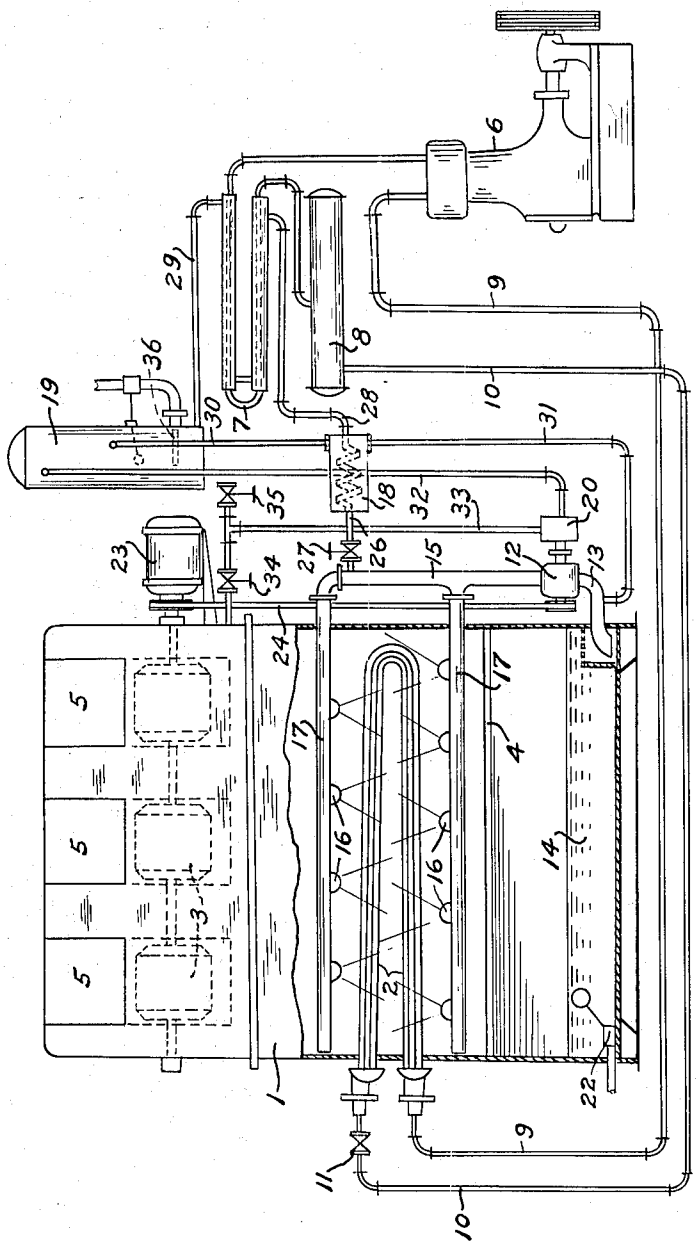
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SYSTEM FOR CONCENTRATING ANTI-FREEZE SOLUTION

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SYSTEM FOR CONCENTRATING ANTI-FREEZE SOLUTION

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This invention relates in general to improvements in the art of treating anti-freeze solutions used to prevent the formation of frost upon cooling elements, and relates more specifically to an improved system for concentrating and preserving chemical solutions such as are utilized to defrost the cooling coils of air conditioning and refrigeration installations.

The primary object of my present invention is to provide an improved system for treating anti-freeze solutions in order to prevent dilution thereof due to absorption of excessive moisture, and to also eliminate waste of costly chemicals used in producing the solutions.

It is common commercial practice in air conditioning systems for various types of buildings and other enclosures, to utilize so called spray type cooling units wherein the fresh air delivered to the conditioned space is drawn by one or more blowers over one or more cooling elements or coils through which refrigerant is constantly circulated by a compressor, and the exterior of which coils are subjected to sprays of anti-freeze solution in order to prevent formation of frost upon the cooling surfaces. The anti-freeze solution thus utilized and exposed to the air flow, consists of chemicals which are susceptible of absorbing considerable moisture sufficient to materially weaken and impair the usefulness of the solution as a frost eliminator, and with the present systems some of the solution is also wasted due to the lack of effective and simple means for recovering the valuable chemicals from excess water removed from the air and which is drained from the cooling units.

It is therefore an important object of the present invention to provide a system for effectively concentrating anti-frost solutions utilized in such air conditioning units in order to prevent excessive weakening and waste of the solutions.

Another important object of this invention is to provide an improved assemblage for dehumidifying a gas such as air by absorption of moisture in a hygroscopic solution, and wherein the solution is effectively treated for the removal of the absorbed moisture.

A further important object of the invention is to provide an improved mode of treating anti-freeze solution such as propylene glycol of predetermined concentration, and which is used to defrost refrigerated heat transfer surfaces exposed to air or other gas, with the aid of simple, reliable and automatically functioning equipment in order to maintain the desired concentration of the solution.

Still another important object of my invention is to provide an improved space air conditioner embodying a refrigerated cooling system, wherein the humidity of the conditioned air is most effectively controlled at minimum cost, and with least attention and utmost safety.

An additional important object of my present invention is to provide an improved spray type of air purifying and cooling system wherein the air cooling coils are defrosted with the aid of chemical solution in a most efficient and economical manner.

These and other more specific objects and advantages

of the invention will be apparent from the following detailed description from which it will be apparent that the gist of the improvement is the provision of a simple and automatically functioning system for effectively concentrating and for preventing waste of hygroscopic anti-freeze solution used to defrost the cooling surfaces in refrigerated air conditioning units, by causing the defrosting solution to absorb excess moisture which is removed before the solution is returned to the cooling elements for subsequent defrosting purposes.

A clear conception of the features constituting this invention and of the construction and operation of a typical spray type air conditioning unit embodying the same, may be had by referring to the drawing accompanying and forming a part of this specification wherein the various parts are designated by suitable reference characters.

The single figure of the drawing is a combined elevation and diagram of a typical commercial spray type of artifically refrigerated air conditioning system utilizing anti-freeze chemical solution to constantly defrost the cooling coils.

While the invention has been shown and described herein as being especially useful in connection with refrigerated air conditioning units of a specific type, it is not the intention to unnecessarily restrict the utility of the improved system by virtue of this limited embodiment; and it is also contemplated that specific descriptive terms used herein be given the broadest possible interpretation consistent with the disclosure.

Referring to the drawing, the typical refrigerated air conditioning system shown comprises in general, an air cooling unit having a casing 1 provided with one or more internal cooling elements or coils 2 and with one or more internal rotary blowers 3 for drawing fresh air through an extensive lower side inlet 4 upwardly past the coils 2 and for delivering cooled air through upper outlets 5 to the receiving space; a compressor 6 cooperating with a heat exchanger 7 and with a condenser 8, pipes or conduits 9, 10, and an expansion or regulating valve 11 to circulate refrigerating medium through the cooling coils 2; a pump 12 having a suction line 13 for receiving anti-freeze solution from a basin 14 in the bottom of the casing 1 and for delivering the solution through a main pipe 15 and through nozzles 16 associated with branch pipes 17 over the external heat transfer surfaces of the coils 2; and instrumentalities including another heat exchanger 18, a distilling drum 19, a vacuum pump 20 and pipes and control valves for concentrating the solution repeatedly circulated through the nozzles 16 by the pump 12.

The cooling unit including the air conducting casing 1, anti-freeze circulating pump 12, and spray nozzles 16, together with the refrigerating system comprising the coils 2, compressor 6, condenser 8, pipes 9, 10, and the expansion valve 11, are all of relatively standard and well known construction and operation. The anti-freeze solution which is circulated from the basin 14 through the spray nozzles 16 by the pump 12 must have a low freezing point, and propylene glycol of proper concentration may be advantageously utilized since it is an effective air sterilizing agent, it is harmless when brought in contact with foods, it inhibits mold growth often found on products in cold storage rooms, and it has a desirably high boiling point but is also hygroscopic and rather costly. The liquid basin 14 in the bottom of the casing is provided with a float controlled fresh water supply valve 22 for maintaining proper liquid level in this basin, and the blowers 3 may be driven by an electric motor 23 which also propels the anti-freeze circulating pump 12 and the vacuum pump 20 through a belt drive 24.

It is important that the anti-freeze solution be constantly maintained at proper strength and that waste of the chemical ingrediens thereof be avoided, and in order to

accomplish these results a special and automatically functioning system including the heat exchangers 7, 18, distilling drum 19, and vacuum pump 20, is provided. The coil of the heat exchanger 18 communicates with the anti-freeze header pipe 15 through a pipe 26 having a regulating valve 27 therein, and connects with the jacket of the refrigerant heat exchanger 7 through a pipe 28. The jacket of the heat exchanger 7 communicates through a pipe 29 with a distillation drum 19 of any suitable type and which is connected to the jacket of the heat exchanger 18 by a pipe 30, and this jacket communicates with the anti-freeze pump suction line 13 through a pipe 31. The interior of the drum 19 communicates with the inlet of the vacuum pump 20 through a pipe 32, and a pipe 33 connects the discharge side of this pump either with the interior of the casing 1 past a control valve 34 or with the ambient atmosphere through a valve 35. In order to insure maintenance of proper temperatures within the drum 19, a thermostatically controlled electric heater 36 is provided.

When the improved anti-freeze solution concentrating system has been properly installed and the air conditioning unit is in operation, the electric motor 23 drives the blowers 3 to cause the same to draw fresh air into the casing 1 through the lower inlet 4, to produce an abundant flow of the air past and in contact with the cooling coils 2, and to deliver the conditioned air to the desired localities through the upper outlets 5; while the circulating pump 12 is simultaneously driven by the motor 23 to constantly withdraw anti-freeze solution through the suction line 13 from the basin 14 and to deliver the same to the spray nozzles 16 through the pipes 15, 17. The outer heat transfer surfaces of the cooling coils 2 are thus constantly maintained free of frost, but the moisture from the air which would be deposited as frost upon the cooling surfaces if no sprays were utilized, is absorbed by the hygroscopic solution which thus becomes diluted while the air is dehumidified. The compressor 6 is also operating to receive the spent refrigerant from the coils 2 through the conduit 9 and to deliver the compressed refrigerant in heated condition to the primary heat exchanger 7 from which it passes into the condenser 8 and is ultimately returned to the coils 2 through the conduit 10 and past the expansion valve 11.

The regulating valve 27 should then be set to permit a suitable quantity of anti-freeze solution to flow through the pipe 26 to the auxilliary heat exchanger 18 and from thence to the primary heat exchanger 7 through the pipe 28. In the heat exchanger 7, the anti-freeze solution absorbs heat from the compressed and heated refrigerant delivered from the compressor 6, and the heated solution then passes into the distilling drum 19 wherein it should be sufficiently heated to cause it to boil and to thus drive off excessive moisture absorbed by the hygroscopic solution. The thermostatically controlled heater 36 should be set to insure such boiling and distillation, and the vacuum pump 20 functions to lower the boiling point of the solution and to withdraw vapors from the drum 19 through the pipe 32 and to deliver the same either to the air stream through the pipe 33 and past the valve 34 in order to re-humidify the air, or through this pipe 33 and past the valve 35 to the atmosphere in case the humidity of the conditioned air is sufficient. The distilled and concentrated hot anti-freeze liquid is delivered from the drum 19 to the auxilliary heat exchanger 18 through the pipe 30 and serves to initially heat the anti-freeze solution withdrawn from the header pipe 15 past the valve 27 and through the pipe 26, and the concentrated water free or distilled solution is returned to the circulating pump 12 through the pipe 31 and the suction line 13.

The anti-freeze solution may thus be maintained in properly concentrated condition and waste of such solution due to overflowing of liquid from the basin 14 can be avoided, while the humidity of the conditioned air may also be effectively controlled, by merely adjusting the regulating valves 27, 34, 35. By opening the valve 27 more of the chemical solution may be delivered through the concentrating system, and by opening the valve 34 and closing the valve 35 more moisture containing slight quantities of the solution may be delivered to the air stream, and vice versa. The heat resulting from the compression of the refrigerant by the compressor 6 and which is ordinarily wasted, may be utilized to intially heat the anti-freeze solution withdrawn from the circulating pipe 15, but any other available type of heating may be utilized in place of the heat exchangers 7, 18 and the electric heater 36 in order to insure effective distillation of the solution within the drum 19.

From the foregoing detailed description of one practical adaptation of the invention, it will be apparent that the improved system after being properly installed and adjusted, functions to automatically and accurately maintain the anti-freeze solution in concentrated condition, to eliminate waste of chemicals, and to control the humidity of the conditioned air. By utilizing propylene glycol as the anti-freeze solution, the slight quantities of this liquid which may be driven off with the water vapor during distillation, may be utilized to sterilize the conditioned air and to prevent mold growth in the air conditioned localities. The system is exceedingly flexible in its adaptation and operation and comprises relatively few simple parts most of which are readily available on the open market, and while the assemblage is especially useful and advantageous as applied to air conditioning units of the spray type, it may also be utilized in conjunction with other types of cooling units utilizing other forms of anti-freeze solutions.

It should be understood that it is not desired to limit this invention to the exact details of construction and operation of the anti-freeze solution concentrating system herein specifically shown and described, for various modifications within the scope of the appended claims may occur to persons skilled in the art.

I claim:

1. In a defrosting system for air stream refrigerated cooling surfaces, means for constantly circulating abundant quantities of hygroscopic solution having low freezing point over the air cooling surfaces to prevent frost deposits thereon by causing the solution to absorb frost producing moisture from the air stream, means for withdrawing regulated quantities of the frost preventing solution mixed with absorbed moisture from the solution circulating means and for distilling the withdrawn mixture under vacuum to concentrate the solution thereof, means for returning the concentrated distilled solution to said circulating means, and valve means operable to return regulated quantities of the moisture resulting from said distillation to the cooled air stream beyond said cooling surfaces and for delivering excess quantities of said moisture to the ambient atmosphere.

2. In a defrosting system for air stream refrigerated cooling surfaces, means for constantly circulating abundant quantities of hygroscopic solution having low freezing point over the air cooling surfaces to prevent frost deposits thereon by causing the solution to absorb frost producing moisture from the air stream, means for withdrawing regulated quantities of the frost preventing solution mixed with absorbed moisture from the solution circulating means and for distilling the withdrawn mixture under vacuum to concentrate the solution thereof, means for returning the concentrated distilled solution to said circulating means, and means for returning removed moisture resulting from said distillation to the air stream beyond said cooling surfaces to humidify the cooled air.

3. In a defrosting system for air stream refrigerated cooling surfaces, means for constantly circulating abundant quantities of hygroscopic solution having low freezing point over the air cooling surfaces to prevent frost deposits thereon by causing the solution to absorb frost

producing moisture from the air stream, means for withdrawing regulated quantities of the frost preventing solution mixed with absorbed moisture from the solution circulating means and for subjecting the withdrawn mixture to a vacuum to separate the moisture from the concentrated solution, means for returning the concentrated solution derived from separation of the withdrawn mixture to said circulating means, and means for introducing moisture derived from separation of the withdrawn mixture into the air stream beyond said cooling surfaces to humidify the cooled air.

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