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AIR CONDITIONING SYSTEM

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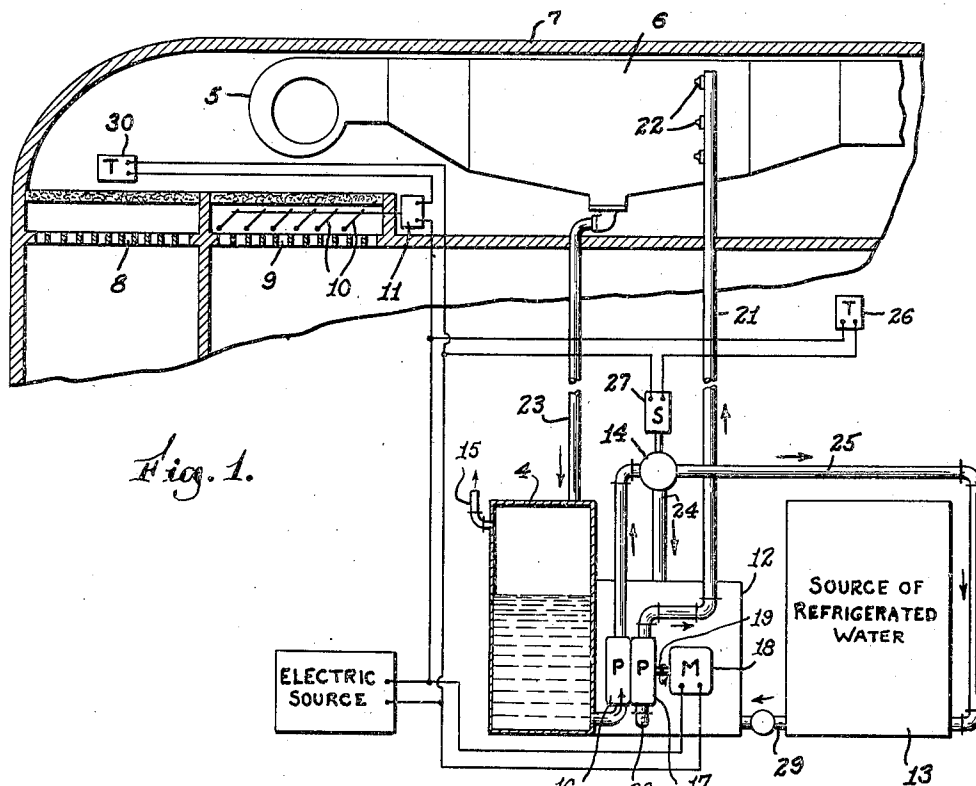
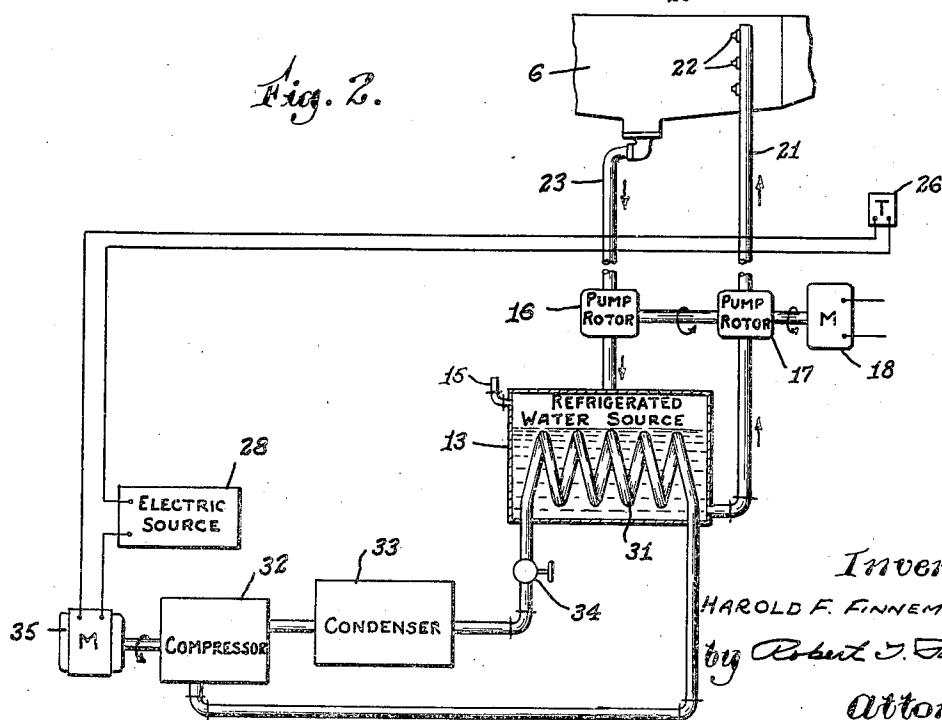


Fig. 2.



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AIR CONDITIONING SYSTEM

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3 Claims. (Cl. 261—11)

This invention relates to air conditioning systems and relates more particularly to air washer systems for passenger vehicles.

This invention provides an improved air washer system for passenger vehicles such, for example, as railway passenger cars, particularly suitable for operation in evaporative cooling, and in refrigerative cooling cycles. Evaporative cooling may be employed when the Wet Bulb temperature is below say, 64° F., with great savings in refrigeration.

A feature of this invention resides in providing in an air washer system, two pumps with their rotors preferably mounted on a single shaft, one pump functioning to supply return water from an air washer through a two-way valve, either directly to a sump or through a water chiller to the sump, and the other pump functioning to supply spray water from the sump to the washer.

An object of the invention is to provide an improved air washer system.

Another object of the invention is to provide an improved evaporative cooling system for passenger vehicles.

Another object of the invention is to provide an improved air washer system for passenger vehicles which is particularly suitable for operation in evaporative cooling and in refrigerative cooling cycles.

The invention will now be described with reference to the drawing of which:

Fig. 1 is a diagrammatic view of one embodiment of an air conditioning system according to this invention, and

Fig. 2 is a diagrammatic view of the water supply section of another embodiment of an air conditioning system according to this invention.

Referring now to Fig. 1, the blowers 5 and air washer 6 are mounted in one end and in the roof zone of a railway passenger car 7. The blowers 5 draw fresh, outdoor air through the vestibule grille 8, and recirculated air through the grille 9. The dampers 10 adjustable by the motor 11, determine the proportions of outdoor and recirculated air supplied to the blowers.

Mounted preferably on the underside of the car are the sump 12, the air relief chamber 4, the refrigerated water source 13, the by-pass valve 14, the air vent 15, the pumps 16 and 17, and their driving motor 18.

The pumps 16 and 17 are preferably mounted on the same shaft 19, which shaft is rotated by the motor 18 so as to rotate the rotors of the pumps 16 and 17, simultaneously. The pumps

16 and 17 and the motor are mounted exterior of and along side the chamber 4 and sump 12.

Water from the sump 12 is drawn through the pipe 20 to the pump 17 and is supplied through the pipe 21 to the spray nozzles 22 in the washer 6. Water from the washer 6 is returned through the pipe 23 to the air relief chamber 4 and from there is drawn by pump 16 and supplied by this pump to the by-pass valve 14 and then through the pipe 24 to the sump 12 or through the pipe 25 to the refrigerated water source 13.

It is difficult to prevent air from being entrained with the water returned from the washer through the pipe 23. Air so entrained interferes with the water flow and it is desirable to eliminate it. For this purpose, the air relief chamber 4 is made higher than the sump 12 so that an air space may exist in the chamber 4, above the water level in the sump 12 and chamber 4. The air entering the chamber 4 through the pipe 23, separates in the chamber 4 from the water and is vented to the atmosphere through the pipe 15.

The by-pass valve 14 provides a water by-pass around the refrigerated water source 13 when the indoor thermostat 26 has been satisfied. The thermostat 26 is connected in series with the solenoid 27 which adjusts the valve 14, and the electric source 28. When the temperature within the car is too high, the thermostat 26 closes its contacts causing the solenoid 27 to become energized to adjust the valve 14 to close the entrance to the pipe 24 and to open the entrance to the pipe 25. This causes the water from the washer to flow through the pipe 25, through the source 13, the pipe 29 and the sump 12. The spray water is thus cooled by refrigeration.

When, however, the desired indoor temperature is attained, the thermostat 26 opens its contacts, the solenoid 27 is deenergized and the valve 14 is adjusted to close the entrance to the pipe 25 and to open the entrance to the pipe 24. The pumps 16 and 17 then continuously recirculate the spray water without refrigeration, through the washer 6 and sump 12. The valve 14 is thus seen to open and close a water by-pass around the refrigerated water source 13.

The thermostat 30 responds to changes in the wet bulb temperature of the outdoor air entering the system and is connected in series with the motor 11 and electric source 28. When the wet bulb temperature is below say 64° F., conditions are favorable for evaporative cooling and the thermostat 30 closes its contacts to close the circuit energizing the motor 11 which then acts to close the recirculated air dampers 10. Only

outdoor air then enters the system and when the indoor thermostat 26 has caused the valve 14 to open the by-pass around the source 13, the recirculated water is cooled down to the wet bulb temperature of the outdoor air and the dry bulb of the air is reduced to the same temperature by evaporative cooling. The system will then continue in an evaporative cooling cycle until the outdoor wet bulb rises above 64° F., and the thermostat 30 causes the motor 11 to adjust the dampers 10 for partial recirculation of the air, or the indoor load is so high that refrigerative cooling is required.

By providing the two pumps, the load on each is reduced. The pump 16 thus serves to overcome the friction of the pipe and valves, reducing the suction load of the pump 17. The two rotors may readily be combined in a single casting requiring little if any more space and expense than that of the usual single rotor pump.

In practice, the valve 14 is elevated so that its stem extends through the car floor with its adjusting wheel or lever above the car floor. This permits inspection and any necessary servicing from within the car. The elevation of the valve 14 thus provides an additional load upon the pumping system and represents another reason for the use of two pumps.

Fig. 1 illustrates a water cooling system in which the water in the source 13 may be cooled by the meltage of ice or by the extraction of heat by evaporator coils.

Fig. 2 illustrates a water cooling system designed specifically for cooling by so-called mechanical refrigeration. The source 13 thus contains the evaporator coils 31. The usual compressor 32, condenser 33 and expansion valve 34 are provided for providing a compressed, condensed refrigerant within the coils 31. The by-pass valve and sump of Fig. 1 are omitted and the thermostate 26 stops and stops the compressor driving motor 35 instead of closing and opening the by-pass valve, respectively. Otherwise the system and its method of operation are the same.

In Fig. 2, no air relief chamber is shown. One similar to that of Fig. 1 may of course be used with the arrangement of Fig. 2 and the pump 16 of Fig. 2 may draw from an air relief chamber. The arrangement shown by Fig. 2 may be used if the pump 16 can handle effectively, both air and water.

While two embodiments of the invention have been described for the purpose of illustration, it should be understood that the invention is not limited to the exact apparatus and arrangement of apparatus illustrated and described, since many departures may be suggested by those skilled in the art, without departing from the spirit of the invention.

What is claimed is:

1. An air conditioning system for a passenger vehicle comprising in combination, an overhead air washer, spray nozzles in said washer, means

forming an air relief chamber below said washer, means connecting said chamber and the base of said washer for returning the water drained from said washer to said chamber, a two-way valve, means forming a sump alongside said chamber, a source of refrigerated water, means including a pump connecting said valve and said chamber for supplying water from said chamber to said valve, a pipe connecting said valve and said sump, piping connecting said valve and said source, means including a pump connecting said sump and said nozzles for supplying water from said sump to said nozzles, means connecting said source and said sump for supplying water from said source to said sump, and means responsive to temperature changes in the passenger space of said vehicle for adjusting said valve to route the water from said chamber through said pipe directly to said pump, or through said piping to said source.

2. An air conditioning system for a passenger vehicle comprising in combination, an overhead air washer, spray nozzles in said washer, means forming an air relief chamber below said washer, means connecting said chamber and the base of said washer for returning the water drained from said washer to said chamber, a two-way valve, means forming a sump alongside said chamber, a source of refrigerated water, means including a pump connecting said valve and said chamber for supplying water from said chamber to said valve, a pipe connecting said valve and said sump, piping connecting said valve and said source, means including a pump connecting said sump and said nozzles for supplying water from said sump to said nozzles, means connecting said source and said sump for supplying water from said source to said sump, thermostatic means responsive to temperature changes in the passenger space of said vehicle for adjusting said valve to route the water from said chamber through said pipe directly to said sump, or through said piping to said source, and common means for driving said pumps.

3. An air conditioning system for a passenger vehicle comprising in combination, an overhead air washer, means forming an air relief chamber below said washer, means forming a sump alongside said chamber, means forming a source of refrigerated water, piping connecting said source and said sump for supplying water from said source into said sump, piping connecting said washer and said chamber for returning the water drained from said washer, a two-way valve located above said sump and connected to said sump and to said source, means including a pump connected to said chamber and said valve for drawing water from said chamber for supplying through said valve to said sump or to said source, means for adjusting said valve, and means including a second pump for drawing water from said sump for supplying to said washer.

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