May 13, 1941. C. O. BERGSTROM 2,241,579

AIR CONDITIONING SYSTEM UTILIZING REFRIGERATION

Filed Dec. 6, 1939

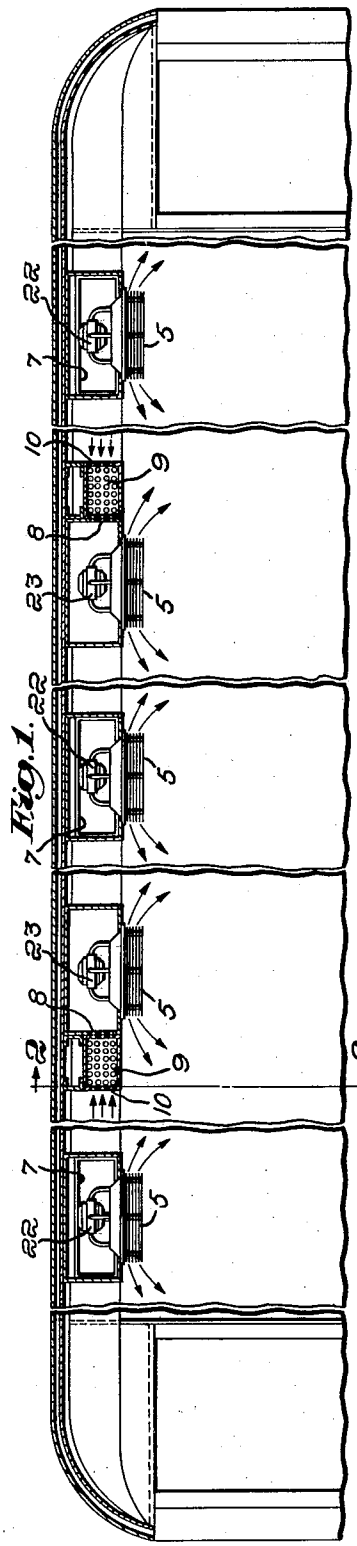

Fig. 1.

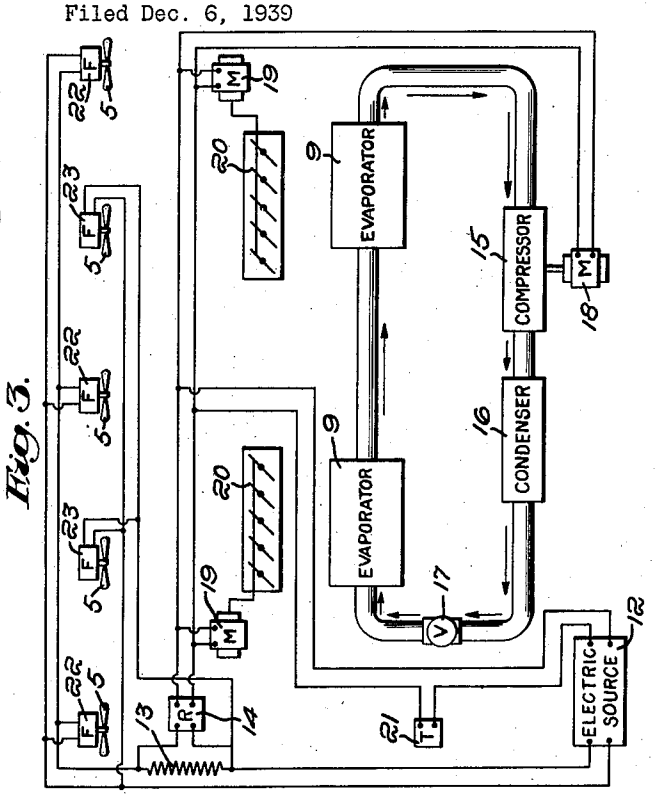

Fig. 3.

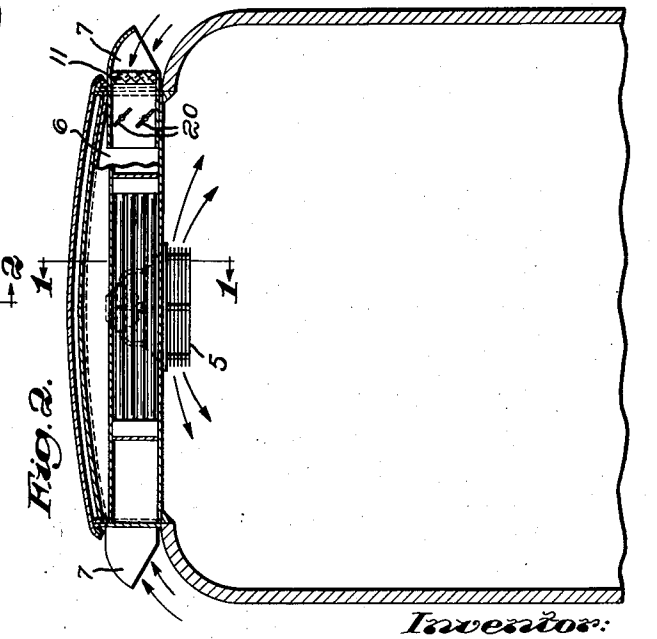

Fig. 2.

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Patented May 13, 1941 2,241,579

UNITED STATES PATENT OFFICE

2,241,579

AIR CONDITIONING SYSTEM UTILIZING REFRIGERATION

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Application December 6, 1939, Serial No. 307,845

5 Claims. (Cl. 62—6)

This invention relates to air conditioning systems for passenger vehicles, utilizing refrigeration, and has as its object to save in refrigeration when outdoor conditions are right for effective cooling to be accomplished through supplying an increased volume of outdoor air.

This application is a continuation-in-part of my co-pending application, Serial No. 284,262, filed July 13, 1939.

On some railroad lines, it is possible to effect sufficient cooling, in summer, by forcing large volumes of outdoor air through the cars. There are brief periods, however, when a relatively small amount of refrigeration for cooling is desired. The system disclosed in my said application utilizes a longitudinal duct in which are mounted evaporator cooling coils and spaced pressure ventilating fans. The present invention dispenses with the common longitudinal duct, utilizes transverse ducts for each fan and associates air cooling evaporators with two of the fans, resulting in a system less expensive to manufacture and to install.

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

Fig. 1 is a side view in section of a railway passenger car embodying this invention with section taken along the lines 1—1 of Fig. 2;

Fig. 2 is a transverse section of the car of Fig. 1, with section taken along the lines 2—2 of Fig. 1, and

Fig. 3 is a diagrammatic view of the apparatus and automatic controls employed.

The centrifugal fans 5 are each mounted in the transverse ducts 6, with their wheels extending through central apertures in the floors of the ducts. The details of the fans illustrated are shown by my Patent No. 2,142,834 which issued on Jan. 3, 1939.

Each duct 6 communicates with outdoor air through a ventilator 7, alternate ducts having ventilators on opposite sides of the car. The filters 11 extend crosswise the ventilators for cleaning the air.

The outer walls of the two next to the end ducts 6 are perforated at 8 to receive recirculated air. The air cooling evaporator tubes 9 are mounted adjacent the perforated walls 8 and receive recirculated air as shown by the upper arrows of Fig. 1 through their perforated supporting walls 10.

The motors 22 of the outer fans 5 and the center fan 5 as shown by Fig. 3, are connected together electrically and to the electric source 12 through the resistor 13 or through contacts on the relay 14 which open to connect the resistor in circuit with the fan motors when the relay is energized. The motors 23 of the other two fans 5 with which the evaporators 9 are associated are connected directly to the electric source 12.

The compressor 15 supplies a refrigerant through the condenser 16 and expansion valve 17, to the evaporators 9. The compressor is driven by the electric motor 18.

The damper motors 19 operate the dampers 20 which are mounted in the two ventilators 7 which supply air into the ducts 6 which include the fans 5 with which the evaporators 9 are associated. When energized the motors 19 adjust the dampers 20 to close off the supply of outdoor air to the fans with which the evaporators are associated.

The operation of the compressor motor 18, the damper motors 19 and the relay 14 is controlled by the thermostat 21, which may be mounted in the passenger space, or may be in the outdoor air.

Normally all five fans operate at the same speed to supply a large volume of outdoor air into the car. When the temperature of the outdoor air rises to a point where it cannot affect cooling in the car, the thermostat 21 is energized and closes the electric circuit including the electric source 12, the compressor motor 18 and the relay 14. This causes the compressor to supply refrigeration to the evaporators; causes the damper motors 19 to close the damper 20, and causes the relay 14 to become energized and to open its contacts which normally shunt the resistor 13 from the electrical circuit including the electric source 12 and the fan motors 22.

The three fan motors 22 slow down and reduce the volume of outdoor air supplied into the car. The dampers 20 shut off the supply of outdoor air to the fans with which the evaporators 9 are associated, causing these fans to draw 100% recirculated air from the passenger space, through the evaporators. The relatively large volume of recirculated air passing through the evaporators cools the passenger space sufficiently for comfort.

Instead of slowing down the end and center fans and completely closing the dampers 20 during the refrigerative cooling cycle, the last mentioned fans may be shut down and the dampers only partially closed so as to permit the entry of some outdoor air.

While 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 apparatus and arrangement

of apparatus illustrated as modifications thereof may be suggested by those skilled in the art without departure from the essence of the invention.

What is claimed is:

1. An air cooling system for a passenger vehicle, comprising a plurality of fans supported overhead the passenger space and spaced longitudinally of the vehicle for supplying outdoor air into said space, refrigerant evaporators associated with certain of said fans, means including a compressor for supplying a refrigerant to said evaporators, volume control means associated with those fans not associated with said evaporators for varying the volume of outdoor air supplied thereby into the passenger space, and means including a thermostat responsive to temperature changes in the air in said passenger space for controlling said compressor and said volume control means.

2. An air cooling system for a passenger vehicle, comprising a plurality of centrifugal fans supported overhead of, and spaced longitudinally of, the passenger space, and arranged to discharge outdoor air into the passenger space, refrigerant evaporators adjacent the next to the end fans, means forming recirculated air passages from the passenger space through said evaporators into the inlets of said next to the end fans, volume control means associated with said end fans for varying the volume of outdoor air supplied thereby into the passenger space, means including a compressor for supplying a refrigerant to said evaporators, and means including a thermostat responsive to temperature changes in the air in said passenger space for controlling said compressor and said volume control means.

3. An air cooling system for a passenger vehicle, comprising a plurality of centrifugal fans supported overhead of, and spaced longitudinally of, the passenger space, and arranged to discharge outdoor air into the passenger space, refrigerant evaporators adjacent the next to the end fans, means forming recirculated air passages from the passenger space through said evaporators into the inlets of said next to the end fans, volume control means associated with said end fans for varying the volume of outdoor air supplied thereby into the passenger space, means including a compressor for supplying a refrigerant to said evaporators, dampers in the outdoor air inlets to said next to the end fans, and means including a thermostat responsive to temperature changes in the air in said passenger space for controlling said compressor, said dampers, and said volume control means.

4. An air cooling system for a passenger vehicle, comprising a plurality of fans supported overhead the passenger space and spaced longitudinally of the vehicle for supplying outdoor air into said space, refrigerant evaporators associated with certain of said fans, means including a compressor for supplying a refrigerant to said evaporators, volume control means associated with those fans not associated with said evaporators for varying the volume of outdoor air supplied thereby into the passenger space, dampers in the outdoor air inlets to said fans with which said evaporators are associated, and means including a thermostat responsive to temperature changes in the air in said passenger space for controlling said compressor and said volume control means.

5. An air cooling system for a passenger vehicle, comprising a plurality of transverse ducts supported overhead of, and spaced longitudinally of, the passenger space, said ducts having substantially centrally arranged openings in the floors thereof, centrifugal fans extending through said openings, said ducts having extensions through a side of said vehicle for the entry of outdoor air, a plurality of said ducts having recirculated air inlets therein, the remainder of said ducts having no recirculated air inlets, refrigerant evaporators associated with the ducts of said first group, means forming recirculated air passages from the passenger space through said evaporators into said inlets, dampers in said extensions of said remainder of said ducts, means including a compressor for supplying refrigerant to said evaporators, volume control means for adjusting the volume of outdoor air discharged into said space by the fans of said plurality, and means including a thermostat responsive to temperature changes in the air in said passenger space for energizing said compressor, adjusting said dampers towards closed position, and adjusting said volume control means for decreasing the volume of outdoor air upon a temperature rise above a predetermined point.

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