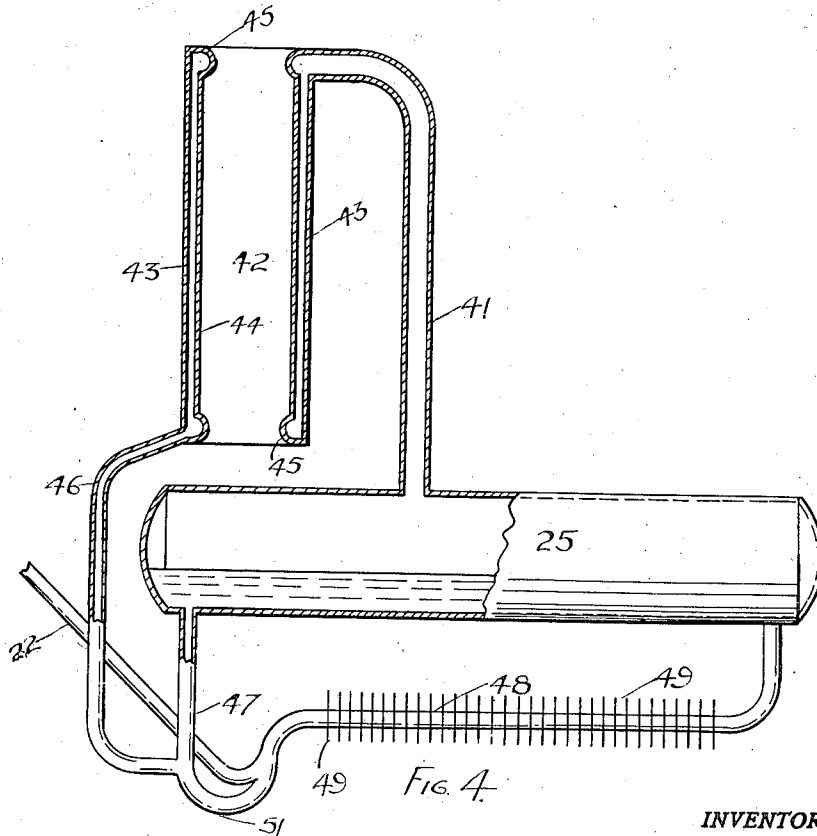


FIG. 4.

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CONDENSER UNIT

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Application March 29, 1934, Serial No. 718,051

7 Claims. (Cl. 62-118)

The invention relates to improvements in condensers, and, more especially to condensers used in intermittent absorption refrigerating systems, using a dead end circuit, the condenser being the dead end of the circuit.

In a dead end absorption refrigerating system, the generator absorber generates vapor in the form of aqua ammonia vapor, by means of applying heat to the generator absorber.

The vapor is forced under pressure, i. e., in generating the vapor a pressure is set up in the generator, which forces the vapor to a rectifier where the major portion of the water in the vapor is removed therefrom and returned to the generator absorber. The ammonia vapor continues to the evaporator and, thence, to the condenser, where it is stored in a condenser receiver, building up a pressure in the condenser unit and above the condensed liquor. At the end of the heating period or cycle, the pressure generated in the generator absorber stops and the built up pressure in the condenser unit forces the ammonia liquor back to the evaporator where it is deposited in the evaporator. During the refrigerating cycle the heat of the refrigerator compartment is absorbed by the ammonia liquor in the freezing coils, boiling the ammonia liquor, and returns in the form of vapor from the freezing coils to the evaporator and, thence, back to the generator absorber.

In a system of this type, it is of the utmost importance that the ammonia vapor be condensed as rapidly as possible, in order to maintain a synchronized balance between the generator absorber and the condenser unit. It is obvious, therefore, that a highly efficient condenser unit must be used.

It has been the practice in the past to provide a condenser unit, having a condenser receiver and a series of coils associated therewith, or other suitable means of heat transfer, the condenser unit being surrounded, or immersed in a liquid transfer means, such as impounded water, or running water.

Where an impounded liquid is used as the heat transfer agent, the volume of liquid necessary for efficient condensing requires extremely large area in order to carry off the heat of the condenser. Where the area is restricted, heat units are built up more rapidly than the liquid transfer means can carry away. The result is extremely inefficient operation of the system, due mainly to the impounded heat retained by the liquid.

A moving, or flowing liquid, such as running water, is also objectionable, due to the high ini-

tial cost of installation, requiring piping from the water supply and a return line for drainage, as well as the variable temperature of the running water. The added expense of running water is also objectionable and retards the sale to homes having no running water.

An object, therefore, of the present invention is to overcome these objections by providing a condenser system which eliminates the use of a liquid cooling medium, or liquid as a heat transfer agent.

A further object of the present invention is to provide a condenser system wherein the vapor is condensed and the hot condensate is circulated through additional cooling means, the cooled liquor being then conveyed to suitable storage means.

Still a further object is to provide a condenser and liquor circulatory cooling means with efficient air cooled surfaces to rapidly transfer the heat units contained in the vapor and ammonia liquor to the atmosphere.

Another object is to provide a condenser receiver having a vapor circulatory means above the condenser receiver and in open communication therewith, and a liquid circulatory means below the condenser receiver and in circulatory communication therewith and additional means for inducing circulation in the liquid circulatory means.

A further object is to provide a condenser and storage unit having a liquor circulatory means in open communication therewith.

The manner of accomplishing these and other objects of the invention will be more apparent in view of the following description when considered in connection with the accompanying drawings, in which:

Fig. 1 is a diagrammatic illustration of an embodiment of the invention as applied to an intermittent absorption refrigerating system in which the condenser, receiver and liquid circulatory coils form a part.

Fig. 2 is a side elevation in a modified form of a condenser system in which the condenser, receiver and liquid circulatory coils form a part.

Fig. 3 is a top plan view of a portion of the condenser system shown in Fig. 2.

Fig. 4 is a side elevation of a further modified form of a condenser system in which the condenser, receiver and liquid circulatory coils form a part.

Fig. 5 is a plan view of the condenser unit shown in Fig. 4.

In describing the invention, it will be assumed

that a binary mixture consisting of ammonia and water is used in correct proportions, although the invention is not limited to the use of these fluids, as any suitable agents may be used.

The generator absorber 5 contains a charge of aqua ammonia. This charge is heated by any suitable ignition means such as a gas burner 6. The generator vapor is conducted through conduit 7 to a water seal trap 8 where the outlet portion of the conduit is carried adjacent to the bottom portion of the trap and immersed in water 9, the vapor or gas is forced through the water and out of the trap through conduit 11, and into rectifier 12, preferably at the top thereof, the major portion of the water contained in the vapor is separated therein and returns to the trap 8 through conduit 13, overflowing therein into conduit 14, the opening of said conduit extending intermediate the top and bottom of the trap, the water flowing through conduit 14 to the generator absorber circulatory loop 15. The vapor continues under the pressure generated in the generator absorber through conduit 16 to the evaporator receiver tube 17, this tube being in open communication with the evaporator 18, wherein the vapor is forced. Freezing tubes 19 are also in open communication with the evaporator and the vapor is likewise forced into these tubes. As soon as vapor pressure is built up in the freezing tubes, evaporator and evaporator receiver tube, the said vapor is forced in conduit 21 where it encounters a liquid seal at about the level of the liquid in the generator absorber. Vapor also continues through conduit 22 which enters the up leg 23 of the condenser receiver circulatory loop 24; it will be noted that conduit 22 is bent upward adjacent to its connection to the condenser receiver circulatory loop. It will also be noted that the lower portion of the up leg 23 extends below the circulatory loop forming a sump 23-a. The vapor fills the loop and continues up and into the condenser receiver 25 filling the same. It will be noted the up leg 23 directs the vapor into an enlarged tube 26 which, in turn, is associated with condenser conduit 27, through which the vapor passes into condenser coil 28. It will be noted that the said circulatory coil is provided with fins 21 for the purpose of rapid heat transfer. The condenser coil is preferably provided with fins 29 or other means of enlarging the surface area. It will also be noted that the condenser coil 28 is of smaller diameter than conduit 27. Each leg of the condenser coil is inclined downwardly, finally connecting into the horizontal portion of the circulatory loop 24. The down leg of the condenser receiver circulatory coil is formed into a U shape, as shown at 31. The vapor is forced into the condenser coil and therein condensed, the condensate flowing down and into circulatory coil 24. The condensate fills the U 31 and flowing towards the up leg where the incoming vapor forces the liquid through the up leg into the condenser receiver wherein it is stored and circulates through the circulatory loop 24, throughout the period that heat is applied to the generator absorber, i. e., throughout the heating cycle.

A conduit 20 is secured to and in open communication with the upper portion of the condenser receiver and continues to the upper portion of the condenser coil 29 where it is secured to and in open communication therewith. The said conduit prevents the unbalancing of the vapors in the condenser receiver and the riser conduit 27.

At the conclusion of the heating cycle, the heat is removed from the generator absorber and the refrigerating cycle starts. Ammonia liquor is now stored in the circulatory loop 24 and in a portion of the condenser receiver. It is obvious that the condenser receiver must be of larger capacity than the total amount of ammonia liquor introduced into the system in the form of the initial charge.

An ammonia pressure is built up in the conduits 26 and 27, condenser coil 28 and the unfilled portion of the condenser receiver. This ammonia pressure forces the ammonia liquor up conduit 22, entering evaporator receiver 17 and flowing down and into the evaporator and freezing tubes.

During the refrigerating cycle the heat in the refrigerator is carried off through the boiling of the ammonia liquor in the freezing tubes. The vapor thus formed passes from the evaporator, thence, to the evaporator receiver tube down through conduit 21 and through conduit 16, rectifier 12, conduit 11 and the water return conduit 14, to the still absorber circulatory loop and into the generator absorber.

A drain conduit 32 enters a leg of the freezing tubes, having its opening adjacent the bottom thereof, the drain conduit continuing up the leg of the freezing tubes, through the evaporator and continuing to a point higher than the highest point of the evaporator receiving tube, from this point it turns downward and enters an enlarged portion 33, a conduit 34 is attached thereto and continues downward, then bending slightly upwardly entering conduit 21 at a point near the level of the liquid in the generator absorber. The drain occurs only during the early portion of the heating cycle, as soon as a slight pressure is created in the system by the generator absorber, the pressure in the drain equalizes with the system and the drain ceases. The function of the drain is to remove any trace of water in the freezing tubes, which would materially reduce the efficiency of the system.

In the modified form of condenser unit, as disclosed in Fig. 2 and Fig. 3, the vapor under pressure from the still absorber travels through the system and enters the down leg of the condenser circulatory loop 24 at a point intermediate the lower portion of the U 31, and the coil 24. The vapor continues through the circulatory coil, thence, through the up leg 23 and into the condenser receiver 25.

Associated with the upper portion of the condenser receiver and in fluid communication therewith are a plurality of U shaped riser tubes 36 extending vertically therefrom. Vertical fins 37 are rigidly secured to the said tubes and extending radially therefrom to provide enlarged heat transfer surface. The vapor in the condenser receiver rises into these tubes condensing therein, the condensate returning to the condenser receiver wherein it is stored and circulated through the condenser receiver circulatory loop with the aid of incoming vapor from the system. In this modified form, the condenser system is as efficient as the system disclosed in Fig. 1.

The function of this system during the refrigerating cycle is similar to the system first described.

Referring now to a further modification of a condenser unit as disclosed in Fig. 4 and Fig. 5, it will be noted that the unit comprises a condenser receiver 25, a conduit 41 which is in open communication therewith, and having its upper

end in open communication with a skin type condenser 42. The said skin type condenser consists of a cylinder within a cylinder. The outer cylinder 43, being somewhat larger than the inner cylinder 44. The top and bottom portions of the inner cylinder are formed to provide an enlarged area 45. A conduit 46 is secured to and in open communication with the skin type condenser, preferably at or near the bottom thereof. The said conduit is bent downward and is attached to and in open communication with the down leg 47 of the circulatory coil 48. It will be noted that the said coil has associated therewith fins 49. The down leg 47 of the circulatory coil forms a U bend 51 at its lower portion. The conduit 22 is secured to and in open communication with the up leg of the said U bend 51. It will be noted that the conduit 22 is bent slightly upwardly at its connection to the circulatory coil. The operation of this condenser system will now be described. The vapor is forced through conduit 22, entering the circulatory loop traveling through the same, and enters the condenser receiver filling the same and continues up the conduit 41 entering the top of the skin type condenser 42 and circulating the condensate therein, the condensate traveling down conduit 46, and into the down leg 47 of the circulatory loop and into the condenser receiver, either through the down leg or through the circulatory coil. When the condenser receiver contains enough liquor to cover the ends of the circulatory coil, a circulation of the liquor is set up by means of the pressure of the vapor received through conduit 22.

It will be understood that this invention is not restricted to condenser means above the condenser receiver, as this portion of the unit may be eliminated if desired without departing from the spirit or scope of the invention, i. e., where space is not available, all of the condensing may be performed in the circulatory loop, thus, eliminating the necessity of condenser coils above the condenser receiver.

Having thus described our invention, what is claimed and desired to be secured by Letters Patent is:—

1. In an intermittent absorption refrigerating system including a generator absorber, an evaporator and condenser all in operative cycle, the said condenser comprising a condenser receiver, condenser coils above the receiver and in fluid communication therewith, a circulatory loop below the receiver and in fluid communication therewith, the connection from the evaporator to the condenser being made in the circulatory loop.

2. In an intermittent absorption refrigerating system including a generator absorber, an evaporator and condenser all in operative cycle, the said condenser comprising a condenser receiver, condenser coils above the receiver and in fluid

communication therewith, a circulatory loop below the receiver and in fluid communication therewith, the connection from the evaporator to the condenser being made in the circulatory loop, the said condenser coils and circulatory loop being provided with finned surfaces.

3. In an intermittent absorption refrigerating system including a generator absorber, an evaporator and condenser, all connected in operative cycle, the said condenser comprising a condenser receiver, condensing means above the receiver and in fluid communication therewith, a circulatory coil below the receiver and in fluid communication therewith, the connection from the evaporator to the condenser being made in the circulatory coil and directed therein to provide circulation during the condensing cycle.

4. In an absorption refrigerating system, including a still absorber, evaporator and condenser all connected by conduits to form an operative system, the said condenser comprising a condenser receiver, condenser means above the said receiver and in fluid communication therewith, circulatory means below the said receiver and in fluid communication therewith, the conduit from the evaporator to the condenser being connected to the circulatory means, whereby the incoming vapor provides circulation therein of the condensed liquor.

5. In an absorption cycle refrigerating system, a still absorber, evaporator, and condenser unit operatively connected in the order named, the said condenser unit including a receiver, condenser means above the said receiver and in open communication therewith, circulatory means below the said receiver and in fluid communication therewith and means to induce flow in said circulatory loop.

6. In an absorption refrigerating system, a still absorber, evaporator and condenser unit operatively connected in the order named, the said condenser unit including a condensate receiver and condenser tubes carried above said receiver and in fluid communication therewith whereby gas evolved in said still absorber necessarily passes through said evaporator and circulates through said condensate receiver and condenser tubes.

7. In an absorption refrigerating system, a still absorber, evaporator and condenser unit operatively connected in the order named, the said condenser unit including a condensate receiver and air cooled condenser tubes carried above said condensate receiver and in fluid communication therewith whereby during the generating cycles the gas driven off from said still absorber must necessarily pass through said evaporator and circulate through said condensate receiver and air cooled condenser tubes.

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