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ABSORPTION REFRIGERATING APPARATUS

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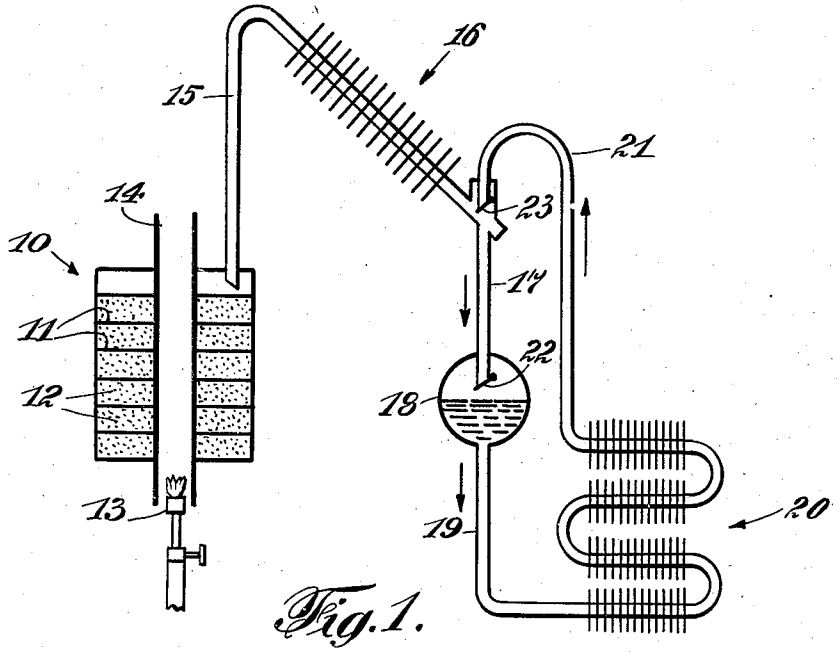

Fig. 1.

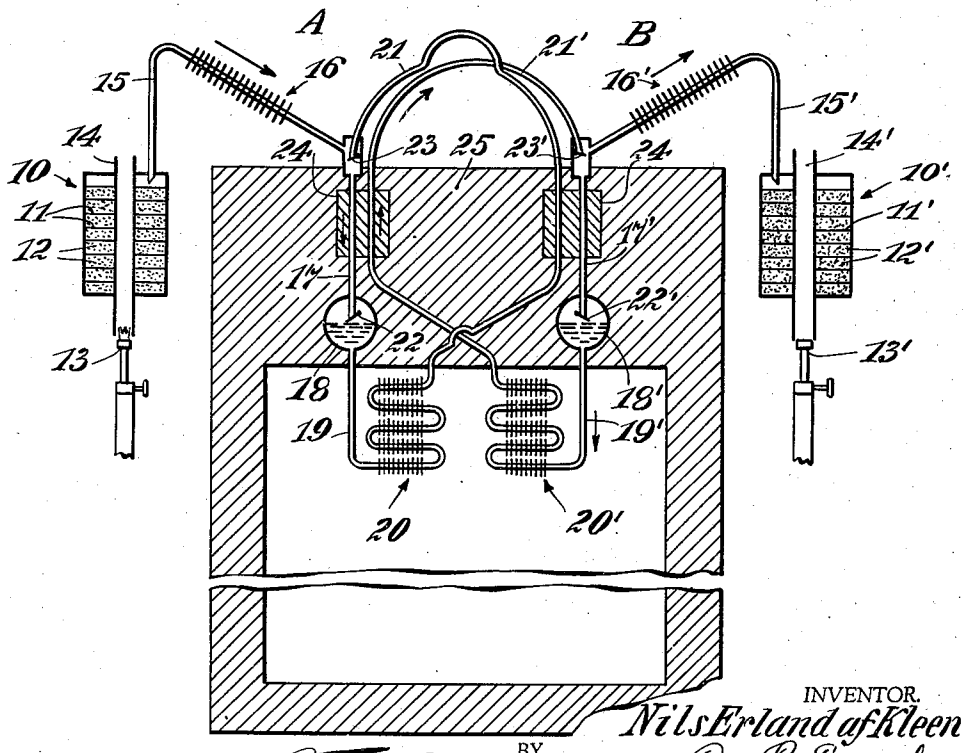

Fig. 2.

INVENTOR.
Nils Erland af Kleen
BY
C. P. Soepel
his ATTORNEY

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ABSORPTION REFRIGERATING APPARATUS

Nils Erland af Kleen, Stockholm, Sweden

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2 Claims. (Cl. 62—118)

This invention relates to new and useful improvements in absorption refrigerating apparatus of the intermittent type wherein the refrigerant is driven out of the boiler absorber during the generating period and delivered to an evaporator system, and the evaporated refrigerant returns to the boiler absorber from the evaporator system during the absorption period to be absorbed by the dry salts, the invention having for its object to insure the proper flow of the refrigerant through the evaporator system.

In the following description and claims, the terms "absorption" and "absorber" are intended to include "adsorption" and "adsorber." Similarly the expression "dry salts" is intended to include any materials capable of absorbing gaseous refrigerant.

In apparatus of this type, the refrigerant condensed in the condenser flows through one branch or liquid line of a conduit to the evaporator proper where the lowest temperature is to be maintained, while the evaporated refrigerant returns to the condenser through another branch or vapor line which joins the first branch. A certain amount of evaporation will take place in the first branch and unless the evaporated refrigerant is prevented from flowing back to the condenser through the first branch, most of the refrigerant would soon be evaporated without entering the evaporator proper with the result that the efficiency of the latter would be materially reduced and would not be effective to produce the minimum temperature desired.

It is therefore another object of the present invention to provide means for preventing the reverse flow of the refrigerant through the evaporator system.

According to the invention, check valves are provided in the two branches of the evaporator system permitting the free passage of the refrigerant in one direction but preventing the reverse flow of the refrigerant therethrough.

With the above and other objects in view which will appear as the description proceeds, the invention resides in the novel features hereinafter set forth, illustrated in the accompanying drawing, and more particularly pointed out in the appended claims.

Referring to the drawing in which numerals of like character designate similar parts in both views,

Fig. 1 is a diagrammatic view of an absorption refrigerating system showing my invention applied to a single intermittently operating unit, and

Fig. 2 is a diagrammatic view similar to Fig. 1 but showing the check valve arrangement applied to two intermittently and alternately operating units.

In the drawing, referring first to Fig. 1, the unit therein illustrated comprises a boiler absorber 10 in the form of a cylindrical shell enclosing a plurality of annular trays 11 containing dry salts 12 capable of absorbing a gaseous refrigerant. The boiler absorber 10 is adapted to be heated for the generating period of operation of the unit by any suitable means, such for example as a gas burner 13, arranged in the lower portion of a vertical flue 14 which extends centrally through the boiler absorber 10.

During the generating period, refrigerant vapors are expelled from the boiler absorber 10 and pass through outlet conduit 15 into a condenser 16 where they are condensed. From the condenser the refrigerant is delivered to the evaporator system comprising a liquid conduit 17 which receives the condensate and delivers it to a collecting tank or accumulator 18 from whence the refrigerant flows through pipe 19 to the evaporator proper 20 shown in the form of a coil having outside fins. From the evaporator 20, the vapors pass upwardly into vapor conduit 21 and enter the upper end of conduit 17 to return to the boiler absorber 10 and be absorbed by the dry salts 12 during the absorption period of operation of the unit.

The evaporator 20 is usually arranged adjacent the ice tray compartment in a refrigerator cabinet where it is desired to maintain the lowest temperature in the cabinet and it is therefore essential to a proper operation of the unit that the evaporation of the refrigerant which produces low temperatures take place in the evaporator. Unless the refrigerant is prevented from passing upwardly in the liquid conduit 17, evaporation of the refrigerant will take place in the collecting tank 18 and the circulation through the evaporator system will be reversed with very little evaporation occurring in the evaporator 20. In order to prevent this reverse flow of refrigerant and the resultant evaporation in the collecting tank 18, the outlet ends of conduits 17 and 21 are provided with any suitable check valves 22 and 23, respectively. Thus the condensed refrigerant leaving the condenser 16 enters pipe 17 and circulates through the evaporator system in the direction of the arrows so that very little evaporation will take place in the collecting tank 18 and, in any event, the vapors will be prevented from passing upwardly therefrom into pipe 17 but will have to pass downwardly through pipe 19 and through the evaporator 20.

Referring to Fig. 2, the apparatus therein shown comprises two units generally indicated as A and B operating intermittently and alternately in the absorption and generating phases, respectively, to produce substantially continuous low temperature. In the following description, parts similar to Fig. 1 have been designated by similar reference characters in unit A while the corresponding

parts in unit B have been designated by the prime of the numeral.

Each unit consists of a boiler absorber 10, 10' in the form of a cylindrical shell in which is disposed a plurality of annular trays 11, 11' containing dry salts 12, 12' capable of absorbing a gaseous refrigerant during the absorption phase operation of each unit and of expelling such refrigerant during the generating phase operation thereof.

The boiler absorber of each unit is heated by any suitable means such as a gas burner 13, 13' arranged in the lower portion of a vertical flue 14, 14'. The refrigerant passes upwardly from the boiler absorber 10, 10' through outlet conduit 15, 15' into the condenser 16, 16' and the condensate is delivered through liquid conduit 17, 17' to the collecting tank 18, 18'. From the bottom of the collecting tank the refrigerant flows through pipe 19, 19' leading to the evaporator proper 20, 20' located on each side of an ice tray compartment in the refrigerator cabinet. The refrigerant evaporating in the evaporator 20, 20' passes upwardly through vapor conduit 21, 21' which joins the upper end of liquid conduit 17, 17' and the refrigerant vapors return to the respective boiler absorber 10, 10' during the absorption phase operation of each unit. Each liquid conduit 17, 17' is provided with a check valve 22, 22' and each vapor conduit 21, 21' has a similar check valve 23, 23' so that the refrigerant in each unit circulates through the respective liquid and vapor conduits in the direction indicated by the arrows and is prevented from flowing in a reverse direction.

In this form of the invention, the liquid conduit 17, 17' of one unit is arranged in heat exchange relationship with the vapor conduit 21', 21 of the other unit through the medium of separate metallic blocks 24 supported in the wall 25 of the cabinet so that the vapor refrigerant returning to the boiler absorber from the evaporator of one unit precools the refrigerant liquid flowing to the collecting tank in the other unit as fully disclosed in my co-pending applications, Ser. No. 188,153 filed Feb. 1, 1938, and Ser. No. 363,864 filed Nov. 1, 1940.

The operation of the apparatus illustrated in Fig. 2 is as follows:

During one cycle, heat is applied to one of the boiler absorbers, for example, boiler absorber 10, so that unit A operates in the generating phase to expel the absorbed refrigerant from the dry salts 12 and deliver said refrigerant to the evaporator system of the unit. Simultaneously with this heating, boiler absorber 10' is cooled so that unit B operates in the absorption phase during which the refrigerant in said unit flows from the evaporator 20' to the boiler absorber 10' and is absorbed by the dry salts 12' therein. For the next cycle, the operation of each unit is reversed and unit A then operates in the absorption phase while unit B operates in the generating phase.

While I have shown and described the evaporator system in both Figs. 1 and 2 as including a collecting tank, the latter may be omitted so that the liquid refrigerant will be delivered directly from the condenser to the evaporator proper. Furthermore, while I have shown the refrigerant evaporated in the evaporator as returning to the boiler absorber by way of the condenser, the vapor conduit 21, 21' may be connected to the outlet pipe 15, 15' instead of the upper end of liquid conduit 17, 17' in which event the refrigerant vapors returning to the boiler absorber will by-pass the condenser.

From the foregoing, it is believed that the construction and advantages of the present invention may be readily understood by those skilled in the art without further description, it being borne in mind that numerous changes may be made in the details disclosed without departing from the spirit of the invention as set out in the following claims.

What I claim and desire to secure by Letters Patent is:

1. In absorption refrigerating apparatus of the intermittent type including combined absorbing and generating means adapted to be heated and cooled alternately for the generating and absorbing periods, respectively, of the apparatus, and condensing means connected to said combined absorbing and generating means for liquefying the refrigerant vapors generated during the generating periods; an evaporating system for the refrigerant liquefied by said condensing means, comprising an evaporator arranged below said condensing means, a downwardly extending conduit for delivering relatively warm liquid refrigerant from said condensing means to said evaporator during each generating period, a separate conduit extending upwardly from said evaporator and terminating in communication with the upper end of said first-named conduit, for the passage of relatively cold refrigerant vapors from said evaporator during each absorbing period, and non-return valve means in each of said conduits for preventing the upward flow of refrigerant vapors through said first-named conduit during the absorbing periods, and the downward flow of liquid refrigerant through said second-named conduit during the generating periods.

2. Absorption refrigerating apparatus of the intermittent type comprising a plurality of units operating in alternate phase relation to one another to produce substantially continuous refrigeration at a common region, each unit including a combined absorbing and generating element adapted to be heated and cooled alternately for the generating and absorbing periods, respectively, of the unit, a condensing element for liquefying the refrigerant vapors generated during the generating periods, and an evaporating system, including an evaporator arranged below said condensing element, a downwardly extending conduit for delivering relatively warm liquid refrigerant from said condensing element to said evaporator during each generating period, a separate conduit extending upwardly from said evaporator and terminating in communication with the upper end of said liquid conduit for the passage of relatively cold refrigerant vapors from said evaporator during each absorbing period, the vapor conduit of one unit being in heat exchange relation with the liquid conduit of the alternately operating unit, whereby the cold vapors in the vapor conduits are utilized to precool the relatively warm liquid in the liquid conduits, and non-return valve means in each of said liquid and vapor conduits, to prevent the upward flow of refrigerant vapors through each of said liquid conduits during the absorbing periods of each unit, and the downward flow of liquid refrigerant through each of said vapor conduits during the generating periods of each unit.

NILS ERLAND AF KLEEN.