Aug. 19, 1930. E. C. CREDICOTT 1,773,220

HEATING, VENTILATING, AND COOLING SYSTEM

Filed Sept. 15, 1928 3 Sheets-Sheet 1

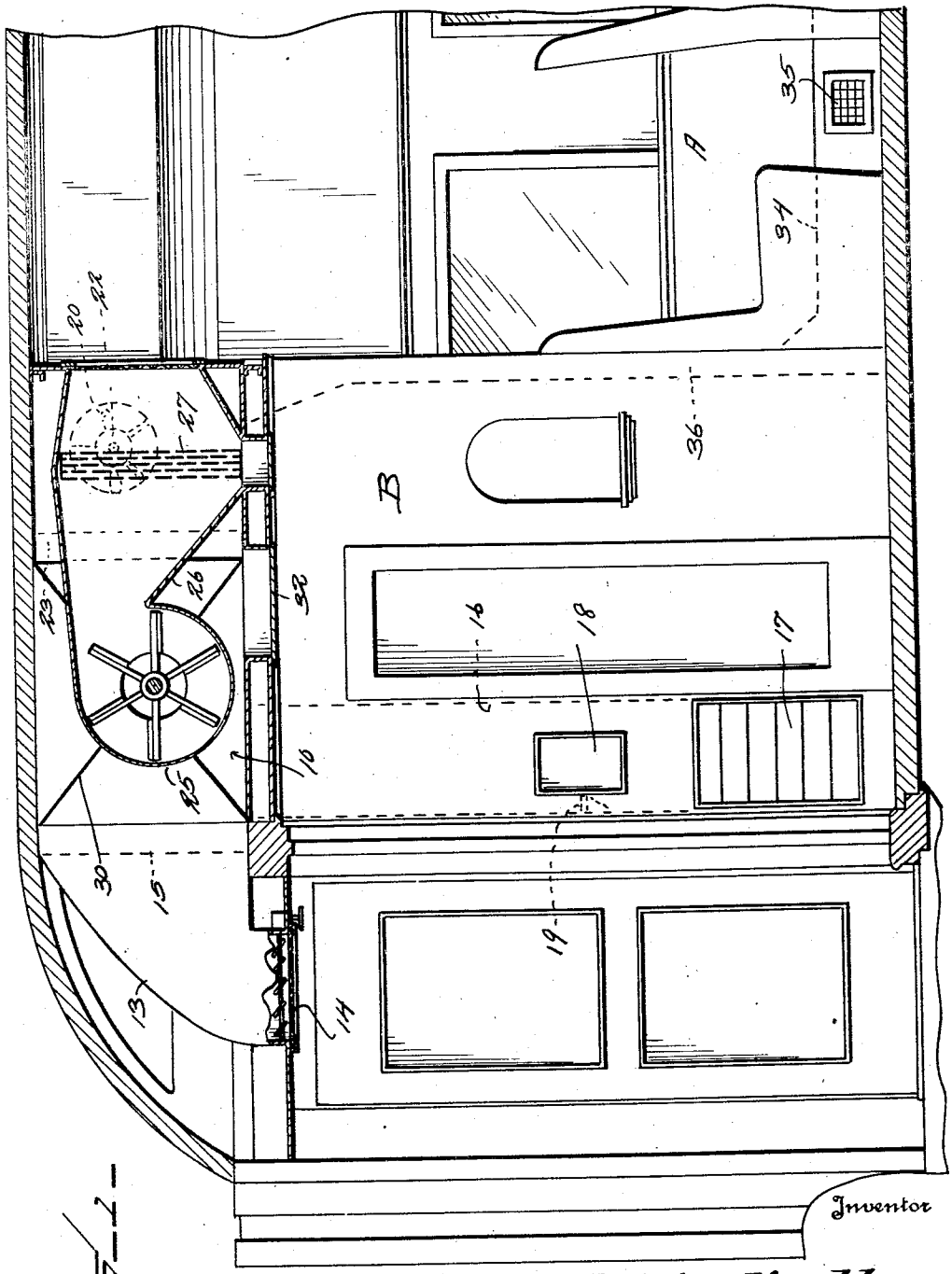


FIG. 1

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HEATING, VENTILATING, AND COOLING SYSTEM

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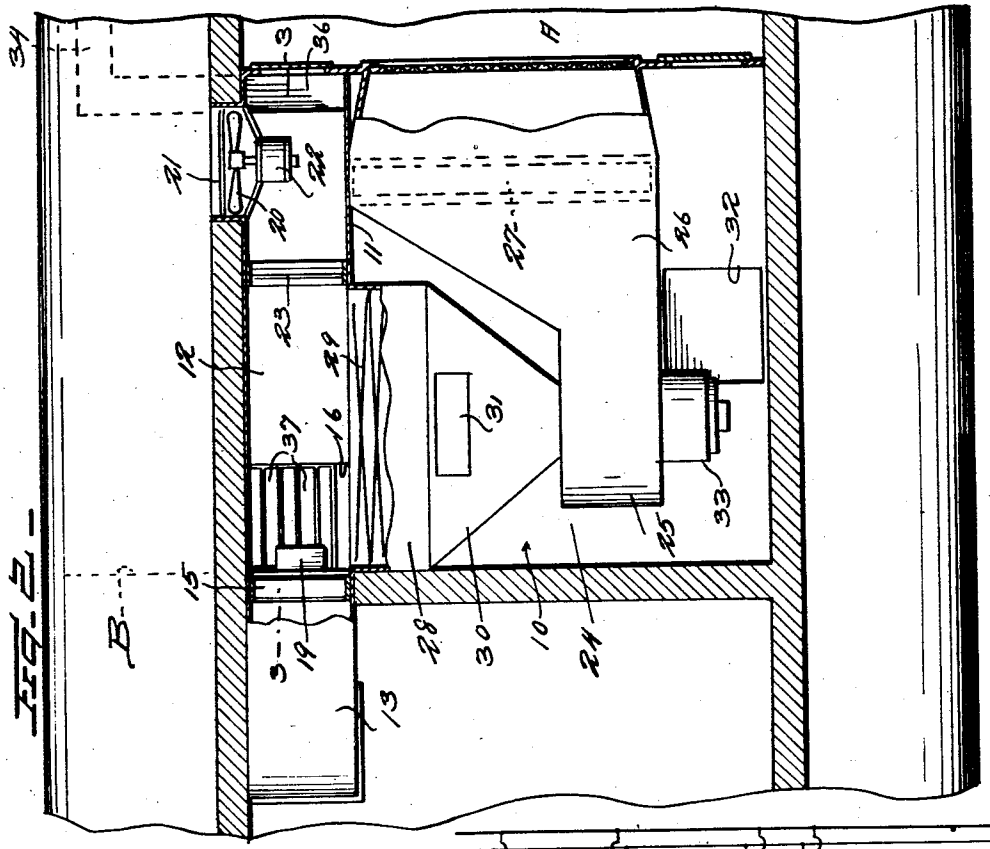


Fig. 2.

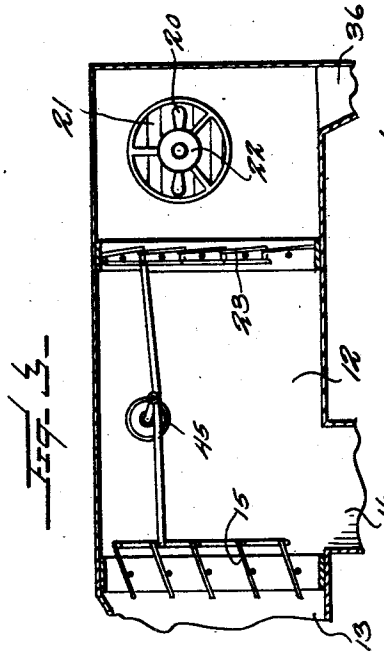


Fig. 4.

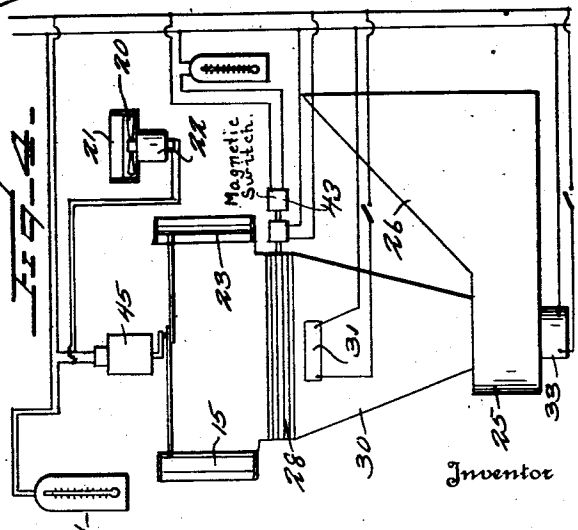


Fig. 3.

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HEATING, VENTILATING, AND COOLING SYSTEM

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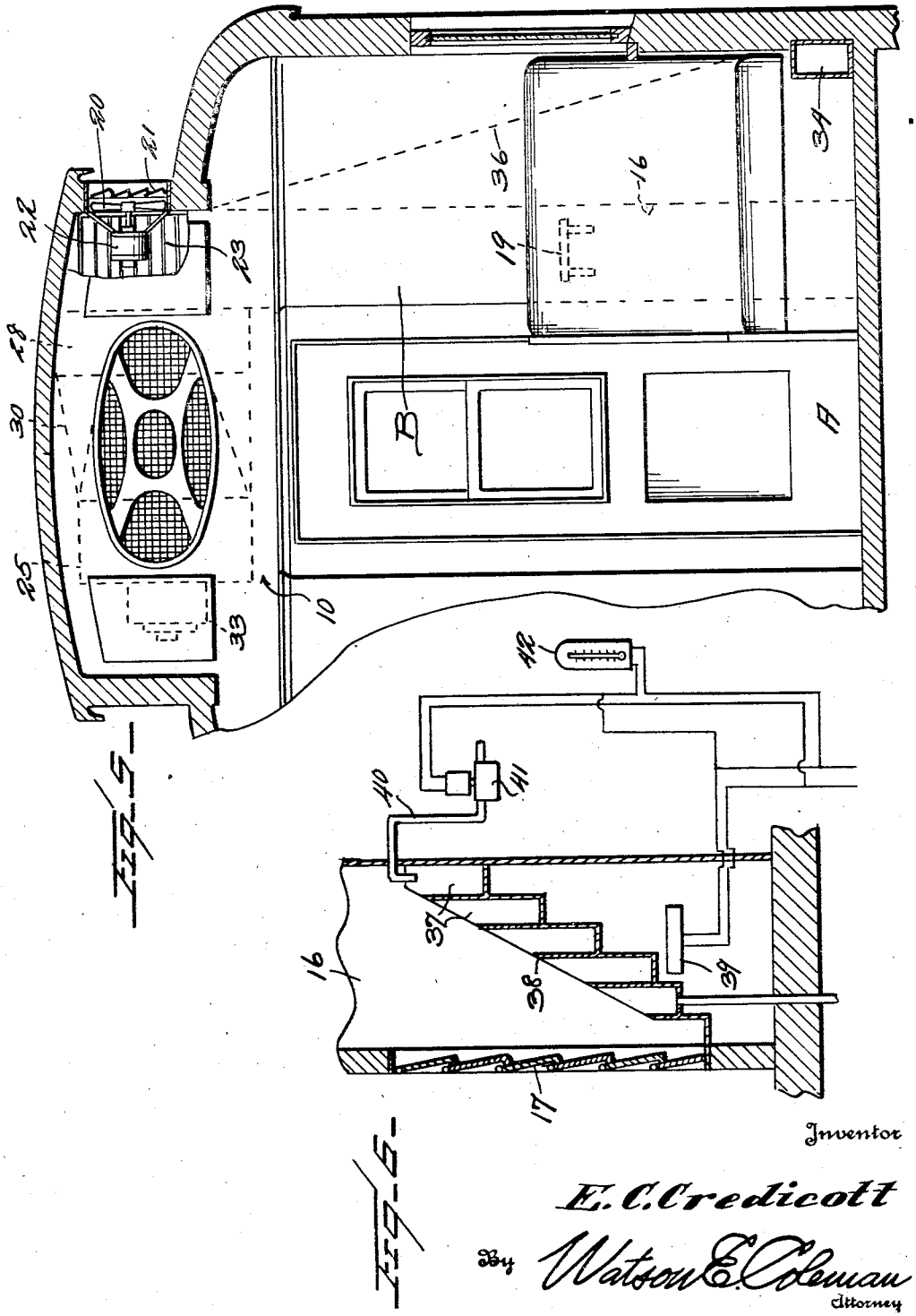


FIG. 1.

FIG. 2.

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UNITED STATES PATENT OFFICE

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HEATING, VENTILATING, AND COOLING SYSTEM

Application filed September 15, 1928. Serial No. 306,163.

This invention relates to passenger vehicles, and particularly to railway vehicles, and has to do with an improved system of heating, ventilating and cooling cars.

The general object of the present invention is to provide a system whereby fresh air may be introduced into the car at one or both ends thereof and adjacent the top of the car, this air being heated, if required, whereby air may be withdrawn from the car adjacent the floor thereof and between the seats and either recirculated or discharged to the exterior atmosphere in case the air is vitiated.

A further object in this connection is to provide means for humidifying the air prior to its discharge into the main body of the car, this humidifying mechanism being controlled by a hygrometer.

A further object is to provide means whereby the air in the car may be fumigated, as well as humidified and whereby the air entering the car shall pass through a heating system, if necessary, and shall pass through air filters and through an ozone box.

Another object is to provide dampers, which in one position permit fresh air to be drawn in to the fan compartment and forced out through the filters, heating apparatus and ozone box, and into the car, and the vitiated air be forced out to the exterior of the car, or whereby the inlet of fresh air may be cut off and the air in the car recirculated.

A further and general object is to ventilate, heat, humidify, clean, fumigate and ozonify the air in railway cars or other passenger vehicles by means of a forced circulation of air, eliminating the present day equipment of heating coils, double sash, and electric fans, and preventing dirt, dust and soot from filtering into the car.

My system is illustrated in the accompanying drawings, wherein—

Figure 1 is a fragmentary longitudinal section of a railway car having my invention applied thereto;

Figure 2 is a horizontal section through the compartment having therein my ventilating apparatus;

Figure 3 is a vertical sectional view on the line 3—3 of Fig. 2;

Figure 4 is a diagrammatic illustration of the controlling means for the dampers and exhaust fan;

Figure 5 is a sectional view transversely of the vehicle and looking toward the front of the ventilating casing, a casing being partly broken away;

Figure 6 is an enlarged section through the evaporating compartment in duct 16 and the damper therefor.

Referring to these drawings, it will be seen that I have illustrated an ordinary passenger car, though it will be understood that my system is equally applicable to Pullman cars, sleeping cars, parlor cars, and other automotive vehicles.

The passenger car which I have illustrated has the usual seat corridor A and the toilet room B. Above this toilet room is disposed a cabinet or compartment which is designated generally 10. This compartment is divided into two sections by a vertical partition 11. The section 12 at the end nearest the vestibule is provided with an inlet duct 13 having therein a cold air register 14 opening downward into the interior of the vestibule. Separating the duct 13 from the chamber or compartment 12 is a damper 15 formed of a plurality of hinged leaves adapted to close the passage through the damper when the damper is opened in one direction and to open the passage when the damper is swung in the other direction. Extending upward into the compartment 12, just inward of this damper 15, is an air inlet duct 16, which at its lower end is provided with a damper 17 formed of pivoted leaves, this being preferably an automatic gravity damper held in a normally closed position and opening to a draft of air upward through the duct 16.

An access door 18 is disposed in the wall of the duct and mounted within the duct is a shelf 19 upon which a fumigating or deodorizing agent may be placed. It will be seen that the lower end of the duct 16 opens into the end of the car adjacent the door. Disposed in the other end of the compartment 12, which compartment forms an exhaust fan-casing, is an exhaust fan 20 discharging through the wall of the car to the outside air, and in front of this exhaust fan, which is driven by an electric motor, is an automatic gravity damper 21, which when the exhaust fan is running swings open under the action of the blast, but swings to a closed position when the fan is not running, the motor for the fan being designated 22. Disposed within the section or compartment 12 and inward of the exhaust fan 20 is a damper 23 adapted to cut off the rear portion of the compartment 12 from the front portion of the compartment. This damper may be of any suitable character but is preferably formed of a series of hinged leaves and the two dampers 15 and 23 are so connected to each other that when the damper 23 is open, the damper 15 is closed and vice-versa. I have illustrated a simple form of connection between the leaves of the dampers but do not wish to be limited thereto.

The partition 11 separates the compartment 12 from a relatively larger compartment 24 having arranged therein a blower 25 discharging into a duct 26, this duct becoming gradually larger in cross sectional area toward the corridor A of the car and then contracting in cross section area. Disposed transversely across this duct 26 are the air filters 27 whose detailed structure will be later described.

The compartment 12 opens into the compartment 24 through a casing 28 containing heating elements 29. While these heating elements may be of any suitable construction, such for instance as hot water pipes or steam pipes, I have illustrated an electrical heating unit. I do not wish to be limited to this however, as my invention includes in its scope the use of any one of many different kinds of heating elements.

The blower 25 is connected to the casing 28 by means of the gradually contracted funnel 30 and disposed in front of the casing 28 of the heating unit is an ozone box 31, which is electrically operated and acts to purify the air. This ozone box may be of any suitable or usual construction and I contemplate using ozone boxes such as are now on the market.

The door 32 in the bottom of the cabinet 10 gives access to the motor 33 for the blower and to the other instrumentalities.

Extending along the floor of the main corridor of the car adjacent the walls is a duct 34 which extends the entire length of the corridor and is provided at intervals as, for instance, between each two seats, with an inlet register 35. The ducts 34 discharge into a vertical duct 36 which extends upward into the compartment 12 adjacent the exhaust fan 20, so that when this exhaust fan is operating, air will be drawn from the lower portion of the car adjacent the floor, carried along the ducts 34 and duct 36, into the casing, to the exhaust fan, and discharged outward by the exhaust fan into the outer air or when the exhaust fan is not operating, and when the damper 23 is opened such air will be carried back through the heating element, the ozone box 31 and discharged by the blower 25 and into the car, thus securing a complete circulation of the air.

The heat and humidity may be controlled by thermostats, hydrostats and hygrometers, such as are found on the market today.

Disposed within the lower end of the duct 16 is an evaporator. This evaporator, as illustrated in Fig. 6 consists of a cast iron tank formed to provide a series of pans 37 disposed one above the other and each having an overflow wall 38. If more water is admitted than will evaporate in the top trough or pan, the water runs over into the second trough or pan, etc., providing a constantly increasing water covered heating surface which acts on the water to evaporate it.

Within the evaporator or humidifying element there is disposed an electric heating unit 39 of any suitable character connected to a source of electricity. A pipe 40 delivers water to the topmost trough 37 which runs to a suitable source of water, and in the mouth of this pipe there is disposed a magnetically controlled valve 41 of ordinary construction which is connected in circuit with a hydrostat or hygrometer, designated generally 42, one terminal of which is connected by a magnetic switch 43 with one of the terminals from the heating unit 39. When the atmosphere gets dry, or drier than normal, the heater 39 will be energized automatically and water will be admitted to the evaporating troughs and this vaporized water will be carried up through the duct 16 into the compartment 12 and then forced out into the car by means of the blower 25. As the humidity rises above normal the magnetic valve will cut off the flow of water to the evaporating troughs and the connection between the electric heater and the source of supply will be broken and no more water will be evaporated for the time being.

The filters 27 are such as are found on the market, and while I may use any form of air filter, I preferably use that form where the filter is composed of a plurality of spaced perforated plates, the perforations of one plate being disposed in staggered relation to the perforations in the other plates, and the plates being covered with fibrous material

which will catch and hold dust and soot particles.

The dampers 15 and 23 are automatically controlled by thermostats 44. Any of the numerous thermostatically controlled damper operating systems may be used, thus for instance, the dampers may be connected to a single motor 45 set into operation by the thermostat 44 and acting, when energized, by a drop in temperature below normal, to move through nearly one-half revolution and then stop. This shifts the damper 15 to a closed position and coincidentally opens the damper 23 so that the air will be circulated within the car and past the heaters, etc., until the atmosphere is warmed up. When the thermostat has reached a predetermined degree, the motor will be again operated automatically to cause the closing of the damper 23 and the opening of the damper 15, and also the energizing of the fan 22 which will carry off the vitiated air and permit the entrance of fresh air. This fresh air will be heated when the heating chamber is energized and will pass through the ozone container 31 and be discharged forcibly by the blower 25 through the filtering element 27 into the interior of the car.

It will be seen that the mechanism which I have heretofore described provides means whereby the temperature of a vehicle may be regulated by heating in winter and cooling in summer, whereby the car may be thoroughly ventilated and provided with clean, fumigated and ozonated air, and whereby the humidity may be controlled. The control of the mechanism is by the use of thermostats, hydrostats or hygrometers, which may be located one or more places within the car.

At all times during use of the apparatus, the blower 25 is in operation and when the weather is cold, the damper 23 will be opened and the damper 15 closed by their thermostatic control. Air is thus circulated through the ducts 16, 36 and 34 through the car and this air is purified by use of the ozonifying apparatus. The humidifier will be in operation and controlled by the humidostat and the exhaust fan 20 will be cut off. As the weather moderates, the damper 23 will be closed and the damper 15 will be opened, with the result that fresh air will be drawn from the vestibule of the car and the exhaust fan 20 operates, exhausting a portion of the vitiated air. The heating units will, however, still be in operation through their thermostatic control, so that the air introduced will be sufficiently heated to be comfortable. As the temperature increases, the heat may be discontinued to maintain a comfortable temperature. When it is desired that the car be fumigated, the damper 23 is closed and the vestibule duct is closed by a hand-operated damper 50 associated with the register 14, thus obtaining the same effect as if both dampers 15 and 23 were closed. The fumigating agent is placed upon the shelf 19 and the blower started. The fumigating agent will thus be circulated and recirculated through the car until a thorough fumigation has resulted. During this time, the ozonifying apparatus may be either in operation or not, as desired.

The damper 21 is a gravity damper which closes when the fan 20 is not in operation, preventing air and dust from entering through the exhaust fan 20.

The duct 34 with the registers 35 take the place of heating coils now in use in railway coaches. The duct 16 in observation or Pullman coaches and other vehicles than ordinary railway coaches, would be changed in location to suit the particular arrangement arising from the arrangement of seats, toilet rooms, etc. The toilet rooms will be heated by a separate heating coil or unit and by an entirely separate ventilating fan or transom, not shown.

In Pullman cars where staterooms are enclosed, a small register is placed over the door or ventilating shutters are used in the doors as panels so that heat will pass in through to the stateroom. The heating system which I have devised eliminates the necessity of opening windows and transoms in vehicles and thus a single sash may be used which is fixed or permanent, and no screening at the window will be required.

By using a forced feed, humidifying, air heating, ventilating and air cleaning system, discomfort to passengers will be greatly eliminated, as are also the cost of constant cleaning due to the infiltration of dust, dirt and soot into the interior of the vehicle. By using a forced air circulation, the static pressure inside of the vehicle will be increased above the outside pressure and there will be no infiltration of air. My system also permits the elimination of the usual electric fans.

It is to be understood that I do not wish to be limited to the exact form of the various details shown, as this showing is purely illustrative and in some cases purely diagrammatic, thus for instance other forms of air filters may be used than those illustrated and the dampers or louvres may be of different form and be differently controlled. Neither do I wish to be limited to an electric heating system. I design to employ all of these parts as commonly found upon the market, but my invention consists in the arrangement and combination of these elements to secure the results stated.

What I claim is—

1. In a heating and ventilating system for vehicles, a casing disposed at the top of the vehicle, a duct extending longitudinally of the vehicle and having inlet openings at intervals, a duct discharging from said cas-

ing into the vehicle adjacent the top thereof, a blower fan disposed within said casing and discharging toward the last named duct, a fresh air duct entering said casing, a recirculating duct opening into the interior of the vehicle and discharging into said casing, an exhaust fan taking air from said casing adjacent the first named duct and discharging the air out of the car, means for constantly operating the blower, thermostatically controlled means for operating the exhaust fan, and dampers adapted respectively to control communication between the fresh air duct and said casing, and between the exhaust fan and said casing, and means for simultaneously opening one of said dampers and closing the other.

2. In a heating and ventilating system for vehicles, a casing disposed at the top of the vehicle and divided to form two compartments communicating with each other, one of said compartments discharging into the vehicle adjacent the top thereof, the other of said compartments having at one end a fresh air inlet duct and at the opposite end an exhaust fan discharging to the exterior air, a duct extending along the floor of the vehicle and having openings at intervals and extending up into the second named compartment adjacent the exhaust fan, a damper disposed between the exhaust fan and the opening between the two compartments, a damper controlling passage through the fresh air inlet duct, means connecting said dampers for reversing operation, a recirculating duct extending upward from a point adjacent the floor of the vehicle and having an inlet opening at this point and opening into said second named compartment adjacent the fresh air inlet end thereof, humidifying means disposed within this recirculating duct, a blower disposed within the first named compartment and discharging into the vehicle, heating means disposed between the blower and the second named compartment and through which the air is drawn by the blower, ozonifying means through which the air is drawn by the blower, thermostatically operated means for controlling the operation of the dampers, and the operation of the exhaust fan, and means for controlling the passage of air through the recirculating duct.

3. In a heating and ventilating system for railway vehicles, a casing disposed adjacent the top of the vehicle, the casing being divided to provide two compartments, one of said compartments having an opening whereby air may be discharged into the vehicle, the other of said compartments having a fresh air inlet and a vitiated air outlet, the two compartments communicating with each other between said inlet and outlet, a blower disposed in the first named compartment and taking air from the second named compartment and discharging it from the first named compartment into the vehicle, a duct extending upward from the lower portion of the vehicle and discharging into the second named compartment adjacent the air outlet thereof, dampers disposed within the second named compartment, one of said dampers being disposed between the last named duct and opening into the first named compartment and the other disposed between the fresh air inlet and the opening in the first named compartment, a recirculating duct opening into the second named compartment between the last two dampers, a damper at the entrance end of the recirculating duct, automatic means for closing one of the first named dampers and simultaneously opening the other damper or vice versa, air filteration means disposed adjacent the outlet of the first named duct, and heating means adapted to heat the air as it passes through said duct prior to its discharge.

4. In a heating and ventilating system for railway vehicles, a casing disposed adjacent the top of the vehicle, the casing being divided to provide two compartments, one of said compartments having an opening whereby air may be discharged into the vehicle and the other of said compartments having a fresh air inlet and a vitiated air outlet, the two compartments communicating with each other between said inlet and outlet, a blower taking air from the second named compartment and discharging it from the first named compartment into the vehicle, a duct extending upward from the lower portion of the vehicle and discharging into the second named compartment adjacent the vitiated air outlet, a recirculating duct extending upward into the first named compartment adjacent the fresh air inlet thereof, said duct opening at its lower end into the interior of the vehicle, dampers disposed one between the last named duct and the fresh air inlet and the other disposed between the opening in the first named compartment and the vitiated air outlet, automatic means for simultaneously closing the first named damper and opening the second named damper and vice versa, an exhaust fan disposed adjacent the vitiated air outlet, and means for simultaneously actuating said exhaust fan when the adjacent damper is closed and stopping the exhaust fan when the adjacent damper is open.

5. In a heating and ventilating system for railway cars, a casing connected to a source of fresh air, a power operated fan in said casing and discharging into the car, a second casing having a vitiated air outlet, an exhaust fan disposed in the vitiated air outlet, a damper controlling the inlet of fresh air to the first named casing, a damper controlling the passage of air from the second named casing into the first named casing, and thermostatically operated means for automatically opening the fresh air damper

when the air in the vehicle becomes too warm and simultaneously closing the second named damper and starting the exhaust fan or when the temperature of the air drops to a predetermined point, closing the first named damper and simultaneously opening the second named damper and stopping the exhaust fan.

In testimony whereof I hereunto affix my signature.

EDWARD C. CREDICOTT.