

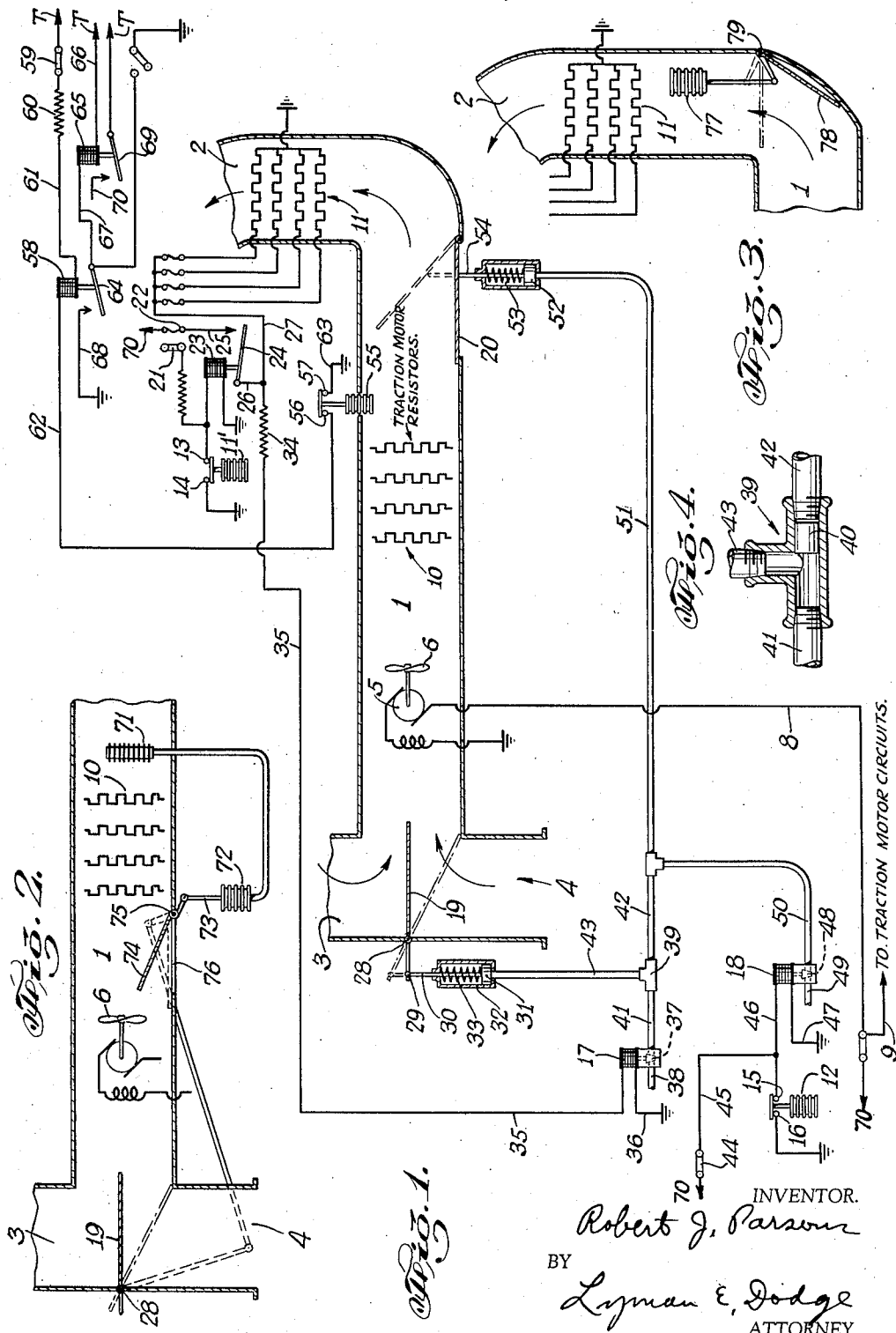
Oct. 20, 1936.

R. J. PARSONS

2,058,252

HEATING AND VENTILATING SYSTEM

Filed Feb. 27, 1935



UNITED STATES PATENT OFFICE

2,058,252

HEATING AND VENTILATING SYSTEM

Robert J. Parsons, Schenectady, N. Y., assignor
to Consolidated Car-Heating Company, Inc.,
Albany, N. Y., a corporation of New York

Application February 27, 1935, Serial No. 8,574

9 Claims. (Cl. 219—20)

This invention relates to electric railways, particularly to the electric cars used thereon and more especially to the heating and ventilating of such cars.

5 A principal object of this invention is to accomplish the heating and ventilating of a car of the type specified by an expenditure of a minimum amount of electrical energy.

10 A further object of the invention is to provide a system for heating and ventilating a car of the type specified which will be practically automatic in operation, to the end that it not only will not require manual operation, which may at times be, unfortunately lacking, but it will
15 serve, as near as is possible, to maintain the heating and ventilating of the car normal, under diverse weather conditions of heating and ventilating.

A further object of the invention is to provide a system of heating and ventilating for a car of the type described which will operate on the principle of a plenum system during the time when heating of the car is required and will act upon the principle of an exhaust system during the time when no heat is required, but ventilating is necessary.

30 A further object of the invention is the production of a system having the advantages and for the purposes specified which will be so flexible as to be readily adaptable to the diverse conditions likely to be found in commercial practice.

35 A further object of the invention is the production of a system of the type described which will be composed of relatively simple apparatus, easy to install and maintain and substantially free from delicate parts likely to get out of order and to require attention even at substantially wide intervals.

40 Other objects and advantages will appear as the description of the particular physical embodiment selected to illustrate the invention progresses and the novel features will be particularly pointed out in the appended claims.

45 In describing the invention in detail and the particular embodiment selected to illustrate the invention, reference will be had to the accompanying drawing and the characters of reference thereon wherein like characters of reference designate like parts throughout the several views, and in which:

50 Figure 1 is a diagrammatic or schematic illustration of a heating and ventilating system for an electric car operable upon an electric railway
55 embodying applicant's invention; Fig. 2 is a dia-

grammatic or schematic view of a device which may be added to the arrangement of Fig. 1 as an additional auxiliary or supplementary feature; Fig. 3 is a schematic view of another auxiliary, additional or supplementary feature which may
5 be added to the system of Fig. 1; Fig. 4 is a detail view illustrating schematically the construction of a valve used in the system of Fig. 1.

In the drawing numeral 1 indicates an air duct or conduit. One end 2 of this conduit
10 opens into the passenger space of an electric car. Of course, it is to be understood that the view is diagrammatic or schematic and the showing is merely for the purpose of illustration and applicant, of course, does not mean to
15 exclude the connection of the conduit end 2 to any suitable distribution system such as is common or usual in connection with the heating and ventilating of electric cars as it is common practice to have a ventilating and heating conduit
20 extend lengthwise of the car upon each side with openings at intervals for allowing ingress and egress for the heating and ventilating medium.

The end 3 of the conduit may likewise be considered as opening into the heating and ventilating space of an electric car and as opening therein in any of the usual or well known manners or positions.

End 4 of the conduit opens to the outside air.
30 This opening may be arranged at any place and in any usual manner customary in connection with the heating and ventilating of electric cars or similar structures.

In order to secure a circulation of air within
35 the conduit 1 and so within the car, applicant prefers a power driven fan or air propeller, and preferably one of the electric type most appropriately mounted within the conduit 1. Such an air propeller or draft creator is indicated at
40 5 as an ordinary electric motor driving a fan blade 6. This motor 5 is conveniently driven from electrical energy taken from the trolley.

In order to furnish heat to the air which is propelled through the conduit 1, applicant
45 installs the ordinary and well known traction motor resistors 10 in position to have the moving air pass thereover, as in the conduit 1.

As the traction motor resistors 10 may not at times supply sufficient heat to heat adequately
50 the air flowing through the duct 1 and out of the end 2, applicant has made provision for further heating the moving air in duct 1. This preferably takes the form of electrically energized resistors positioned so that the air flowing through

duct 1 must pass thereover. It is usual and customary to supply electrically energized resistor heaters for such purposes, and it is usual to either concentrate or distribute them in accordance with what seems to be the best construction, but for the purposes of illustration applicant has concentrated or assembled the heaters at one point within the duct 1. These resistor heaters are indicated by 11 and are energized, as will be more fully hereinafter described, by electrical energy from a trolley T.

As applicant desires not only to heat the car but also to ventilate it, it is impossible to merely recirculate the air in the car and to the end that proper ventilation may be secured when desired, applicant has provided not only the entrance opening 3 communicating with the passenger space of the car but also the entrance opening 4 communicating with the outside atmosphere.

With all of the parts as shown in the position as illustrated by Fig. 1, the fan 6 would draw air not only from the passenger space of the car but also from the outside atmosphere and passing over the traction motor resistors 10 would be heated so that approximately one half of the air circulating through the car would be recirculated air and the other half would be fresh air. This would be the condition if the interior of the car was at a temperature say below 55° F. and above 50° F., the limits assumed by applicant for the two main thermostats positioned within the passenger space of the car for regulating the automatic operation of the system. The thermostat under the above stated conditions which is above 50° is the thermostat 11' and the thermostat which is below 55° is the thermostat 12, each of which is represented in the conventional manner as being of the ordinary syphon form. Under the conditions as stated, that is, with the temperature in the passenger space of the car above 50° the thermostat 11' would be closing contact between the members 13 and 14 and with the temperature below 55° the thermostat 12 would be closing contact between the members 15 and 16 so that, as will be more fully hereinafter described, both solenoids 17 and 18 would be de-energized and no air would be supplied to the system which controls the dampers 19 and 20 so that they would be in position as shown in Fig. 1.

It is also to be observed that under the conditions specified even when manually operable switch 21 closes upon contact 22 no electrical energy would be supplied to the auxiliary or supplementary heating resistors or heaters 11.

If the temperature in the passenger space of the car falls below 50° the thermostat 11' will break the connection between members 13 and 14 so that with manually operable switch 21 in contact with contact 22 electrical energy will flow from the member 70 to and through electro-magnet or relay 23 and cause its armature 24 to be raised into contact with wire 25 so that electrical energy may then flow from 70 through wire 25, armature 24, wires 26 and 27 to and through all of the resistors 11 thereby heating the same and furnishing additional heat to the resistors 10 to the current of air flowing through conduit 1, thereby more strongly and quickly heating the passenger space of the car.

In order to more quickly and efficiently heat the passenger space of the car under the conditions assumed, that is, in which thermostat 11' is exposed to a temperature less than 50° not only would the resistors 11 be heated but the damper

19 would be shifted to the dotted line position as shown in the figure. This would be done so that while heating the car when its temperature is below 50° there would be no air taken from the outside. In order to shift the damper 19 to the dotted line position it is pivoted at 28 and is connected at 29 to the piston rod 30 of a piston 31 in an air cylinder 32. This piston 31 is normally spring pressed by the spring 33 to the position as shown in Fig. 1. When the thermostat 11' is exposed to a temperature less than 50° the electro-magnet 23 is energized as hereinbefore stated and the armature 24 is raised thereby energizing electro-magnet or valve 17, the current flows in a circuit as follows: 70, wire 25, armature 24, wire 26, resistance 34, wire 35, electro-magnet coil 17, and wire 36 to ground or common. When electro-magnet 17 is energized the valve 37 is raised allowing compressed air entering at the end 38 of the pipe to flow to the valve 39, shown in detail in Fig. 4. This valve has a plug 40 therein which moves to the position as shown in Fig. 4 when air enters through the pipe 41. The effect of this is to close off the pipe 42 to the entrance of compressed air but allow the compressed air to flow into the pipe 43. The air flowing through the pipe 43 causes the piston 31 to be raised, as viewed in Fig. 1, thereby causing damper 19 to be moved to the dotted line position.

When damper 19 is in the dotted line position, and resistors 11 are energized, the heating of the passenger space of the car is most rapid and efficient, because all of the air forced into the car through the duct 1 is taken from the passenger space of the car through the entrance 3 so that it is practically a recirculation of the air in the car.

When the temperature of the space in car has been raised from below 50° to 50°, the thermostat 11' makes contact between members 13 and 14 and so by-passes the electro-magnet 23, thereby de-energizing it and causing armature 24 to break circuit with wire 25. This removes the heating energy from the resistors 11 and de-energizes electro-magnet 17 thereby causing valve 37 to seat and prevent the entrance of compressed air under the piston 31 so that the spring 33 gradually pushes the piston to the position as shown in Fig. 1 and the damper 19 to the position as shown in Fig. 1. Continued operation of the fan 6 under the conditions last outlined will cause a further heating of the car because of the heating of the moving air by the traction motor resistors 10, but not only will heating be accomplished, but ventilation as well because the entrance 4 to the duct 1 is also open and part of the air driven into the car will be taken from the car and part from the outside atmosphere.

When the temperature of the car goes above 55° the thermostat 12 will break contact between 15 and 16 so that the by-pass around electro-magnet 18 will be broken. Electro-magnet 18 will be energized by current flowing in a path as follows: 70, manually operable switch 44, wires 45 and 46, electro-magnet 18 and wire 47 to ground or common. Current flowing in the above traced path energizes the electro-magnet 18 and causes the valve 48 to be raised from its seat thereby allowing compressed air to flow in at the end 49 of the pipe 50. The air flowing in the pipe 50 will pass into pipe 42 and move the valve 40 to the left, as viewed in Fig. 4, stopping the end of pipe 41 but allowing the air to flow into the pipe 43 where it will operate the damper 19 to the dotted line position. At the same time, the air will flow

into pipe 51 and under piston 52 in cylinder 53, causing the piston rod 54 to raise the damper 20 to the dotted line position as shown in Fig. 1. The conditions last described the heating of the passenger space of the car will be affected by the air which passes over traction motor resistors 10 and all of the air passing over those resistors will be drawn from the passenger space of a car because of the dotted line position of the damper 19.

All of the air which is drawn from the passenger space of the car through the entrance 3, however, is not returned to the car. Only such a portion is returned as is represented by the volume which gets by the space between the upper end of the damper 20 in the dotted line position and the wall of the conduit 1. As a consequence the system is working practically as an exhaust system. The air is being drawn from the passenger space of the car and only partly replaced, as a consequence, some air must reach the passenger space of the car through the doors or windows or other available entrance. This last described arrangement of the several parts is the one which will be in force when no heat is called for by the car thermostat 12. The damper 20 will be adjusted so that the amount of heat passing by will be sufficient to maintain the car temperature during average operating conditions. It causes the ventilating and heating of the passenger space of the car with the minimum expenditure of electrical energy. This will be seen to be so when it is realized that the heating is done entirely by the traction motor resistors which furnish what is practically waste heat, and the only energy necessary to be expended for the ventilating and heating is that required to operate the fan motor 5. It is to be observed, however, that the method of heating which contemplates a usual condition wherein all of the heat is supplied by the traction motor resistors 10 is especially applicable to those situations where the traction motor and its circuits are arranged not only so that the resistors are in circuit as is customary upon accelerating but are also in circuit with the motors when decelerating, that is, the motors are used as a dynamic brake to retard the motion of the car. The amount of heat generated in the resistors 10 when used in connection with a motor used as a dynamic brake is such that an ample supply of heat is secured from the resistors alone to enable the passenger space of the car to be suitably heated under generally existing conditions while the car is in operation.

As will be readily understood, if the system is in the condition whereby damper 19 is in the dotted line position and damper 20 is in the dotted line position with electro-magnet 18 energized because the temperature in the passenger space of the car is greater than 55°, then when the temperature falls to 55° or lower, the members 15 and 16 would be conductively united establishing a by-pass or shunt around the electro-magnet 18 thereby de-energizing it. The de-energization of electro-magnet 18 would remove the air pressure from pipes 42 and 51 and so cause damper 20 to go to its full line position and damper 19 to its full line position so that the operation of the system would then proceed as hereinbefore described.

If after dampers 19 and 20 are returned to the full line position the temperature should further drop then thermostat 11' would function, as here-

inbefore described, and break the shunt around electro-magnet 23.

It is vitally necessary that the resistors 10 do not overheat. To this end applicant has positioned a thermostat 55 so as to be affected by them or the air passing thereover. If thermostat 55 is exposed to too great a heat contact is broken between 56 and 57 so that electro-magnet 58 becomes de-energized as this electro-magnet is in a circuit as follows: trolley T, manually operable switch 59, resistance 60, wire 61, electro-magnet 58, wire 62, contact 56, thermostat 55, contact 57, and wire 63 to common or ground. When the electro-magnet 58 is de-energized its armature 64 falls thereby de-energizing main circuit breaker 65 of the car, the circuit of which is as follows: trolley T, wire 66, electro-magnet or circuit breaker 65, wire 67, armature 64, and wire 68 to common or ground. When electro-magnet circuit breaker 65 is de-energized the armature 69 breaks contact with the general current supply 70 of the car from the trolley T.

If too much heat is generated by the resistors 10 the thermostat 55 controlling the circuits and apparatus described will cause the main circuit breaker 65 of the car to open thereby cutting off all energy, as is usual, from the resistors 10.

It is essential that the motor 5 is always operating while the resistors 10 are functioning. To this end the circuit of the motor 5 originates on a manually operable switch 7 which not only places the motor 5 in connection with electrical energy but also places the traction motors control circuits through wire 9 in connection with the electrical energy. By this means it is certain that motor 5 is always supplied with energy for the operation thereof when it is positioned to heat resistors 10 by the operation of the traction motors.

In Fig. 2 an auxiliary or supplementary means are shown which may be used with the arrangement as shown in Fig. 1. In this arrangement one portion of thermostat 71 is positioned adjacent the resistors 10 and another portion of the thermostat, the expansible and contractible member 72 is positioned outside of the duct 1 and has an operating rod 73 attached thereto cooperating with a damper 74 pivoted at 75. When the temperature of the air passing over 71 reaches a certain low limit, say 55°, the sylphon member 72 will have allowed the damper 74 to open to the position as shown in full lines in Fig. 2 and at the same time the damper 19 will have been moved to the dotted line position as shown in Fig. 2 so that not only is no air being taken from the outside atmosphere through the entrance 4 but all of the air moved by the fan 6 is not passing over the resistors 10 as part of it is flowing out through the opening 76 uncovered by damper 74, so that the remaining volume of air being less becomes more greatly heated in passing over the resistors 10. When it becomes so greatly heated that it raises the temperature 71 beyond, say, 55°, then the sylphon 72 through the rod 73 closes the damper 74 and opens the damper 19 and the system proceeds in the normal manner.

Another method of providing for a reduced temperature of the air passing over resistors 10 is shown in Fig. 3. Just before reaching resistor 11 the air is passed over sylphon 77 which as the temperature lowers gradually raises the damper 78 pivoted at 79 so that it decreases the available area of duct 1, consequently decreases the volume of air passing therethrough and so the volume

of air passing over resistors 10. As a consequence, the air which passes over the resistors 10 becomes more intensely heated and as it becomes more intensely heated causes the damper 78 to gradually move to its full line position as shown in Fig. 3.

From the hereinbefore given description, it will now be understood that applicant's system of heating and ventilating an electromotor operated car is such that it operates as a plenum system when heating is required in that it forces heated air into the space to be heated, and as an exhaust system when ventilation only is required, as at that time more air in volume is drawn out of the car than is returned thereto by the heating and ventilating duct 1 so that some air must leak in from available openings in the car.

Having described the principle and mode of operation of my invention and one particular physical embodiment thereof, it is desired to have it understood that the particular form described is illustrative merely but does not exhaust the possible physical embodiments of the idea of means underlying the invention.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. In a car heating system, in combination: a duct adapted for the passage of air there-
through, provided with a discharge opening communicating with a space to be heated, an inlet opening communicating with the space to be heated, and an inlet opening communicating with the outside atmosphere; an electrically driven air propeller positioned to discharge air through the discharge opening and to draw air into the duct through the inlet openings; traction motor resistors positioned in the duct between the air propelling means and the discharge opening thereof; supplementary electrically energizable heating resistors situated within the air duct in such position that all air leaving the discharge opening of the air duct must pass thereover; means for supplying energy to the supplementary resistors governed by the temperature of the space to be heated; a damper, said damper provided with a pivot and so positioned that the damper may close or open the entrance to the duct from the outside atmosphere; means governed by the temperature within the space to be heated to control the movement of the said damper whereby the entrance to the duct from the outside atmosphere is closed when the temperature of the space to be heated is below a predetermined minimum.

2. In a car heating system, in combination: a duct adapted for the passage of air therethrough, provided with a discharge opening communicating with a space to be heated, an inlet opening communicating with the space to be heated, and an inlet opening communicating with the outside atmosphere; an electrically driven air propeller positioned to discharge air through the discharge opening and to draw air into the duct through the inlet openings; traction motor resistors positioned in the duct between the air propelling means and the discharge opening thereof; supplementary electrically energizable heating resistors situated within the air duct in such position that all air leaving the discharge opening of the air duct must pass thereover; means for supplying energy to the supplementary resistors governed by the temperature of the space to be heated; a damper, said damper provided with a pivot and so positioned that the

damper may close or open the entrance to the duct from the outside atmosphere; means governed by the temperature within the space to be heated to control the movement of the said damper whereby the entrance to the duct from the outside atmosphere is closed when the temperature of the space to be heated is below a predetermined minimum; said duct provided with an opening to the outside atmosphere beyond the traction motor resistors in the direction toward the discharge opening of the duct; a damper mounted to pivot to cover and uncover said opening, said damper when open partially closing the air duct whereby a less volume of air can be propelled by the air propeller past the damper toward the discharge opening of the duct, said last mentioned damper when unclosing the opening allowing a portion of the air propelled by the air propeller to flow to the outside atmosphere whereby a greater volume of air is withdrawn from the space to be heated than is delivered thereto; and means governed by a maximum temperature of the space to be heated for controlling the operation of the last mentioned damper.

3. In a car heating system, in combination: a duct adapted for the passage of air therethrough, provided with a discharge opening communicating with a space to be heated, an inlet opening communicating with the space to be heated, and an inlet opening communicating with the outside atmosphere; an electrically driven air propeller positioned to discharge air through the discharge opening and to draw air into the duct through the inlet openings; traction motor resistors positioned in the duct between the air propelling means and the discharge opening thereof; supplementary electrically energizable heating resistors situated within the air duct in such position that all air leaving the discharge opening of the air duct must pass thereover; a thermostat positioned in the space to be heated; means governed by the thermostat for supplying energy to the supplementary resistors; a damper, said damper adapted to be movable and to be positioned to open or close the entrance to the duct from the outside atmosphere; means controlled by the thermostat for causing said damper to open or close the entrance to the duct from the outside whereby the entrance to the duct from the outside atmosphere is closed by the damper when the supplementary resistors are energized.

4. In a car heating system, in combination: a duct adapted for the passage of air therethrough, provided with a discharge opening communicating with a space to be heated, an inlet opening communicating with the space to be heated, and an inlet opening communicating with the outside atmosphere; an electrically driven air propeller positioned to discharge air through the discharge opening and to draw air into the duct through the inlet openings; traction motor resistors positioned in the duct between the air propelling means and the discharge opening thereof; supplementary electrically energizable heating resistors situated within the air duct in such position that all air leaving the discharge opening of the air duct must pass thereover; a damper, said damper adapted to close or open the entrance to the duct from the outside atmosphere; said duct provided with a second discharge opening positioned between the traction motor resistors and the supplementary resistors; a damper adapted to close or open the last named discharge open-

ing and when open to partially close the duct; a thermostat positioned in a space to be heated; means controlled by the last mentioned thermostat when the temperature of the space to be heated is above a predetermined maximum for causing the first mentioned damper to close the entrance to the duct from the outside atmosphere and to open the discharge opening to the outside atmosphere whereby the system acts as an exhaust system and the space to be heated receives additional air from the outside atmosphere through any available openings.

5. In a car heating system, in combination: a duct adapted for the passage of air therethrough, provided with a discharge opening communicative with the space to be heated, an inlet opening communicating with the space to be heated, and an inlet opening communicating with the outside atmosphere; an electrically driven air propeller positioned to discharge air through the discharge opening and to draw air into the duct through the inlet openings; traction motor resistors positioned in the duct between the air propelling means and the discharge opening thereof; supplementary electrically energizable heating resistors situated within the air duct in such position that all air leaving the discharge opening of the air duct must pass thereover; means for supplying energy to the supplementary resistors governed by the temperature of the space to be treated; a damper, said damper provided with a pivot and so positioned that the damper may close or open the entrance to the duct from the outside atmosphere; and means to control the movement of the damper whereby the entrance to the duct from the outside atmosphere may be closed and opened selectively.

6. In a car heating system, in combination: a duct adapted for the passage of air therethrough, provided with a discharge opening communicating with a space to be heated, an inlet opening communicating with the space to be heated, and an inlet opening communicating with the outside atmosphere; an electrically driven air propeller positioned to discharge air through the discharge opening and to draw air into the duct through the inlet openings; traction motor resistors positioned in the duct between the air-propelling means and the discharge opening thereof; supplementary electrically energizable heating resistors situated within the air duct in such position that all air leaving the discharge opening of the air duct must pass thereover; means for supplying energy to the supplementary resistors governed by the temperature of the space to be heated; said duct provided with an opening to the outside atmosphere beyond the traction motor resistors in the direction toward the discharge opening of the duct; a damper mounted to pivot to cover and uncover said opening, said damper being movable to control the volume of air propelled by the air propeller past the damper toward the discharge opening of the duct, said damper when unclosing the opening allowing a portion of the air propelled by the air propeller to flow to the outside atmosphere whereby a greater volume of air is withdrawn from the space to be heated than is delivered thereto; and means governed by a maximum temperature of the space to be heated for controlling the operation of the damper.

7. In a car heating system, in combination: a duct adapted for the passage of air therethrough, provided with a discharge opening communicating with a space to be heated, an inlet

opening communicating with the space to be heated, and an inlet opening communicating with the outside atmosphere; an electrically driven air propeller positioned to discharge air through the discharge opening and to draw air into the duct through the inlet openings; traction motor resistors positioned in the duct between the air-propelling means and the discharge opening thereof; supplementary electrically energizable heating resistors situated within the air duct in such position that all air leaving the discharge opening of the air duct must pass thereover; means for supplying energy to the supplementary resistors governed by the temperature of the space to be heated; a damper, said damper provided with a pivot and so positioned that the damper may close or open the entrance to the duct from the outside atmosphere; means governed by the temperature within the space to be heated to control the movement of the said damper whereby the entrance to the duct from the outside atmosphere is closed when the temperature of the space to be heated is below a predetermined minimum; said duct provided with an opening to the outside atmosphere beyond the traction motor resistors in the direction toward the discharge opening of the duct; a damper mounted to pivot to cover and uncover said opening, said damper being movable to control the volume of air propelled by the air propeller past the damper toward the discharge opening of the duct, said last named damper when unclosing the opening allowing a portion of the air propelled by the air propeller to flow to the outside atmosphere whereby a greater volume of air is withdrawn from the space to be heated than is delivered thereto; and means governed by a maximum temperature of the space to be heated for controlling the operation of the last mentioned damper.

8. In a car heating system, in combination: a duct adapted for the passage of air therethrough provided with a discharge opening communicating with a space to be heated, an inlet opening communicating with the space to be heated, and an inlet opening communicating with the outside atmosphere; an electrically driven air propeller positioned to discharge air through the discharge opening and to draw air into the duct through the inlet openings; traction motor resistors positioned in the duct between the air propelling means and the discharge opening thereof; supplementary electrically energizable heating resistors situated within the air duct in such position that all air leaving the discharge opening of the air duct must pass thereover; said duct provided with a second discharge opening positioned beyond the traction motor resistors in the direction toward the discharge opening of the duct; a damper adapted to close and open selectively the last-named opening to control discharge of air from the duct to the outside atmosphere, and means to operate said last-named damper.

9. In a car heating system, in combination: a duct adapted for the passage of air therethrough, provided with a discharge opening communicating with a space to be heated, an inlet opening communicating with the space to be heated, and an inlet opening communicating with the outside atmosphere; an electrically driven air propeller positioned to discharge air through the discharge opening and to draw air into the duct through the inlet openings; traction motor resistors positioned in the duct between the air propelling means and the discharge opening thereof; supplementary

electrically energizable heating resistors situated within the air duct in such position that all air leaving the discharge opening of the air duct must pass thereover; a damper, said damper adapted to close or open the entrance to the duct from the outside atmosphere; means to operate said damper, said duct provided with a second discharge opening positioned beyond the traction

motor resistors in the direction toward the discharge opening of the duct; a damper adapted to close and open selectively the last-named opening to control discharge of air from the duct to the outside atmosphere and means to operate said last-named damper. 5

ROBERT J. PARSONS.