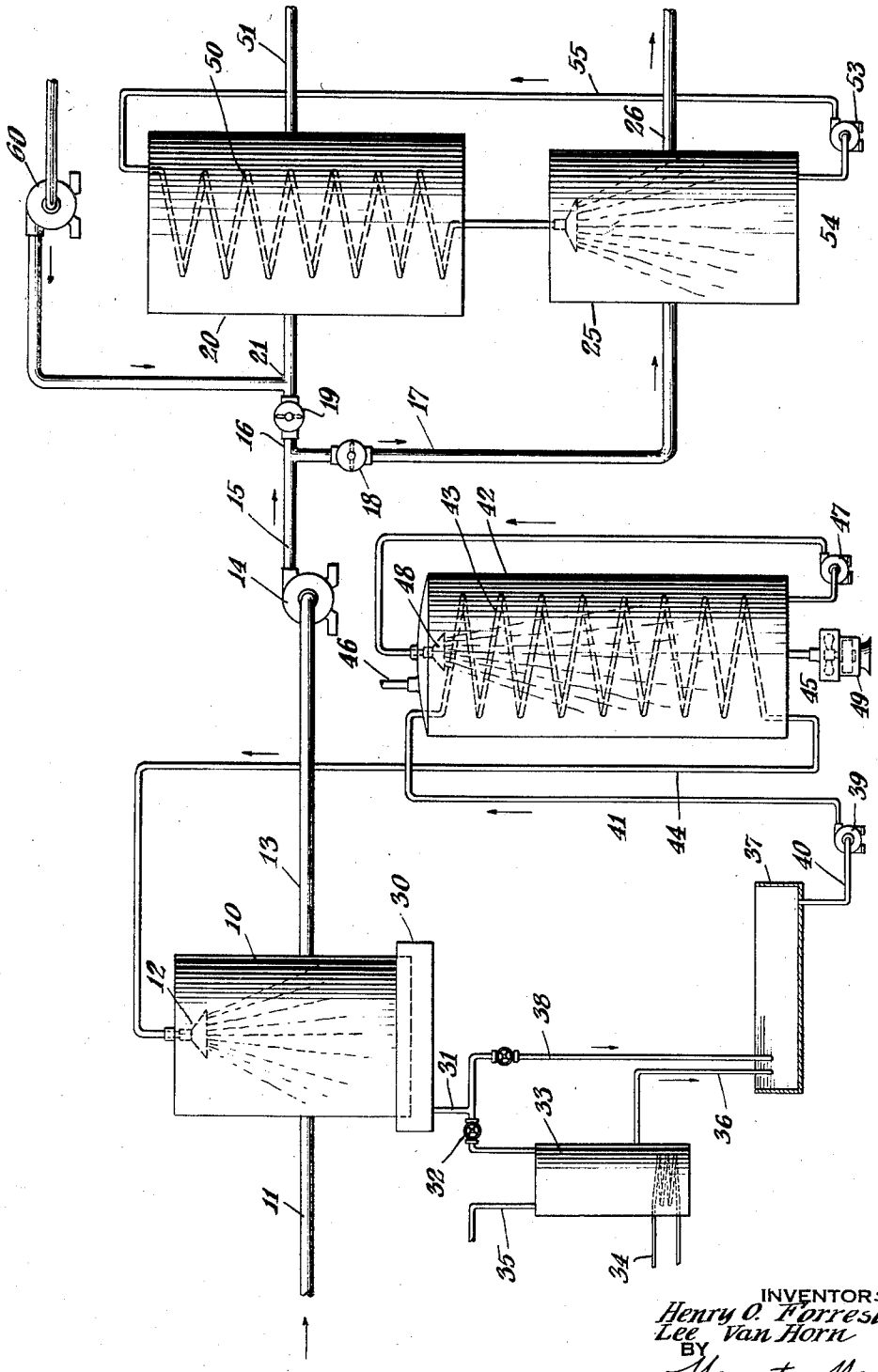
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METHOD AND APPARATUS FOR CONDITIONING AIR

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METHOD AND APPARATUS FOR CONDITIONING AIR

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This invention relates to air conditioning and more particularly to a process and apparatus for conditioning air for rooms, residences and closed vehicles such as railroad trains, and contemplates imparting to air characteristics of temperature and humidity which bring the air being conditioned within the healthful comfort range.

According to our invention, we provide an air conditioning system wherein air is first contacted by a hygroscopic fluid of controlled concentration and thereby given desired characteristics of humidity. This step may be carried on isothermally with respect to the air by cooling the hygroscopic liquid. Next the air is conducted to a cooling chamber and is cooled to the desired temperature. A suitable fluid reactivating system is provided to control the concentration of the hygroscopic fluid and a cooling chamber, which may be in the form of a water tower, is provided to cool the fluid. Also a chamber is provided to cool the fluid circulated through the air cooling chamber by contacting it with a supply of dehydrated air and these auxiliary devices form a part of the system making up our invention.

An object of our invention is to provide an air conditioning system wherein air is given desired characteristics of temperature and humidity.

Another object of our invention is to provide a method of lowering the temperature of a refrigerating fluid.

A further object of our invention is to provide in an air conditioning system a water cooling device utilizing as a cooling agent a supply of dehydrated air.

These and other objects will be apparent to those skilled in this particular art from the claims and the description in the specification in connection with the drawing in which:

The figure is a schematic layout of an apparatus illustrative of our invention.

In the embodiment of the invention, which has been chosen for purposes of illustration, and referring now to the drawing, there is shown an air conditioning device in which air is admitted to a chamber 10 by means of an air duct 11 and while in this chamber is contacted by a hygroscopic fluid sprayed therethrough by means of a spray member 12. This fluid may be a water absorbing solution such as calcium or lithium chloride brine and by controlling its concentration, its dehydrating power is controlled.

After being contacted by the liquid in the chamber 10 for a suitable period of time, the air is drawn from the chamber through an air outlet duct 13 by means of a suitable fan or blower 14. An air outlet duct 15 is connected to the outlet end of the blower 14 and is provided with a branch 16 which leads to an air cooling chamber 20 and a branch 17 which leads to a water cooling chamber 25. A valve 18 controls the amount of air delivered to the chamber 25 and a valve 19 controls the amount of air delivered to the chamber 20.

A sump 30 is located in the bottom of the tank 10 and it receives the dehydrating fluid that is sprayed through the chamber. This fluid flows down a pipe 31 and a portion of it, the amount of which is controlled by valve 32, flows to an evaporator 33. In the evaporator 33, water is driven off by means of a heating element 34 which, in this instance, is a steam coil. This water passes out the vent 35 in the form of steam. The reactivated fluid then flows down a fitting 36 to a storage tank 37 and is mixed with the dehydrating fluid that has flowed down the fitting 38.

From the tank 37, the brine is drawn by means of a pump 39 through a fitting 40 and is forced through a pipe 41 to a cooling tower 42. This brine solution is forced through coils 43 in the cooling tower and by means of the pipe 44 is returned to the spray member 12. The cooling tower 42 consists of a casing which may be cylindrical and which has an air inlet 45 in the lower portion thereof and an air outlet 46 at its upper portion. A supply of water is forced by a pump 47 to a spray member 48 and is circulated continuously. When the device is in operation and water is being sprayed through the cooling tower, a fan 49 forces a supply of air through the water spray and cools it by evaporation. This air, with any moisture it might have absorbed in the water, leaves the cooling tower 42 by the air vent 46.

In the operation of this device, when it is being used to cool and dehumidify air, air is admitted to the dehydrating chamber 10 and sprayed with a dehydrating fluid which may be a concentrated solution of calcium, lithium, or zinc chloride or any other hygroscopic fluid that is desired. This brine is reactivated and then cooled and by virtue of this cooling, the dehydrating process may be carried on isothermally with respect to the air so that the air leaves the dehumidifying chamber at the same temperature it was admitted, but it has been dehumidified to the desired degree.

The portion of this air which is to be conducted to the air space which is to be conditioned is forced by the fan or blower 14 to the cooling

chamber 20 and there the air contacts a plurality of cooling coils 50 and is cooled to the desired temperature. This air is conducted by a duct 51 to the conditioned space (not shown). A portion of the dehydrated air is carried by a duct 17 to the chamber 25. In this chamber 25, the water which has been circulated through the cooling coils 50 is sprayed and the dehydrated air, by contacting a spray of water, evaporates a portion thereof, and by this evaporation cools it to a temperature which may be equal to the wet bulb temperature of the air. This cooling air, and any water it may have absorbed leaves the chamber 25 through an outlet air duct 26 and is discharged to the atmosphere. This cooled water settles to the bottom of the chamber 25 and by means of a pump 53 and pipes 54 and 55 is returned to the cooling coils 50 of the chamber 20. A fan or blower 60 removes air from the conditioned space and returns it to the branch 16 at 21 where it joins the dehydrated air being conducted to the cooling chamber 20.

By virtue of the apparatus just described, it is apparent that an inexpensive, yet effective, device for conditioning air is provided. In the ordinary operation of this device a cheap supply of dry air is available and by utilizing a portion of this dry air, the temperature of the cooling medium, which may be water, is effectively lowered so that a satisfactory cooling medium is supplied without the use of refrigeration in the ordinary sense of the term.

A specific device has been described in some detail, but it is to be understood that changes, additions, substitutions and omissions may be made therein within the spirit of the invention as defined by the appended claims.

We claim:

1. The method of conditioning air which comprises dehumidifying air in a dehumidifying zone, cooling a portion of said dehumidified air in a cooling zone by indirect heat exchange with a cooling liquid, conducting said dehumidified and cooled air to a point of utilization, discharging cooling liquid from said cooling zone into a spray zone, and introducing into said spray zone another portion of the dehumidified air from said dehumidifying zone to effect evaporation of said cooling liquid.

2. The method of conditioning air which comprises dehumidifying air in a dehumidifying zone, cooling a portion of said dehumidified air in a cooling zone by indirect heat exchange with water, conducting said dehumidified and cooled air to a point of utilization, discharging said cooling water from said cooling zone into a spray zone, and cooling said cooling water in said spray zone by evaporation by a portion of said dehumidified air from said dehumidifying zone.

3. The method of conditioning air which comprises introducing air to be conditioned into a dehumidifying zone, circulating a hygroscopic liquid continuously through said dehumidifying zone and through a cooling zone in which it is cooled by indirect heat exchange with a cooling fluid, withdrawing dehumidified air from said dehumidifying zone, cooling a portion of said dehumidified air in a second cooling zone by indirect heat exchange with a cooling liquid, conducting said dehumidified and cooled air to a point of utilization, discharging cooling liquid from said second cooling zone into a spray zone, and introducing into said spray zone another portion of the dehumidified air from said dehumidifying zone to effect evaporation of said cooling liquid.

4. The method of conditioning air which comprises introducing air to be conditioned into a dehumidifying chamber, circulating a hygroscopic liquid continuously through said dehumidifying chamber and through a cooling zone in which it is cooled by indirect heat exchange with a cooling fluid, withdrawing dehumidified air from said dehumidifying chamber, cooling a portion of said dehumidified air in a cooling chamber by indirect heat exchange with water, conducting said dehumidified and cooled air to a point of utilization, discharging cooling water from said cooling chamber into a spray chamber, and introducing into said spray chamber another portion of the dehumidified air from said dehumidified chamber to effect evaporation of said cooling water.

5. In an air conditioning system, means for dehumidifying air, means for cooling a portion of said dehumidified air by indirect heat exchange with a cooling liquid, means for supplying said dehumidified and cooled air to a point of utilization, and means for cooling said cooling liquid by evaporation, said last-mentioned means including a spray chamber into which said liquid is sprayed and a connection for supplying dehydrated air from said dehumidifying means to said spray chamber.

6. In an air conditioning system, means for dehumidifying air, means for cooling a portion of said dehumidified air by indirect heat exchange with water, means for supplying said dehumidified and cooled air to a point of utilization, and means for cooling said cooling water by evaporation, said last-mentioned means including a spray chamber into which said water is sprayed and a connection for supplying dehydrated air from said dehumidifying means to said spray chamber.

7. In an air conditioning system, a dehumidifying chamber, means for supplying air to be conditioned thereto, means for continuously circulating a hygroscopic liquid through a path including said chamber, said hygroscopic liquid being in contact with said air during its passage through said chamber, means for cooling said hygroscopic liquid by indirect heat exchange with a cooling fluid during said circulation, means for maintaining the concentration of said hygroscopic liquid during said circulation, means for withdrawing dehumidified air from said dehumidifying chamber, a cooling chamber, means for supplying a portion of said withdrawn dehumidified air to said cooling chamber, a spray chamber, means for supplying a portion of said withdrawn dehumidified air to said spray chamber, means for continuously circulating a cooling liquid through said cooling chamber in indirect heat exchange relation with the air therein and through said spray chamber in direct contact with the air therein, whereby said cooling liquid is evaporated and cooled in said spray chamber for use in said cooling chamber, and means for delivering the dehumidified air cooled in said cooling chamber to a point of utilization.

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