June 8, 1937. F. J. HAMILTON ET AL 2,082,957

AIR CONDITIONING SYSTEM UTILIZING REFRIGERATION

Filed Feb. 24, 1936 2 Sheets-Sheet 1

Fig. 1.

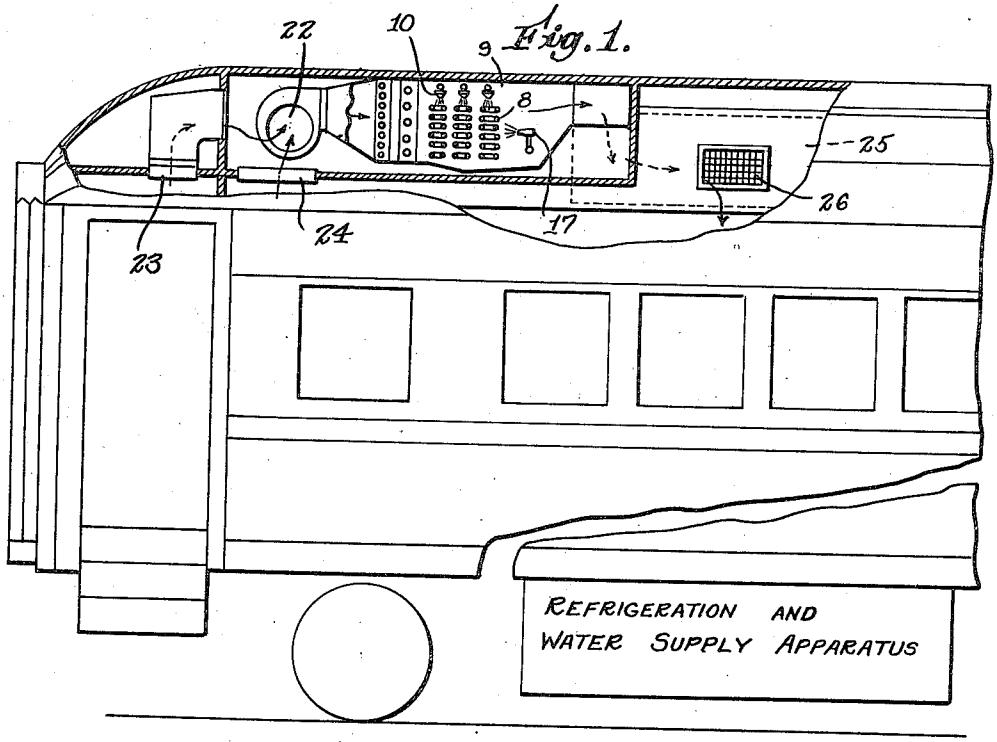
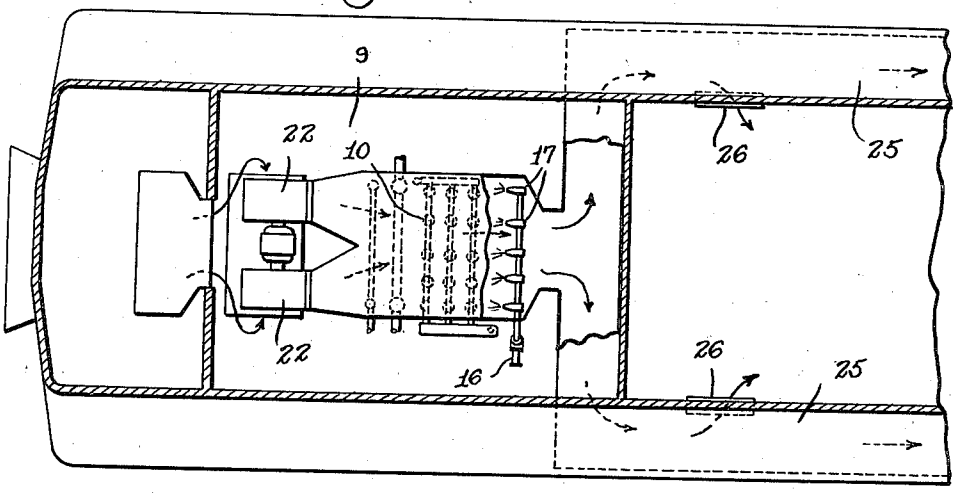



Fig. 2.

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Filed Feb. 24, 1936 2 Sheets-Sheet 2

Fig. 3

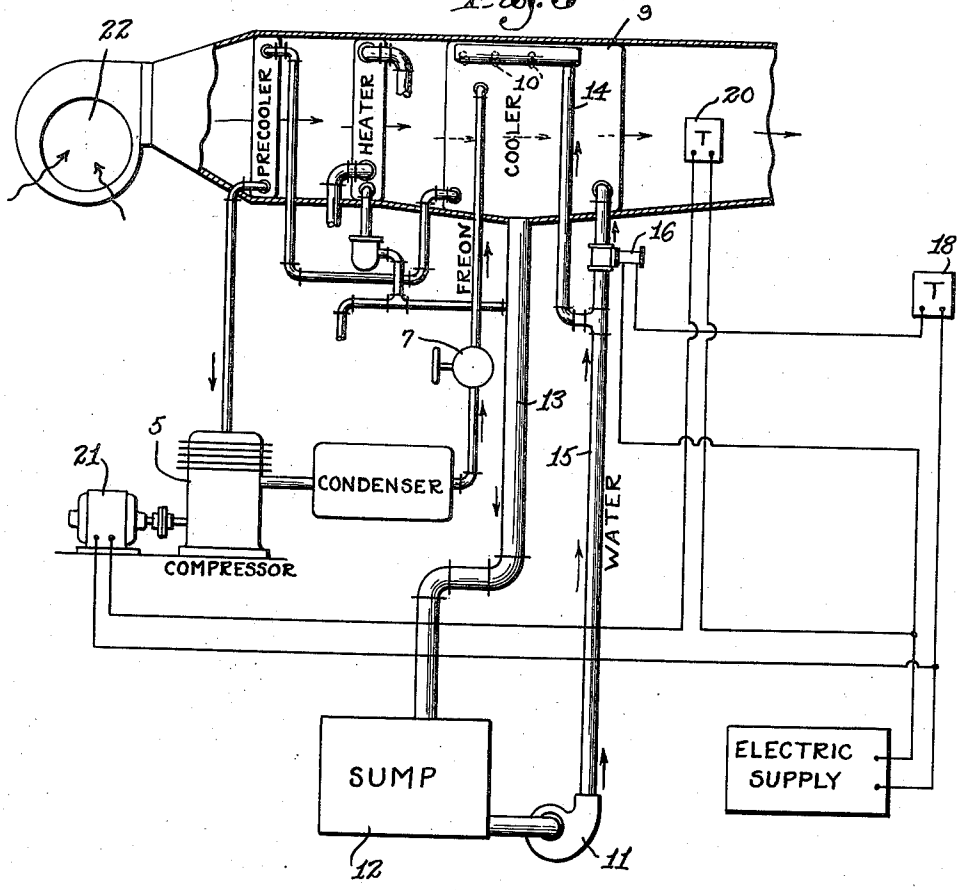
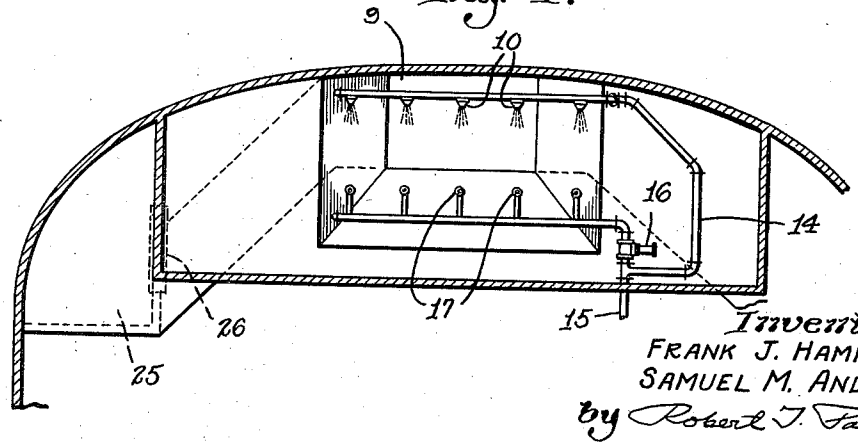



Fig. 4.

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# UNITED STATES PATENT OFFICE

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## AIR CONDITIONING SYSTEM UTILIZING REFRIGERATION

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Application February 24, 1936, Serial No. 65,334

4 Claims. (Cl. 62—129)

This invention relates to methods and apparatus utilizing refrigeration for cooling the air supplied to passenger vehicles and relates more particularly to a cooling system utilizing both spray and coil heat exchangers.

Practically all of the railroad passenger car conditioning systems in service today utilize dry coils through which a volatile refrigerant or ice water is circulated, for cooling the air to be supplied within the passenger space. While these coils are effective for cooling and dehumidifying the air, auxiliary filters of the dry type are used for cleaning the air and they do not do this satisfactorily. After a period of time a thick coating of scum forms over the coils, decreasing their effectiveness and adding odors to the air. Furthermore, the dry filters do not remove the many odors peculiar to railroad cars.

While the advantages of spray type coolers have been recognized, they are not desirable in railroad systems because of the relatively great amount of water required, together with the additional auxiliary apparatus.

According to this invention, a combined spray and coil cooler is used on a mechanical system. A volatile refrigerant is evaporated in coils in the path of the air to be cooled and water is sprayed upon the surface by the coils and acts not only to cool but to effectively clean the air. The volume of water required is relatively small since a substantial part of the heat exchange surface is provided by the coils.

According to a feature of the invention, the volume of the water sprayed upon the coils is varied under thermostatic control affording an effective by-pass through and above the spray.

An object of the invention is to provide a combined spray and coil cooler for a passenger car conditioning system.

Another object of the invention is to cool spray water through contact with evaporator coils in a dehumidifier.

Another object of the invention is to dehumidify air with water sprayed on evaporator coils, and to wash and cool the air with this water.

Other objects of the invention will be apparent from the following description taken together with the drawings.

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

Fig. 1 is a side view with a portion in section of a conditioning system according to this invention, mounted in a railroad passenger car;

Fig. 2 is a plan view, with the car in section, looking down upon the apparatus of Fig. 1;

Fig. 3 is a diagrammatic view illustrating a complete refrigerating and air conditioning system according to this invention, and

Fig. 4 is an end view looking at the spray nozzle in the conditioning unit.

The refrigerant which is compressed in the compressor 5, condensed in the condenser 6 and expanded in the valve 7 is evaporated in the plurality of rows of evaporator coils 8 which extend cross-wise the air stream in the conditioning chamber 9. Arranged above the coils 8 are the flooding nozzles 10 supplied with water through the branch pipe 14, by the pump 11 from the small sump 12. The water from the nozzles 10 trickles over the surface of the coils 8 and is cooled by contact with it and serves to cool and clean the air passing the coils 8 as well as to keep clean the coils.

The water cooled by contact with the coils 8 is collected in the drainage sump in the compartment 9, below the coils and is returned as chilled water to the sump 12, through the pipe 13. A portion of the water circulated by the pump 11 passes through the branch pipe 15 in which is inserted the control valve 16, to the atomizing nozzles 17 which are spaced to the rear of the coils 8, with respect to air flow, and which also project water upon the coils 8. The volume of water sprayed by the nozzles 17 is controlled through the valve 16 by the dry bulb thermostat 18, located in the passenger space. This permits a control of the dry bulb temperature of the air by varying the surface to which the air is exposed in the conditioner. The evaporator coils are arranged in multiple or parallel relationship through being connected to common supply and return headers. In series with the group of coils 8 is the precooler coils 19. The refrigerant passes through these precooler coils before returning to the compressor 5 and any unevaporated refrigerant leaving the coils 8 is completely evaporated within the coils 19. The coils 19 will have a higher temperature than the coils 8 but will contact with higher temperature air.

The wet bulb thermostat 20 in the conditioned air stream acts as a dew point control to open and close the circuit of the compressor driving motor 21.

The fans or blowers 22 draw in fresh air through the inlet 23 and recirculated air through the inlets 24 forces the mixed air through the conditioner and then into the longitudinal discharge ducts 25, from which it is discharged through the spaced outlets 26.

The thermostats 18 and 20 and the controls

actuated thereby may be of the well known electrical type as illustrated.

It is seen that this invention provides a simple compact spray as well as refrigeration system. The ordinary water cooler is dispensed with due to the evaporator coils being mounted in the air stream and this feature also results in a spray system utilizing a minimum of water thus overcoming the objection of the railroads to prior spray systems.

Whereas one embodiment of the invention has been described for the purpose of illustration, it should be understood that the invention is not limited to the exact arrangement described, since many departures will suggest themselves to those skilled in the art, after having had access to this disclosure.

What is claimed is:

1. Air conditioning apparatus for a passenger vehicle comprising a conditioning chamber, means for passing air horizontally through said chamber for conditioning and for then supplying it into the passenger space, evaporator coils in said chamber extending crosswise the air flow therethrough and having a substantial surface exposed to the air flow, flooding nozzles above said coils, spray nozzles adjacent and to one side with respect to air flow of said coils arranged to project water upon their surface, thermostatically controlled means for controlling the volume of water supplied to said spray nozzles, means for supplying water to said nozzles, and means for supplying a volatile refrigerant to be evaporated in said coils.

2. Air conditioning apparatus for a passenger vehicle comprising a conditioning chamber, means for passing air through said chamber for conditioning and for then supplying it into the passenger space, evaporator coils in said chamber extending crosswise the air flow therethrough and having a substantial surface exposed to the air flow, flooding spray nozzles above said coils arranged to project water upon their surface, atomizing spray nozzles to the rear with respect to air flow, of said coils, means for supplying water to said nozzles, and means for supplying a volatile refrigerant to be evaporated in said coils.

3. Air conditioning apparatus for a passenger vehicle comprising a conditioning chamber, means for passing air through said chamber for conditioning and for then supplying it into the passenger space, evaporator coils in said chamber extending crosswise the air flow therethrough and having a substantial surface exposed to the air flow, flooding spray nozzles above said coils arranged to project water upon their surface, atomizing spray nozzles to the rear with respect to air flow, of said coils, means for supplying water to said nozzles, thermostatically controlled means for controlling the volume of water supplied to said atomizing nozzles, and means for supplying a volatile refrigerant to be evaporated in said coils.

4. Air conditioning apparatus for a passenger vehicle comprising a conditioning chamber, means for passing air through said chamber for conditioning and for then supplying it into the passenger space, a group of evaporator coils arranged in parallel so as to receive substantially equally divided portions of refrigerant, extending cross-wise said chamber in the air flow therethrough, a precooler coil in series with respect to refrigerant flow to said group of coils, arranged in advance of said group of coils with respect to air flow, a refrigerant compressor, and means for supplying a refrigerant from said compressor to said group of coils and for continuously returning all of the refrigerant from said group of coils to said compressor through said precooler coil.

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