June 23, 1942. A. O. WILLIAMS 2,287,215

VENTILATING SYSTEM

Filed Nov. 1, 1939 3 Sheets-Sheet 1

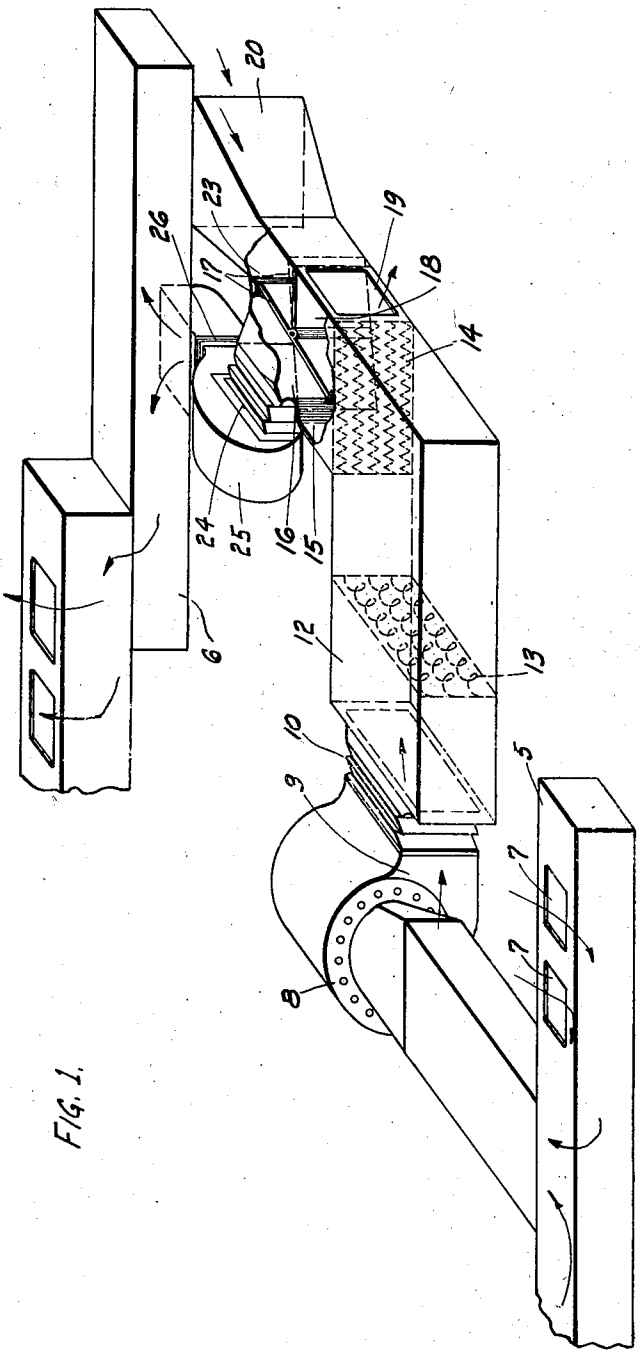


FIG. 1.

INVENTOR.
ALFRED O. WILLIAMS.
BY Walter E. Schirmer
ATTORNEY.

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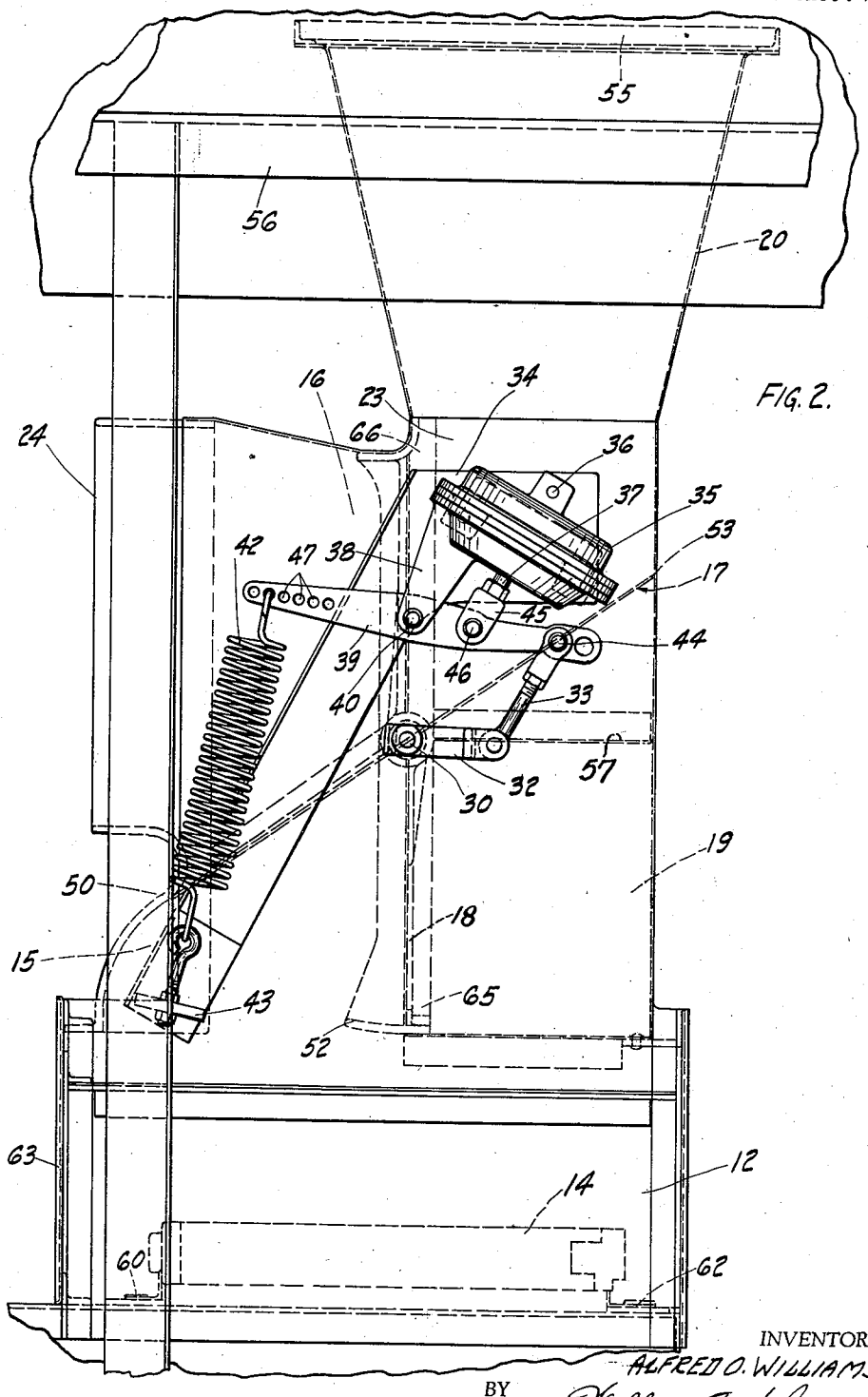


FIG. 2.

INVENTOR.
ALFRED O. WILLIAMS.

BY Walter E. Schirmer

ATTORNEY. 21

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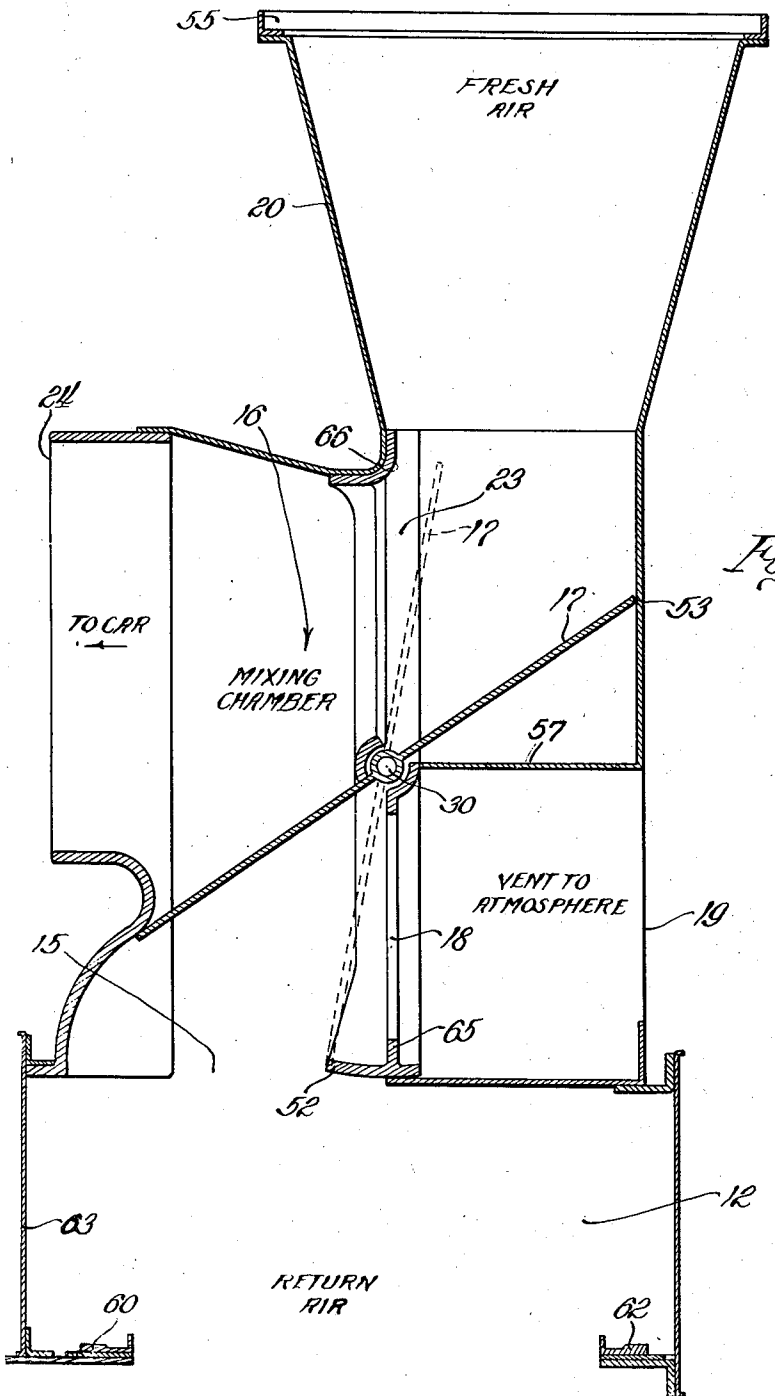


Fig. 3.

Inventor
Alfred O. Williams
By Walter E. Schirmer
Atty.

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2,287,215

UNITED STATES PATENT OFFICE

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VENTILATING SYSTEM

Alfred O. Williams, Battle Creek, Mich., assignor to Clark Equipment Company, Buchanan, Mich., a corporation of Michigan

Application November 1, 1939, Serial No. 302,281

4 Claims. (Cl. 98—10)

This invention relates to ventilating systems, and more particularly is directed to a ventilating system for use in rail cars, such as street railway cars, elevated and subway coaches and railway passenger coaches.

The present invention constitutes a continuation of my copending application, Serial No. 216,673 filed June 30, 1938, and constitutes a modification thereof to eliminate the use of the double damper arrangement disclosed therein.

It is a primary object of the present invention to provide a ventilating system for coaches of this general nature in which the air is forced into the car under a predetermined pressure to prevent infiltration of dust or the like into the car.

In this connection, the invention contemplates the provision of both an inlet and exhaust blower, the exhaust blower being of less capacity than the inlet blower so that a predetermined quantity of make-up air is introduced into the car at all times.

In electrically operated cars of this general nature the resistors for the electric motors are usually mounted beneath the car body, and some means must be provided for dissipating the heat therefrom. The air in the car body is exhausted through outlet ducts connected into box-like side sills which form air exhaust conduits. The exhaust blower is connected to the sill conduits and is adapted to withdraw air from the interior of the car and pass this air over the electric resistors of the driving motors. This effectively transfers the heat from these resistors into the exhaust air stream, heating up this exhaust air so that it may be used for heating the interior of the vehicle. Additional resistors are provided for insuring sufficient heated air for the interior of the car under the most adverse weather conditions.

The system is so designed that this exhaust air which has been heated is used to modify the temperature of the incoming fresh air when it is desired to heat the interior of the vehicle, being automatically admixed with a predetermined quantity of the fresh air to insure the proper temperature conditions within the car body.

However, during warm weather it is desired that the interior of the car body be cooled, and under such conditions, all or substantially all of the exhaust air is dumped to atmosphere and only fresh outside air is admitted to the car body. It is essential that at all times the exhaust air be passed over the motor resistors to insure cooling thereof, and only such amount of this heated exhaust air to produce predetermined temperature conditions is admixed with the fresh air to provide the desired temperature within the car body.

To control the admixture of the warm and cool air in proper amounts, a mixing baffle is employed between the fresh and exhaust air streams which is automatically controllable in accordance with temperature conditions in the car to provide proper tempering of the air drawn to the inlet blower.

Inasmuch as a pressure condition is maintained within the car, the capacity of the inlet blower is greater than that of the exhaust blower so that a certain amount of tempered air is exhausted through the doors and other leakage points in the vehicle body. In a preferred form of the invention the inlet blower has a capacity of 1200 cubic feet per minute as compared with a 900 cubic feet per minute of the exhaust blower.

Another feature of the present invention is the provision of a novel linkage control for regulating the position of the mixing damper to insure proper temperature of the air being drawn into the inlet blower. This control is effected through a suitable thermally responsive member in the car body which is adapted to actuate a suitable valve for swinging the mixing damper through its various positions from a position in which all of the heated exhaust air and the predetermined minimum of fresh air is introduced into the car body to a position in which all the heated exhaust air is dissipated and only fresh air admitted to the car body.

Other objects and advantages of the present invention will appear more fully from the following detailed description which, taken in conjunction with the accompanying drawings, will disclose to those skilled in the art the particular construction and operation of the preferred form of the present invention.

In the drawings:

Figure 1 is a diagrammatic perspective view of the ventilating system in its relationship to the car body;

Figure 2 is a top elevational view of the actual mechanism employed for control of this ventilating system; and

Figure 3 is an enlarged sectional view of the mixing chamber and the ducts leading thereto.

Considering the drawings in detail, the vehicle body is provided as shown in Figure 1, with side sills or rails 5 and 6 forming the supporting base

for the car body and so arranged as to provide air passage conduits. The conduit 5 is provided with openings 7 therein through which air is withdrawn from the interior of the car either by communication with exhaust grills in the side wall of the car or other suitable manner to the inlet side of a blower 8. The exhaust side of the blower 8, as indicated at 9, is connected through the flexible non-metallic bellows 10 to the conduit 12 in which is disposed the resistors 13 of the electric motors used in driving the vehicle. These resistors 13 are arranged across the duct 12 in such manner that the air exhausted from the blower 8 must pass therethrough and absorb heat therefrom. After the air has passed through the resistors 13 and been tempered thereby, it is passed through secondary resistors 14 in the form of heater coils, which may be controlled so as to add additional heat to the air if so desired. From the coils 14 the exhaust air is directed at right angles to be passed through the return air port 15 into a mixing chamber, indicated generally at 16, and controlled by a vertically pivoted damper member 17. This damper member when in the position shown in Figure 1, and in dotted lines in Figure 3, allows substantially all of the tempered air from the passageway 12 to be admitted into the mixing chamber 16. However, when the damper is in the dotted line position, shown in Figure 2, and in full lines in Figure 3, the return air port 15 is closed to the passage of air from the duct 12, and consequently this air is passed at right angles to the right through the passageway 18 to an exhaust opening 19 from which it is exhausted into atmisphere beneath the car body. When the damper is in the dotted line position of Figure 2, therefore, none of the heated air is admitted to the mixing chamber 16 and this exhaust air is then used only for dissipating the heat of the motor resistors 13.

A fresh air inlet duct 20 is provided at one side of the car body for communication with the mixing chamber 16 and has the end thereof opening laterally to the side of the car body. The air entering through this duct is admitted into mixing chamber 16 through inlet port 23 in accordance with controlled by the position of the damper 17. When the damper is in the full line position shown in Figure 2, a certain predetermined minimum quantity of fresh air is admitted to the mixing chamber 16, and as the damper moves to the full line position shown in Figure 3, more and more fresh air is admitted to the mixing chamber thereby cooling the exhaust air to provide the proper air temperature for the air passing through the flexible connection 24 from the mixing chamber 16 to the line side of the inlet blower 25. The outlet side of the inlet blower 25 is connected through the sealed flexible connection 26 to the side sill member 6 from which this air is passed, as indicated by the arrows, longitudinally through this sill member and expelled into the car through grills located in the side walls thereof.

It will therefore be seen that with this system the heated air which is withdrawn from the car and passed over the resistors 13 and 14 is admixed with the fresh air in such manner as to provide the proper temperature in the air introduced to the car body. The amount of heated air used for this purpose varies from all the air passed over the resistors to no air from this source, depending upon the position of the damper 17. In the latter case all of the heated air is expelled to atmosphere through vent 19 after having absorbed the heat from the resistors 13 in order to maintain the same at proper operating temperatures.

Considering now Figure 2 in detail, it will be noted that the vane or damper 17 is mounted upon a vertically extending pivot post 30 disposed substantially centrally thereof. The pivot post 30 is provided at its upper end with an arm 32 secured thereto and having the link 33 pivotally connected to the free end thereof. A suitable supporting plate or bracket 34 is mounted over the top of the conduit construction and extends in a diagonal direction from the fresh air inlet opening 23 to the return air inlet opening 15. Mounted on this bracket in any suitable manner is a diaphragm valve 35 having the connection 36 by which this valve is connected to a suitable air pressure line controlled by means of a thermally responsive means in the car body. This control is so arranged that as the temperature in the car increases, the pressure in the diaphragm valve increases, tending to force the plunger 37, connected to the diaphragm, outwardly of the valve.

The valve body is provided with an extending bracket portion 38 upon which is pivotally mounted the lever 39, as by means of the pin 40. At one end the lever 39 is connected through the coil spring 42 to a stationary lug portion 43 at the end of the bracket 34 whereby the spring 42 normally urges the lever 39 in a counter-clockwise direction, as viewed in Figure 2. At its opposite end the lever 39 has connected thereto the link 33 whereby rotation of the lever 39 about the pivot 40 effects rotation of the arm 32 and pivot post 30 of the damper 17.

Between the pivot pin 40 and the pivotal connection 44 of the link 33 the lever is engaged by the plunger 37, this plunger being provided with a clevis 45 pivotally connected to the lever, as indicated at 46. It will therefore be apparent that increasing of pressure within the valve 35 causes the plunger 37 to move outwardly, and therefore tends to rotate the lever 39 in a clockwise direction against the resistance of the spring 42. Preferably, the end of the lever 39 to which the spring 42 is connected is provided with a series of longitudinally spaced openings 47 in which the spring may be optionally connected for varying its effective tension upon the lever in accordance with the amount of pressure required in the valve 35 to move the plunger 37.

As shown in Figures 2 and 3, the damper 17 is in one of its limiting positions in which all of the air in the return air duct 12 which passes into the return air port 15 is by-passed to the right and exhausted to atmosphere through the dump 19. In this position the inlet blower 25 receives through the outlet 24 of the mixing chamber only fresh air entering through the fresh air intake duct 20, and consequently no tempering of this air is provided as it is introduced into the car body.

As the temperature in the car body drops, the pressure in the valve 35 correspondingly drops and the spring 42 begins to urge the lever 39 in a counter-clockwise direction. This results in counter-clockwise rotation of arm 32 and corresponding rotation of the damper 17 about the pivot 30. As a result, the damper moves from its blocking position with respect to the return air port 15, and a certain amount of this return air is allowed to enter the mixing chamber 16 for admixture with the fresh air.

As more and more heat is required in the car body, the lever 39 rotates further in a counterclockwise direction admitting more and more of the heated return air and less fresh air until such time as the end 50 of the damper moves into alinement with the lip 52 formed in the return air port 15. When this occurs, all of the return air is admitted to the mixing chamber 16 with no portion of this air being exhausted through the dump 19. However, at the same time, the opposite end 53 of the damper 17 has not moved into a position so as to entirely close off the fresh air inlet port 23 inasmuch as the system is so arranged that a certain minimum quantity of fresh air is at all times admitted to the inlet blower in order to make up for the difference in capacities between the inlet and exhaust blowers. It will be noted that the inlet opening 55 of the inlet port 20 is disposed substantially at the side of the car body beneath the inlet duct 6 and below frame member 56, and withdraws air from below and at the side of the car whereby a minimum amount of dust is introduced into the system. If desired, under certain conditions, filters may be placed over the port 55 to insure the removal of dust under adverse conditions. The dump 19 may be arranged to open either downwardly or longitudinally of the car body, and is sufficiently removed from the fresh air inlet 55 so that none of the heated return air exhausted from the dump will be drawn into the fresh air inlet. Preferably the partition wall 57 extends across the inner end of the fresh air duct from the pivot 30 to the side wall having the opening 19 therein. This therefore baffles the fresh air duct from the exhaust air.

The resistors 14 are mounted in vertically superposed position upon suitable brackets 60 and 62, and the end wall plate 63 of the conduit 12 is arranged for removal so that these resistors can be removed therethrough if so desired. It is to be understood that in the duct 12 anterior to the resistors 14, there is provided the motor resistances 13 over which the return air must pass to dissipate the heat therefrom. The resistors 14 are only a supplemental heating means operable under extremely cold weather conditions in order to secure sufficient heating of the car, and may be varied in capacity and number as conditions may require.

From the foregoing, it is apparent that I have provided an extremely simple type of control system for admixing fresh and return air to maintain predetermined temperature conditions within the car, while at the same time providing for proper cooling of the motor resistances regardless of the amount of heated air required in the ventilating system.

Inasmuch as the control is entirely automatic, no attention need be paid by the operator of the car to the operation of the ventilation system, since under hot weather conditions the damper 17 will be automatically moved to the position shown in Figure 2, and only fresh air will be introduced into the car body, all of the heated air being exhausted through the dump vent 19. Similarly, when the car body is extremely cold, the system will move the damper 17 into such position that the end 50 thereof moves against the stop 65, thereby moving the opposite end 53 against the member 66, completely closing the inlet opening from the mixing chamber 16 in which case only the hot air is introduced into the car body in order to initially warm the car body when it has been standing in a barn or at some other location for a considerable period of time. As the system comes into operation, the damper 17 moves in a clockwise direction admitting more and more fresh air until such time as the thermally responsive means is satisfied, which may require a proportionate mixture of fresh and return air to secure the desired temperature in the car body. The mechanism will then maintain the damper in such position as to insure maintenance of this predetermined temperature in the car body, thereby providing a comfortable car body temperature without any attention on the part of the operator.

I am aware that various changes may be made in certain details of the present construction, and I therefore do not intend to be limited except as defined by the scope and spirit of the appended claims.

I claim:

1. In a duct arrangement for the ventilating system of a rail car, a transverse fresh air duct beneath the car having a normally directed outlet port, a longitudinally extending return air duct transversely offset with respect to said fresh air outlet port beneath the car having an outlet port and passageway opening at right angles to said fresh air outlet port, a mixing chamber common to said ports, a single damper pivoted intermediate its ends between said outlet ports and having the portion on one side of said pivot swinging in said fresh air duct and the other portion swinging across said return air duct outlet port, a third opening in said chamber, an inlet supply duct communicating with said last mentioned opening for conducting air to said car, the construction and arrangement of said fresh air outlet port, said return air outlet port and said damper being such that when the damper is moved to position to permit full flow of air from said return outlet port to said mixing chamber, the fresh air outlet port is partially unobstructed.

2. In combination, in a ventilating system for a car body, a mixing chamber beneath said body having an outlet communicating with the interior of said body, a transverse fresh air duct beneath the body having a lateral port opening into the end of said chamber, a return air duct beneath said body laterally offset from said fresh air duct and having a return air port opening at its inner end into the side of said chamber, a dump port opening for said return air duct disposed at right angles to said return air port and disposed in the same end of said chamber as said fresh air port, a damper pivotally mounted intermediate its ends on a pivot disposed at the junction of said fresh air and return air ports into said chamber, one portion of said damper controlling the proportion of return air admitted to said chamber and to said dump port and the other portion of said damper controlling the opening of said fresh air port into said chamber, and means for controlling pivotal movement of said damper to progressively close said fresh air port while opening the return air port into said chamber and closing said dump port.

3. The combination of claim 2 wherein said return air port has a baffle so arranged as to effect complete closing of said dump port by said damper prior to closing of said fresh air port.

4. In a ventilating system for a car body having fresh and return air ducts extending trans-

versely beneath the car body in laterally offset relation, a substantially rectangular housing beneath the body having offset openings in opposite sides thereof forming ports for said ducts into said chamber, the remaining sides also having corresponding offset openings, one communicating with atmosphere and constituting a dump port, and the other connected to an inlet blower, a partition in said housing extending from the center thereof to the side wall having said dump opening therein and baffling said dump port from said fresh air duct opening, a damper pivotally mounted intermediate its ends on the inner end of said partition and operable to control the passage of fresh air and return air through said ports toward said blower connection opening, said damper simultaneously proportioning the amount of return air exhausted through said dump port.

ALFRED O. WILLIAMS.