June 2, 1936. G. F. ZELLHOEFER 2,042,694

COOLING UNIT

Filed Feb. 6, 1935

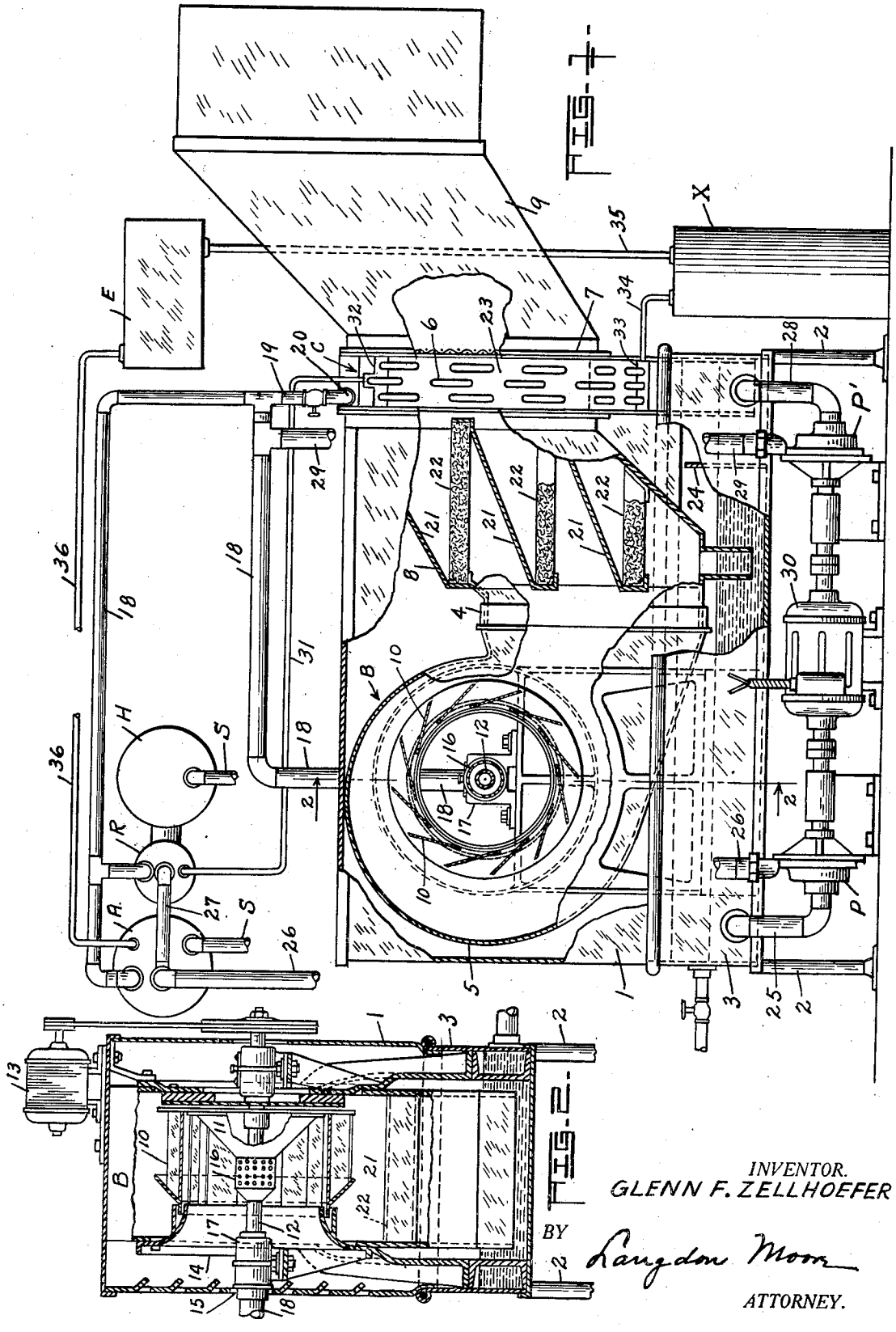


FIG. 1.

FIG. 2.

INVENTOR.
GLENN F. ZELLHOEFER

BY Langdon Moore

ATTORNEY.

Patented June 2, 1936

2,042,694

UNITED STATES PATENT OFFICE

2,042,694

COOLING UNIT

Glenn F. Zellhoefer, Bloomington, Ill.

Application February 6, 1935, Serial No. 5,162

5 Claims. (Cl. 62—119)

This invention relates to improvements in cooling units and more particularly to an improved mechanism for reducing the temperature of water used in cooling absorbers, rectifiers and condensers of absorption type refrigerating apparatus.

In the absorption type of refrigeration devices, such as disclosed in this applicant's prior copending application 736,232, filed July 20, 1934, a solution of a gaseous refrigerant and a liquid solvent is formed in an absorber, then the gaseous refrigerant is expelled or boiled off the solution in a heater and the gaseous refrigerant under the increased pressure is passed into a condenser where under reduced temperature it becomes a liquid which is transferred to the evaporator or cooling coil to escape therein under a reduced pressure so as to return to the gaseous state, at the same time absorbing heat from the atmosphere surrounding the evaporator, and thereafter the gaseous refrigerant is returned to the absorber. During this change in physical state of the gaseous refrigerant, the solvent from which the refrigerant has been expelled in the heater is passed through a heat exchanger and is returned to the absorber to form a solution with the gaseous refrigerant returned from the evaporator and the solution is passed through the heat exchanger into the heater to continue the process. In such systems, it is desirable to pass cooling water through the absorber and through the rectifier connected in the gaseous refrigerant line between the heater and condenser, and also it is necessary to pass a cooling water through the condenser in order to maintain the proper temperatures and pressures in the various containers depending upon the particular nature of the gaseous refrigerant and liquid solvent.

It has been found that while it is desirable that the temperature of the cooling water passed through the absorber ranges between certain definite degrees Fahrenheit, it is desirable that the temperature of the cooling water circulated through the condenser be of a higher degree because the gaseous refrigerant will condense at a much higher temperature than that required of the cooling fluid for the absorber. It is desirable in this type of refrigerating machine to recycle or pass the cooling water continuously through the absorber, rectifier, and condenser, and through a cooling unit to reduce the temperature of the cooling water before re-cycling.

It is an object of this invention to provide a cooling unit which will supply cooling water at the desired temperature to be passed through the absorber and then through the condenser and be returned to the operating part of the cooling unit or a portion of the heated cooling water may be by-passed over the condenser coils before it is returned to the operating part of the cooling unit. With this object in view, reference is made to the accompanying sheet of drawing illustrating a preferred embodiment of this invention with the understanding that minor changes may be made without departing from the scope thereof.

In the drawing:

Figure 1 is a view partly in elevation and partly in central vertical section illustrating an embodiment of this invention with the elements of the refrigerating apparatus shown connected thereto in diagram.

Figure 2 is a view in transverse section taken on the line 2—2, Figure 1, looking in the direction of the arrows with parts broken away.

The cooling unit shown in Figure 1 includes a rectangular casing 1 mounted upon legs 2, the bottom portion 3 of the casing forming a water tank. A limit load fan blower B of commercial type is mounted within the water tank 3 and so supported that the discharge orifice 4 of the blower will lie in a vertical transverse plane approximating the center of the water tank and spaced apart from the bottom thereof with the exterior of the convolute casing 5 adjacent one end thereof. The condenser C for the gaseous refrigerant of an absorption type refrigerating apparatus in the form of coils 6 is mounted preferably in a rectangular frame 7 in a vertical position over the opposite end of the water tank 3. The discharge orifice 4 of the fan blower B is connected by casing 8 to the frame 7 of the condenser C, adjacent thereto, and the opposite side of the condenser C is preferably connected to an upwardly extending angular discharge duct 9.

The limit load type fan blower B includes a plurality of spaced-apart vanes 10 supported at an acute angle to the direction of rotation upon a spider or support 11 secured upon the driving shaft 12 driven by an electric motor 13. The shaft 12 passes through the air intake opening 14 of the fan and an opening 15 in the surrounding casing 1 which is provided with louvers 15a adjacent the air intake 14. In accordance with this invention, the shaft 12 is hollow for a portion of its length and is surrounded within the fan blades by a perforated housing 16 spaced apart from the exterior of the shaft, and the shaft within the perforated housing 16 is also perforated. The interior of the shaft extending within the bearing 17 therefor in the air

intake side is connected to a pipe 18 which conveys the cooling water from the absorber A and rectifier R to the interior of the hollow shaft 12. The pipe 18 is connected to a branch pipe 19 which will convey a portion of the heated cooling water from the absorber and rectifier to a horizontal perforated pipe 20 mounted across the upper portion of the rectangular frame 7 of the condenser C. Upon the operation of the fan the heated cooling water is sprayed from pipe 20 over the condenser coils 6 and is also sprayed through the perforated housing 16 into the interior of the vanes 10 to be intermingled with the air drawn in through the intake 4 of the fan, and the particles of water passing through the vanes 10 will be dashed against the interior of the convolute casing 5 and collect at the bottom of the tank 3, while the air is discharged through the casing 8 and passes through the spray of cooling water from the pipe 20 and through the coils 6 of the condenser C.

It is preferable to provide a plurality of angular baffle plates 21 within the casing 8 and horizontal eliminators 22. The eliminators 22 comprise rectangular frames supporting glass wool or like material between screens so that the air may pass readily therethrough, and such particles of water which may be carried over will be collected therein and returned to the tank. It is also preferable to provide the coils 6 of the condenser with cooling fins preferably in the form of vertical spaced-apart plates 23 mounted in the rectangular casing 7.

The tank 3 is provided with a transverse divisional plate 24 forming separate compartments for the collection of the cooling water draining from the condenser C and inclined discharge duct 9 as well as from the fan blower B. A motor-driven pump P is provided with its intake 25 communicating with the interior of the main portion of the tank 3 and its discharge communicating by pipe 26 to the interior of the absorber A having a by-pass 27 connected to the interior of the rectifier R, which circulates the cooled water from the main portion of the tank through the absorber and rectifier to the pipe 18 which returns the water heated thereby to the cooling unit. A similar pump P' is provided, having its intake connected by a pipe 28 with the interior of that portion divided by the portion 24 from the main part of the tank 3 and its discharge connected to a pipe 29 which communicates with the return pipe 18 leading to the blower B. It is preferable to operate these pumps P and P' simultaneously and by a single motor 30, as shown. While the operation of the pump P circulates the cooled water from the main portion of the tank 3 through the cooling system, the pump P' transfers the water of higher temperature from the smaller division of the tank 3 below the condenser to the pipe 18 leading to the fan blower B.

The absorber A and heater H, with the connected rectifier R, are merely shown diagrammatically. The gaseous refrigerant under high pressure is conducted from the rectifier R through pipe 31 to a manifold 32 connected with the upper coils 6 of the condenser C with the lower ends thereof connected to a manifold 33 which in turn is connected by the pipe 34 to a receiver X from which the condensed liquefied gaseous refrigerant is conveyed by pipe 35 to the evaporator E. The refrigerant, in passing through the evaporator, returns to its gaseous state and is conveyed by a pipe 36 to the absorber A. The pipe 36 is broken away to avoid the necessity of illustrating the heat exchanger. The solution is transferred from the heater H through the pipe S to the absorber A. The pipe S is also broken away for the same purpose as the pipe 36.

In order to fully disclose the novelty and utility of the above described apparatus, the following specific example is described. Because of the characteristics of an absorption type refrigerating apparatus generally described at the beginning of the application which employs ethyl ether or diethylene glycol acetate as the solvent and dichloromonofluoromethane as the refrigerant, it is desirable to maintain a temperature in the condenser of ninety degrees to ninety-five degrees. A lower temperature does not provide satisfactory head pressure to effect the circulation of the weak liquors from the heater through the heat exchanger to the absorber. While it is desirable to maintain at least ninety degrees in the condenser, it is desirable to maintain as low a temperature as possible in the absorber.

To provide a water tower or cooling unit whereby two different temperatures are maintained, it is, therefore, more efficient to cool the water for the absorber as low as possible by circulating the atmospheric air through a spray of water and use the air so saturated over the condenser at the desired temperature, without the necessity of handling an additional quantity of air for the condenser requirements.

As an example of the manner in which this apparatus operates, assume the following conditions: the wet bulb temperature of the atmosphere is seventy-eight degrees, the air to be handled per ton of refrigeration is seven hundred and fifty cubic feet per minute, and the water to be handled is seven gallons per minute. Under these conditions, the water will be cooled to approximately eighty-eight degrees by going through the wheel of the water tower, will be circulated through the absorber and rectifier and raised to approximately ninety-four degrees, and will be returned to the condenser where the air with a wet bulb temperature from the blower of approximately eighty-four degrees wet bulb will cool the refrigerant and water to approximately ninety-two degrees to ninety-four degrees.

If a conventional cooling tower or unit were used, the water for the condenser would have to be pumped from the tower through the condenser, and would have to be handled through the wheel of the water tower, and an additional amount of air would have to be handled to cool this water flowing from the condenser. This operation would require almost twice as much power and almost twice as much investment in water tower equipment to serve the same purpose as would be served by the equipment described in my invention.

As another example, assume a wet bulb temperature of the atmosphere as sixty-five degrees. Then the water should leave the tower at approximately seventy-nine degrees to be circulated through the absorber and rectifier, and warmed to approximately eighty-five degrees, returned to the condenser in the outlet of the water tower where it would flush over the condenser coil, and maintain a temperature of ninety degrees to ninety-two degrees by controlling the flow of the water to the quantity necessary to attain this result. The excess water required for this purpose is by-passed directly to the wheel of the wa-

ter tower without passing over the condenser coil This by-pass is operated by the pressure in the condenser.

What I claim is:

1. In an absorption refrigeration apparatus including an absorber, a heater, a condenser and an evaporator, the combination with a cooling unit including a fan blower and means for circulating water cooled thereby through the absorber, of means for diverting a portion of the heated water returning from the absorber to pass through the condenser on its way to the cooling unit, said condenser being located in the path of air discharged from the blower.

2. A cooling unit for water circulated through the absorber and condenser of an absorption refrigerating apparatus including a water tank, a fan blower mounted thereover and the condenser of the apparatus mounted in the path of the air discharged from the blower, means circulating the cooled water from the tank through the absorber, means diverting a portion of the water heated by the absorber through the condenser, and means delivering the water from the absorber and condenser within the fan blower.

3. The structure of claim 2 wherein the water tank is divided to segregate the water cooled by passing through the fan blower from the water passing through the condenser.

4. The structure of claim 2 wherein the water tank is divided to segregate the water cooled by passing through the fan blower from the water passing through the condenser and wherein means is provided to convey the condenser water from its compartment of the water tank to within the fan blower.

5. A cooling unit for water circulated through the absorber and condenser of an absorption refrigeration apparatus including a water tank, a limit load fan blower and the condenser coils of the condenser of the apparatus both mounted above said tank, a casing directing the air from the discharge of the blower thru the condenser coils, means for circulating the cooled water through the absorber including a return pipe for delivering the water heated by the absorber in the form of a spray within the veins of the fan blower with a pipe leading from said return for delivering a portion of the water heated by the absorber to pass over the condenser coils and through the air discharged therethrough, said water tank divided into compartments, one compartment to receive the cooled water passing through the veins of the fan blower and the other compartment to receive the water passing through the condenser, a pump for delivering the water cooled by the fan blower to the absorber, and a pump for delivering the water from the condenser to the spraying means for the returned heated water within the veins of the fan blower.

GLENN F. ZELLHOEFER.