

[54] **FREEZE PROTECTION FOR OUTDOOR COOLER**

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[56] **References Cited**

UNITED STATES PATENTS

2,238,952 4/1941 Stacey, Jr.165/134

2,715,514 8/1951 Stair165/50

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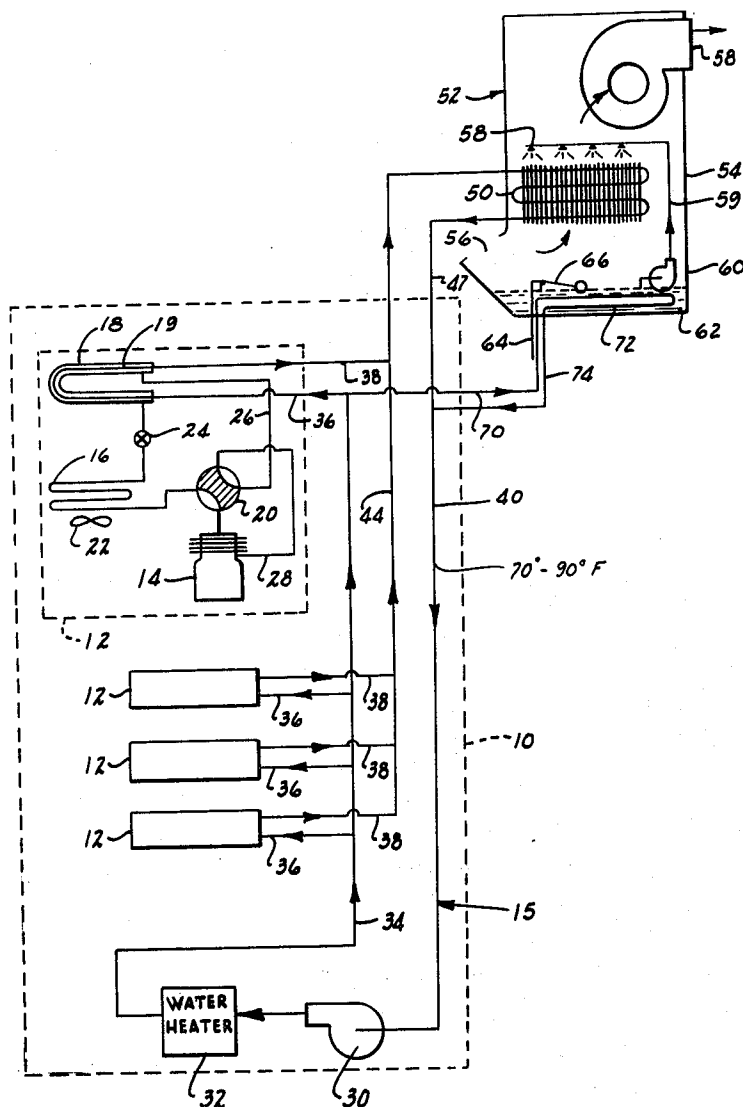
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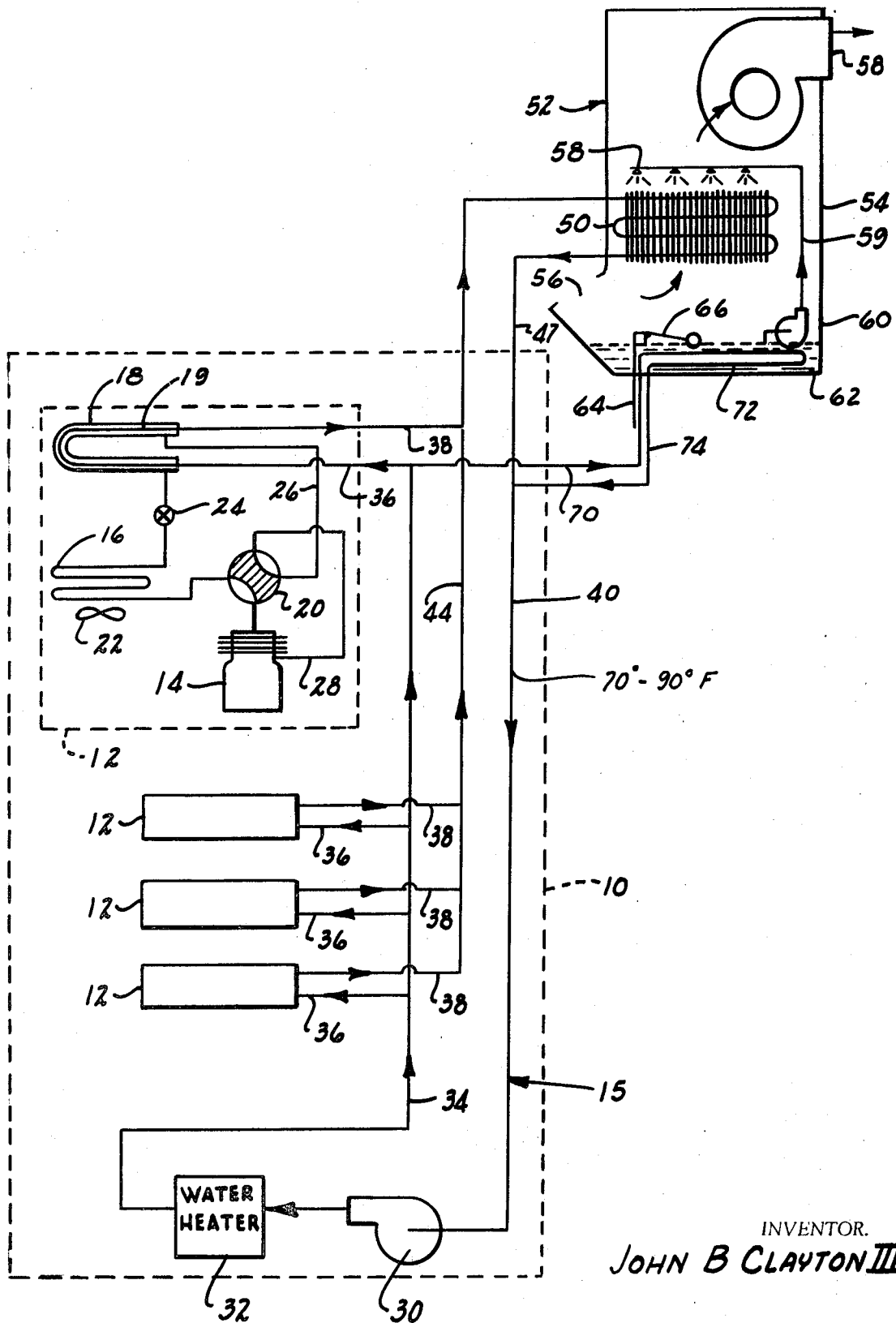
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ABSTRACT

A room heating-cooling system of the type wherein a water loop extends through a plurality of room air conditioning units to exchange heat therewith, said water loop comprising an outdoor evaporative cooler and an indoor water heater: the improvement comprising branch water lines connecting the water loop with a heat exchange coil in the sump of the evaporative cooler for keeping the sump liquid above freezing level when the outdoor temperature drops below 32° F.

3 Claims, 1 Drawing Figure





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THE DRAWINGS

The single FIGURE is a schematic view of a room cooling-heating system incorporating the invention. Numeral 10 denotes a conventional building (motel, office building, etc.) having a multiplicity of room air conditioner units 12. A representative one of these air conditioning units comprises a self-contained reverse cycle refrigeration machine which includes a refrigerant compressor 14, air-contacted refrigerant coil 16, water-contacted refrigerant coil 18, and reversing valve 20. In its illustrated position valve 20 allows high pressure refrigerant gas from compressor 14 to flow through coil 16. Fan 22 passes room air over the coil to condense the refrigerant and thus heat the air. Condensed refrigerant flows across a restriction 24 and through coil 18 where it undergoes evaporation; water flowing through coil 19 supplies the heat for vaporization of the refrigerant. Evaporated refrigerant is drawn through lines 26 and 28 back to the compressor.

Rotational adjustment of reversing valve 20 causes the high pressure gas from compressor 14 to be delivered through line 26 for condensation in coil 18. Condensed refrigerant flows across restriction 24 and through coil 16 where it undergoes evaporation, thus cooling the air supplied by fan 22.

It will be seen that in the illustrated position of valve 20 coil 16 acts as a refrigerant condenser to heat the room air, while coil 18 acts as a refrigerant evaporator to cool the water flowing through coil 19. In the non-illustrated position of valve 20 coil 16 acts as a refrigerant evaporator to cool the air supplied by fan 22, while coil 18 acts as a refrigerant condenser to heat the water flowing through coil 19.

WATER LOOP

Various coils 19 in the room air conditioning units 12 are each continually supplied with water by means of a water loop 15 which includes continuously energized water pump 30, indoor water heater 32, water supply line 34, branch supply lines 36 for the individual air conditioner units, branch return lines 38 for the individual units, and main water return lines 44 and 40.

Water line 44 delivers loop water to a heat exchange coil 50 which is intended to act as a loop water cooler. The heat exchanger is intended to be actuated when loop water temperatures rise above about 90° F., as by energization of the water spray pump 60 and blower 58 via thermostat control (not shown). In the loop water temperature range between about 70° F. and 90° F. it is intended that the water cooler 50 and water heater 32 both be inactive. When the loop water temperature drops below about 70° F. it is intended that water heater 32 become active, as by means of a thermostat control (not shown). The air is to continually maintain the loop water temperature in a range between 70° F. and 90° F. so that each water coil 19 can effectively exchange heat with the refrigerant in the associated coil 18. Pump 30 preferably is energized on a continuous basis for a continuous circulation of water through the loop and through the various coils 19 in the various room conditioning units.

OUTDOOR COOLER 52

Evaporative cooler 52 includes a duct-like casing 54 having an air inlet 56 and a centrifugal fan 58 for drawing air upwardly through the coil 50. Evaporative cooling liquid is provided by overhead spray nozzles 58 which are supplied with water from line 59 going from sump pump 60. Make-up water is supplied to the sump 62 through a water line 64 conventionally connected to a float valve 66 so that a predetermined water level is maintained in the sump. The general operation involves thermostatic control of pump 60 and fan 58 whereby loop water is caused to flow through heat exchanger 50 while water is sprayed onto coil 50 through the water sprays 58; simultaneously air is flowed upwardly through the coil by means of the fan 58. This operation produces an evaporation of the water on the exterior surfaces of coil 50, and a cooling of the loop liquid within the coil.

The illustrated system is usable in northerly climates on a year-round basis. Due to variations in heat-cool loads at different zones in the building (electric lighting, cooling of electronic gear, high-low density occupancy areas, effect of sunlight on large glass areas, wall insulation, wind direction, etc.) some of the units 12 may be on air-cooling cycles while others are on air-heating cycles. This mode of operation may exist even when the outdoor temperatures drop below 32° F. Cooler 52 operation during such low temperature periods is hampered by possible freeze-up of the sump 62 liquid.

The present invention proposes that liquid in the water loop be used as a source of heat to prevent the sump liquid from freezing during winter operations. As shown in the drawing, the water loop connects with a branch water line 70 which admits loop liquid to a heat exchange coil 72 emersed in the sump 62 liquid. Coil 72 liquid is returned to the main loop through a second line 74.

As previously mentioned, pump 30 is operated on a continuous basis for maintaining a continual flow of water through loop 15. Therefore in the illustrated arrangement a small portion of the loop water is continuously supplied to coil 72. Coil 72 will therefore maintain the sump 62 liquid at a fairly high temperature somewhat near 70° F., even during the winter months. It is contemplated that a thermostatic valve could be provided in branch lines 70 or 74 to prevent flow of water through coil 72 when such flow is not needed, as during the summer months. However such a valve is not believed essential. The water flow through coil 72 is very minor compared to the main flow through the loop.

Preferably pump 60 and spray supply line 59 are located within the confines of duct 54 to semi-insulate them from outdoor ambient wind effects. Also, the system is preferably self-draining so that all or most of the liquid is either in the sump where it can be heated by coil 72. As a further anti-freeze measure the water supply line 64 may be run into the cooler 52 alongside the pipes 70 and 74 to be heated thereby.

The volume of sump 62 liquid is preferably kept fairly small to permit employment of small size heater coil 72. Attainment of satisfactory liquid sump levels with low sump volumes can be achieved by forming the sump as a V-shaped trough; the coil 72 would preferably run parallel to and within the trough for its full length (normal to the V).

It will be understood that cooler 52 can be disposed in its conventional outdoor location, usually on a concrete slab at ground level, or on the building roof top.

I claim:

1. In a building air conditioner system operable to provide simultaneous and selective heating or cooling in individual room air conditioning units; said conditioning units individually comprising an air-contacted refrigerant coil, a liquid-contacted refrigerant coil, a refrigerant compressor, and refrigerant control means operable to selectively (1) cause the air-contacted coil to act as a refrigerant condenser and the liquid-contacted coil to act as a refrigerant evaporator or (2) cause the air-contacted coil to act as a refrigerant condenser and the liquid-contacted coil to act as a refrigerant evaporator; a closed liquid circulation loop including branches connected with each liquid-contacted coil, a continuously operating pump, a loop liquid heating means, an outdoor loop liquid cooling means, and means for selectively energizing the heating means and cooling means to maintain the temperature of the loop liquid in a range appreciably above its freeze point; said outdoor liquid cooling means comprising an evaporative cooler having a liquid supply sump subject to freeze-up when outdoor temperatures drop below the aforementioned freeze point: the improvement comprising a liquid heater coil located in the sump below the sump liquid level, and liquid connections between the loop and said liquid heater coil whereby relatively hot liquid is diverted from the loop through the heater coil to prevent freeze up of the sump liquid.

2. The system of claim 1 wherein the evaporative cooler comprises a heat exchanger having overhead liquid sprays, a liquid pump disposed in the sump, and spray supply piping

connecting the sump pump discharge with the overhead
sprays; said sump pump and supply piping being disposed
within the confines of the cooler.

3. The system of claim 1 wherein the heating means and
cooling means are selectively operated to maintain the loop 5
liquid temperature in the range between about 70° F. and 90°
F., whereby the sump heater coil is supplied with liquid having
a temperature appreciably above 32° F.

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