VENTILATION SYSTEM FOR RAPID TRANSIT CAR

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This invention relates to improvements in rapid transit car ventilation systems.

The present invention was designed specifically as an improvement over the type of ventilation systems used in subway cars of the New York City Transit Authority. In such systems, an air duct extends along the roof above the ceiling and communicates with the passenger space through a plurality of openings. Fans are mounted in some of the openings and outlet grilles are mounted in the remaining openings so that air flows into the passenger space from the air duct through the fans and exhaust from the passenger space into the air duct by flowing through the outlet grilles. The air duct also communicates with the outside through an opening controlled by a selectively operated damper. When the damper is closed, air is merely recirculated by operation of the fans. When the damper is open, a portion of the air passing through the outlet grilles is exhausted to the outside through the damper controlled opening and the remainder of the air is recirculated and mixed with fresh air which comes in through the damper controlled opening.

In such systems, the air flow through the outlet grilles is divided into the above portions by providing pairs of transverse baffles. Each pair of baffles is located above the center of one of the grilles and divides the air duct into a plurality of chambers. The space between the baffles of each pair is an exhaust chamber through which exhaust air flows from the passenger space to the outside, and the spaces between adjacent pairs of baffles form chambers through which recirculated air and fresh air flow, the baffles preventing the recirculated and fresh air from contacting the exhaust air in the air duct.

The present invention is designed as an improvement over systems of the type described above and has, among its objects, the provision of a simple, cheap ventilation system that eliminates the need for baffles, of the above type, by not requiring any physical means separating the air flow paths.

In order that the manner in which these and other objects and advantages are attained may be understood, reference is had to the following description taken in connection with the accompanying drawings wherein:

FIG. 1 is a side elevation view of a rapid transit car embodying the invention;

FIG. 2 is a top plan view of the ceiling, looking generally along lines 2—2 of FIG. 4;

FIG. 3 is an enlarged top plan view, looking along lines 3—3 of FIG. 4, illustrating various air flow paths which occur when the control damper is open and closed;

FIGS. 4 and 5 are transverse sectional views through the roof, taken along lines 4—4 and 5—5, respectively, of FIGS. 1 and 2.

Referring now to the drawings, there is illustrated a rapid transit car 10 which embodies the invention. Car 10 includes a roof 12 having a longitudinally extending dome 14 and a ceiling 16 defining therebetween a longitudinally extending air duct 18.

The air duct 18 extends along the length of the car and communicates with the outside through a pair of longitudinally extending outlet openings 20 each of which is controlled by a selectively operated damper 22. Dome 14 also includes a pair of longitudinally-extending, downward-facing sections 24 that exclude weathering elements, such as rain, snow, hail and the like, from outlet openings 20.

Ceiling 16 also includes a plurality of openings extending between the passenger space and air duct 18. Mounted in certain of the openings is a plurality of fans 26 and mounted in the remaining openings is a plurality of outlet grilles 28 each of which is divided into two sections by a control, longitudinal light fixture 30. In the arrangement illustrated in FIG. 2, there are four fans and five grilles arranged with the fans between the grilles.

The fans are each mounted in a shroud 32 which extends upwardly into the air duct 18 and are also associated with a plurality of underlying distribution rings 34 that distribute the air as it flows through the fan. The ceiling also includes a plurality of the usual ceiling panels 40 upon which are mounted a pair of continuous, longitudinal light fixtures 36 and a plurality of hand grips 38.

As best understood with reference to FIGS. 3—5, when dampers 22 are open, air flows to flow through outlet openings 20. Operation of fans 26 causes air to flow from the outside, through screens 24, through openings 20 and past damper 22 into air duct 18, the flow of such air being indicated schematically by arrows 44. This flow of fresh air is mixed in the air duct with recirculated air which flows in the direction of arrows 46 from outlet grilles 28, through the air duct and into the fans. The mixed fresh air and recirculated air flows into the passenger space along paths indicated by arrows 50. Now assuming that all of the car windows are closed, the air forced or blown into the passenger space builds up a static pressure and thereby causes a portion of such air to flow upstream through outlet grilles 28. The air that flows upstream through the outlet grilles is divided into two portions; one portion recirculates along arrows 46 and the other portion exhausts to the outside by flowing along the paths indicated schematically by arrows 52 from outlet grilles 28, through the air duct 18, past dampers 22, and through outlet openings 20 and screens 24.

When dampers 22 are closed, no fresh air is taken in and so that all of the pumped air is recirculated and flows generally along arrows 46 and 50. When the windows are open, air flows through openings 20 in two directions; fresh air flows inwardly adjacent to fans 26 and exhaust air flows outwardly adjacent to outlet grilles 28. Obviously, there are several nulls at various points along openings 20 where the air velocity is zero and the air does not flow in either direction.

Duct 18 extends from one end of the car to the other and is not divided into chambers by any transversely extending baffles that extend completely across the duct. Thus, duct 18 is baffless. In this connection, however, it is to be noted that the roof contains structural members, such as the usual carlines and ribs, which might extend into the air duct but these are not to be considered baffles in the sense of this description since they do not direct the flow of air although they might interfere to a certain extent with it.

As is well known in the ventilation field, the exact proportion of recirculated air, fresh air and exhaust air depends upon the resistances of the various flow paths and these resistances can be designed and adjusted, as by inserting wedges or other obstructions to increase the resistance, to provide the desired proportions of flow.

While only a single embodiment has been illustrated it will be apparent to those skilled in the art that changes can be made both in the details and arrangement of parts without departing from the scope of the invention as defined in the appended claims.

What is claimed is:

1. In a rapid transit car ventilation system having a passenger space, the combination of: a longitudinally extending, open air duct extending from one end of the car...
to the other, said air duct having a first opening extending along said duct and communicating with the outside and a plurality of second openings communicating with the passenger space; a plurality of outlet grilles in alternate ones of said second openings; a plurality of fans mounted in others of said second openings between said outlet grilles; and selectively operated damper means operatively connected for controlling the flow of air through said first opening, said damper means being movable between open and closed positions and operable, when open, to permit the flow of air simultaneously into and out of said first opening at spaced points along the length of said first opening, in response to operation of said fans.

2. In a rapid transit car ventilation system having a passenger space, the combination of: a longitudinal air duct open from one end of the car to the other, and having a first opening extending along said duct and communicating with the outside, a plurality of second openings communicating with the passenger space, said second openings being spaced longitudinally between said second openings; a plurality of outlet grilles mounted in said second openings; a plurality of fans mounted in said third openings for drawing air from said duct and pumping it into the passenger space; and selectively operated damper means covering said first opening and being movable between a closed position whereby operation of said fans recirculates air through said passenger space and said air duct, and an open position whereby said fans draw fresh air into said duct through said first opening and recirculated air into said duct through adjacent second openings and whereby said fans exhaust air to the outside from said passenger space through said second openings and said first opening.

3. In a rapid transit car ventilation system having a passenger space, the combination of: a roof including a ceiling and an upwardly extending dome defining therebetween an air duct that extends and is open from one end of the car to the other along the center of the roof; said air duct having along its sides a pair of laterally spaced, longitudinally-extending first openings communicating between the air duct and the outside; said air duct further having a plurality of second openings and a plurality of third openings communicating with the passenger space, said third openings being spaced between said second openings; a pair of selectively operated dampers operatively connected for controlling the flow of air through said openings; a plurality of longitudinally spaced grilles mounted on said air duct in said second openings and affording communication between the passenger space and said air duct for the flow of air therebetween; and a plurality of fans mounted on said air duct in said third openings and arranged to pump air from said air duct into the passenger space, the resistances of the various flow paths being proportioned whereby, when said dampers are open, air flowing through said grilles diverts into exhaust air which flows through said first openings to the outside at points alongside of said grilles and into recirculated air which mixes with fresh air in said duct and is blown into said passenger space, said fresh air being drawn in through said first openings at points alongside of said fans.

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