

June 2, 1953

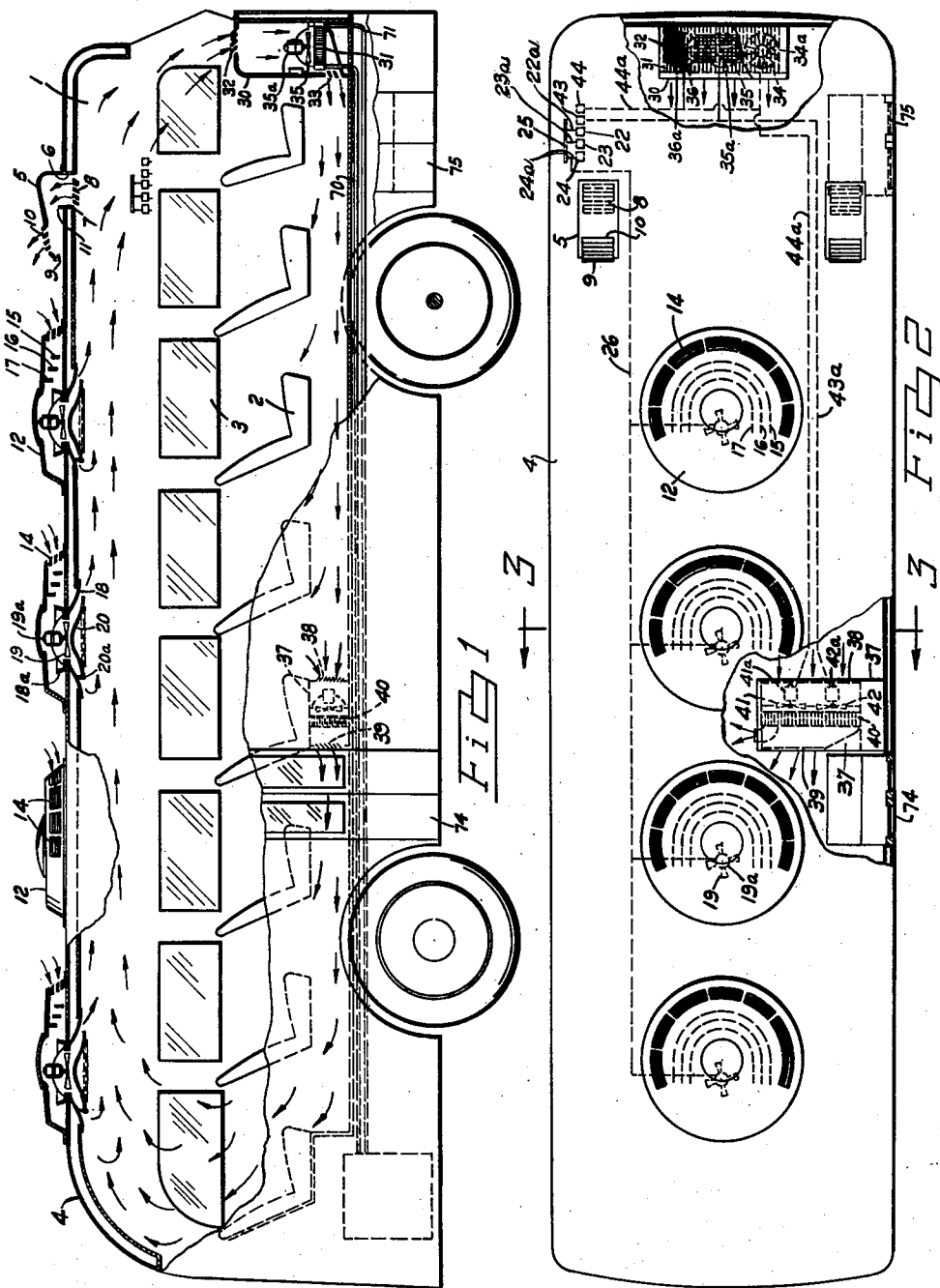
E. E. HANS

2,640,409

AIR FRESHENING SYSTEM

Filed June 3, 1949

4 Sheets-Sheet 1



INVENTOR.
Edmund E. Hans
BY *Ernest E. Lewis*
Attorney.

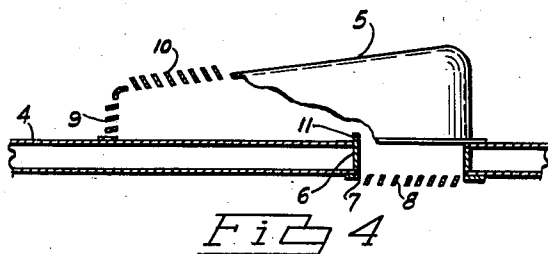
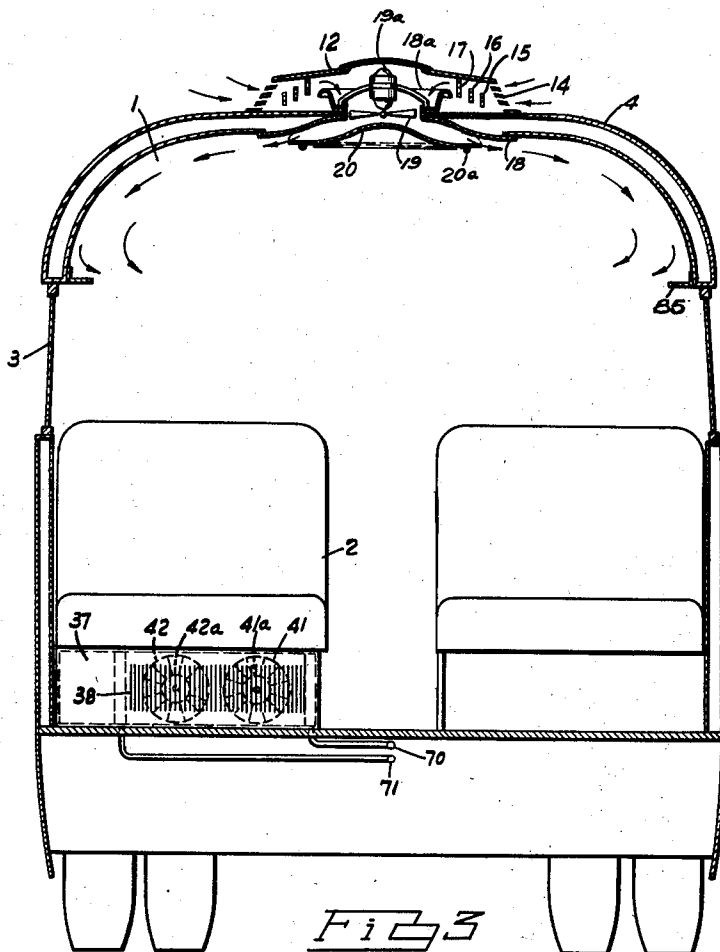
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4 Sheets-Sheet 2



INVENTOR.
Edmund E. Hans
BY *Charles E. Baldwin*
Attorney

June 2, 1953

E. E. HANS

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AIR FRESHENING SYSTEM

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4 Sheets-Sheet 3

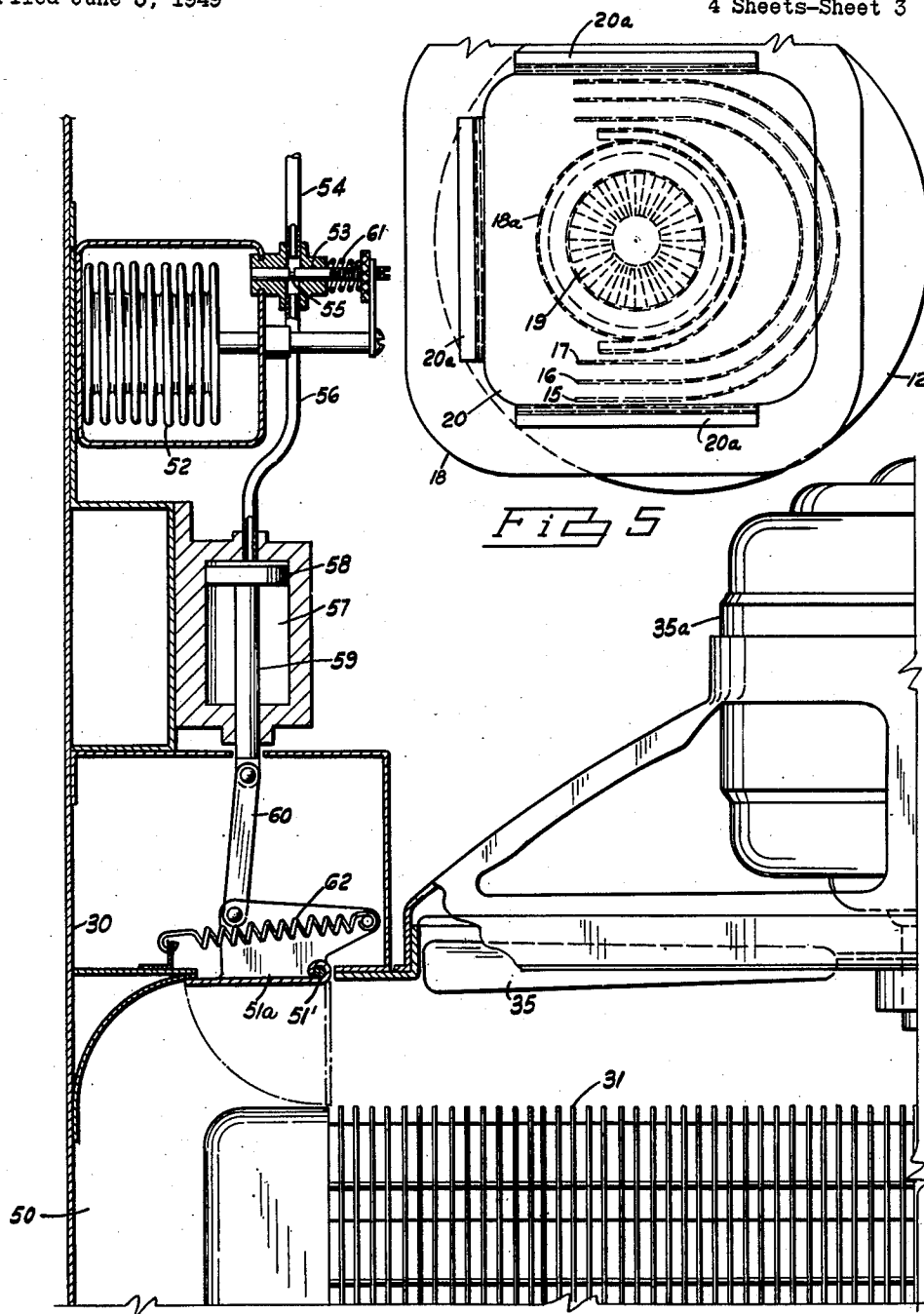


Fig 7

INVENTOR.

Edmund E. Hans

BY

Ernest R. Baldwin

Attorney.

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E. E. HANS

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4 Sheets-Sheet 4

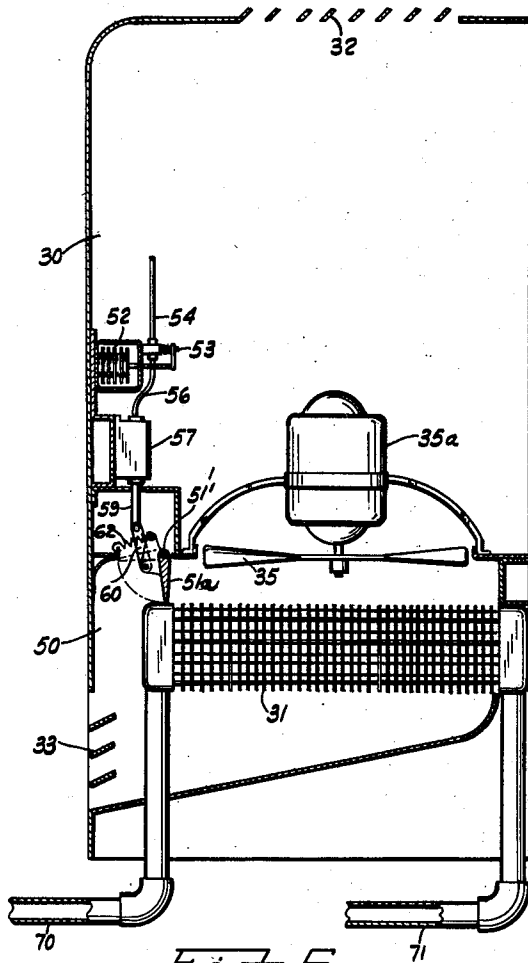


FIG 6

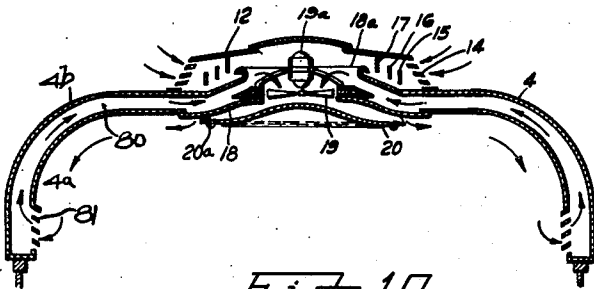


FIG 10

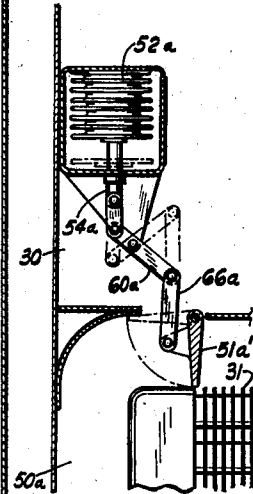


FIG 8

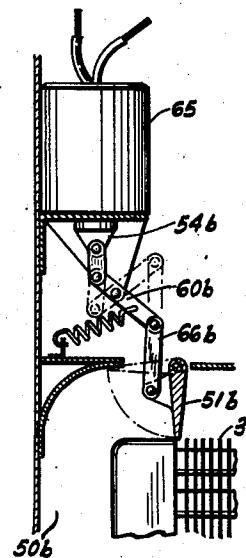


FIG 9

INVENTOR.

Edmund E. Hans

BY

Charles R. Rabin

Attorney

UNITED STATES PATENT OFFICE

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AIR FRESHENING SYSTEM

Edmund E. Hans, Detroit, Mich.

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3 Claims. (Cl. 98—10)

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This invention relates to improvements in air freshening systems for use in the interior of closed bodies, such as busses or rooms of buildings.

In most closed vehicle bodies it is customary at the present time to provide a heating system having a capacity of around 500 cubic feet of air a minute, with the result that in cold weather the equipment operating at full capacity heats and discharges the same air again and again so that it soon becomes vitiated and evil smelling. Even in cases where provision is made for admitting some fresh air from outside, this air is usually induced through cramped ducts at excessive expenditure of electricity. This invention aims to provide an air freshening system wherein a free flow of fresh air is immediately available to fans mounted in the roof so that a much larger influx of fresh air is economically furnished, and to provide means for heating and circulating about 2,000 cubic feet of air per minute with the result that the air is at all times clean and sweet. Moreover in order to maintain a rapid exchange of air within the closed body I also provide a vent in the roof so positioned as to increase the air circulation without causing a draft.

One object of the invention is to provide an air freshening system including means for heating air within the body or room and discharging it rearwardly therein at a low elevation whereupon this air rises at the rear and flows back at a higher level; to provide a series of longitudinally spaced fresh air inlet housings in the roof in communication with the outside and a fan in each housing whereby such a large volume of fresh air is normally discharged into the body or room that a slight but measurable pressure is maintained therein; and also to provide a vent housing on the roof adjacent the front of the body or room through which some of the air escapes thereby assisting in drawing the air in the upper portion of the body or room forward so that air not liberated through the vent is returned for reheating and recirculation.

Another object of the invention is to provide an air freshening system including a heating unit adjacent the front and another intermediately of the length of the body or room so arranged that both units discharge heated air rearwardly, and to provide sufficient heating and discharging capacity in these units not only to insure maintenance of the air flow cycle when all the fans are in operation, but which will maintain the flow cycle even when some of the fans have been stopped because the air within the body or room has reached a predetermined temperature.

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Another object of the invention is to provide an air freshening system including a plurality of inlet housings (more fully described in my copending application, Serial No. 96,791, filed June 2, 1949) through which a large volume of fresh air may be discharged substantially horizontally immediately adjacent the roof of the room or body so that it mingles there with tempered air therein in such a manner that no cold unmixed air strikes the occupants of the room or body; and automatic means operated by the temperature within the room or body for controlling the volume of fresh air so discharged, so that by increasing the volume of fresh air brought in it is often unnecessary to reduce the amount of air circulated by the units. In that way it is often practicable to utilize all the heat that may be extracted from the heater cores by increasing the volume of fresh air and thus increasing the total volume of air flowing around its prescribed path.

A further object of the invention is to provide an air freshening system including means for automatically bypassing some of the air in the units around the heater cores therein when the air within the body or room has reached a predetermined temperature, to insure a sufficient air flow from the units to maintain the flow cycle without unduly raising the temperature of the air within the room or body.

Figure 1 is a vertical section of a body of a bus showing my air freshening system therein, and

Figure 2 is a plan view thereof.

Figure 3 is an enlarged section on the line 3—3 of Figure 2.

Figure 4 is an enlarged detail showing a side view, partly in section of the vent housing.

Figure 5 is an inverted plan of one inlet housing.

Figure 6 is an enlarged detail showing one heating unit and one form of automatic means for operating a closure for a bypass passage therein; the closure being shut.

Figure 7 is a further enlarged view of part of Figure 6 but showing the closure open.

Figures 8 and 9 are modified arrangements of the automatic means for actuating the bypass closure.

Figure 10 shows a modified form of an inlet housing.

In the drawings and in the specification which follows the invention is shown and described applied to a bus, but obviously it is equally applicable to a room or hall in a building.

Referring to the drawings, 1 designates a closed body, in the present instance the body of a bus, having seats 2 therein and windows 3 and

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a roof 4. Mounted on the latter, preferably centrally of its width and a short distance from the front is a vent housing 5 having a downwardly projecting tubular portion 6 at the front which fits into and extends through an opening 7 formed through the roof 4. This tubular portion 6 is provided at its lower extremity with downwardly and rearwardly inclined louvres 8 the undersides of which are substantially flush with the underside of the roof 4. Formed in the back of the vent housing 5 and across the rear portion of the top of the latter are other louvres 9 and 10 respectively. The louvres 9 are preferably downwardly and rearwardly inclined, and the louvres 10 are generally upwardly and rearwardly arranged. Moreover the louvres 10 are spaced rearwardly relative to the outlet 7 and an upwardly projecting flange 11 is formed across the said outlet to prevent any rain which finds its way through the louvres 9 and 10 dropping into the body 1.

Mounted on the roof 4, preferably centrally of its width, at spaced intervals therealong, are a plurality of circular air inlet housings 12 the front one of which is spaced behind the vent housing 5. These inlet housings 12 are closed on the top and formed through the periphery of each housing across the front and along both sides past its vertical axis are a plurality of louvres 14. Mounted within the housing are a plurality of U-shaped baffles 15, 16 and 17, which are spaced concentrically from one another in vertically overlapping relation. The bottom baffle 15, which is longest extends upwardly from adjacent the roof 4; the central baffle 16, which is of intermediate length, projects both above and beneath the top of the baffle 15; and the top baffle 17, which is shortest, extends downward from adjacent the closed top of the housing to beneath the top of the baffle 16. All the baffles 15, 16 and 17 project rearwardly beyond the rearmost louvres 14 on both sides of the housing, and also behind the vertical axis of a fan 19 mounted therein.

Formed through the roof 4 somewhat rearwardly of, but in longitudinal alignment with, the axis of each inlet housing 12 is an opening around the underside of which an annular guide member 18 is secured which is generally downwardly and outwardly inclined and has its outer margin outwardly flared so that it merges with the underside of the roof 4. Extending upwardly from the roof 4 coaxial with the guide member 18 is an upwardly and outwardly inclined collar 18a. Mounted in each housing 12 coaxial with the member 18 and collar 18a is an electrically operated fan 19 adapted to discharge fresh air from within the housing into the body 1; and suitably supported beneath and coaxial with the fan is an imperforate deflector plate 20 raised at the center and formed so that its margin is usually spaced beneath the member 18. Since in quite cold weather fresh air discharged laterally and rearwardly into the body may tend to cause a perceptible draft, means may be provided for decreasing the amount of fresh air discharged into the body in those directions. For this purpose marginal portions 20a may be hinged on the plate 20 which can be either partly or fully upturned to partly or fully close the outlet in any one or all of those directions, though other means may be employed for that purpose. Moreover to prevent air discharged laterally from the inlet housings 12 flowing transversely beneath the roof 4 and down immediately adjacent the sides of

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the body 1 to cause a draft on people seated adjacent to said sides longitudinally arranged fins 25 may be provided to project inwardly from the sides of the body a short distance beneath the roof. These fins interrupt any downward flow of air and divert it so that it turns more or less horizontally toward the center of the body where it becomes mixed with forwardly flowing air.

Regarding the formation of the inlet housings 12, it will be noted that the baffles 15, 16 and 17 prevent any concentrated inward surge of air into the housings even when the latter are mounted on the top of a bus travelling at a high rate of speed. Due also to the fact that the louvres 14 extend rearwardly past the center of the housings any tendency for fresh air entering at the front through the said louvres to flow past the fan 19 when the latter is not in operation is offset by the tendency for air around the fan to flow upwardly and outwardly through the rear portions of the said louvres 14. Consequently the air in the central portion of each housing 12 is substantially balanced, that is there is no marked tendency for it to flow in either direction so that it remains substantially static when the fans 19 are inoperative.

Suitable means are provided for setting the fans 19 in operation and gradually increasing their speed of rotation as the temperature in the body 1 increases. In order to maintain a uniform flow of fresh air into the body throughout its length the motors 19a on all the fans 19 are started simultaneously; this occurs when the interior of the body reaches a predetermined temperature and then the fans are first rotated slowly. When the temperature within the body reaches an intermediate temperature the speed of all the fans is increased, and when a further increase in temperature occurs therein all the fans operate at their maximum speed. In the present instance this is done by means of three thermostatic switches 22, 23 and 24 (Figure 2) set to close at different temperatures, these switches are connected by leads 22a, 23a and 24a respectively to a resistor 25. From the resistor 25 a connection 26 extends to all the motors 19a the opposite sides of which are grounded. It is however understood that any other means may be substituted for automatically controlling the speed of the fans 19 according to the temperature within the body 1. For the sake of simplicity the source of electrical energy and the leads therefrom to the switches 22, 23 and 24 are not shown in the drawings.

Mounted on or adjacent the floor of the body 1 adjacent the front thereof is a heating unit 30 having a horizontal heater core 31 therein, and an inlet 32 and outlets 33 on opposite sides of the core so that air induced into the said unit by fans 34, 35 and 36 therein is discharged through the core 31 and the outlets 33 which are rearwardly or substantially rearwardly directed at a low elevation in the said body. 37 denotes another heating unit arranged immediately of the length of the body 1 and preferably located adjacent floor level therein beneath one of the seats 2 to boost the rearward flow of the heated air. Provided in the unit 37 are front air inlets 38, rear air outlets 39 and a vertical heater core 40, together with fans 41 and 42 for inducing a flow of air through the inlets 38 and discharging it through the said heater core and rearwardly or substantially rearwardly through the outlets 39. The operation of the fans 34, 35, 36, and 41 and 42 is electrically controlled in the

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following manner by thermostatically operated switches 43 and 44 which are generally located adjacent the switches 22, 23 and 24.

The switch 43 is connected by a lead 43a to the motors 35a and 42a which operate the fans 35 and 42 respectively, and the switch 44 is connected by a lead 44a to the motors 36a, 34a and 41a which operate the fans 36, 34 and 41 respectively. Both the switches 43 and 44 are normally closed but when the air immediately adjacent the switch 43 reaches a predetermined temperature it opens so that the fans 35 and 42 are no longer operated, and when the air around the switch 44 reaches a second and higher temperature it also opens so that the fans 36, 34 and 41 also become inoperative.

However in both heating units 30 and 37 adjacent the fans 35 and 42 a bypass passage 50, Figures 6 and 7, is provided to one side of the heater core 31, or 40, and the inlet to the said passage is controlled by a closure 51 so arranged that in one position of the latter air discharged by the fan 35, or 42, passes only through the heater core 31, or 40, and when the closure is in its other position some of the air discharged by the fan flows unheated through the passage 50 and rearwardly through the unit outlet 33, or 39. In Figures 6 and 7 a bellows-type thermostat 52 is shown which, when it expands, moves a rod 53 axially so that suction exerted through a suction line 54, which in the case of a bus installation may be connected to the intake manifold of the engine, is also exerted around an annular groove 55 in the said rod and through a pipe 56 which is connected to one extremity of a cylinder 57. Thus suction then raises a piston 58 in the cylinder and a rod 59 connected to the said piston. Pivotaly mounted on the opposite end of the rod 59 is a link 60 which is also pivoted to the closure 51 which, in turn, is hingedly mounted at 51' in the heating unit 30, or 37. By upward movement of the rod 59 the closure 51a is moved from its position shown in Figure 6 to that shown in Figure 7, whereupon some of the air discharged by the fan 35, or 42, flows through the bypass passage 50. When the thermostat 52 contracts, a spring 61, mounted around the rod 53, moves the latter axially so that the annular groove 55 is no longer opposite the suction line 54 and pipe 56, then a spring 62 connected at one extremity to the heating unit 30, or 37, and at its opposite extremity to the closure 51a returns the closure to its closed position shown in Figure 6.

Figure 8 shows a modified form of control for the closure 51a'. The thermostat 52a has a rod 54a extending from its extensible extremity, so that upon outward movement of the said rod an arm 63a, pivoted intermediately of its length on a fixed member mounted in the casing 30, or 37, and at its opposite extremities on the rod 54a and a link 66a respectively, moves a link 66a connected to the pivoted closure 51a and opens the latter. Upon contraction of the thermostat 52a the closure 51a' is shut, as shown in Figure 8, to prevent air discharged by the fan entering the bypass passage 50a.

In Figure 9 another modified form of control for the closure 51b is shown. In this case a solenoid 65 is employed which is connected to the thermostatic switch 44 so that when the latter opens to cut off operation of the fans 35 and 42, the said solenoid is actuated to move the plunger 54b outward, thereby swinging an arm 60b about

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its central axis and moving the link 66b to open the closure 51b.

The operation of my air freshening system is as follows: When the interior of the body 1 is cold, water from any suitable source flows into and from the heater cores 31 and 40 through piping as shown at 70 and 71 in Figure 6. Air is induced into the units 30 and 37 by the fans 34, 35, 36, 41 and 42, and is discharged through the heater cores 31 and 40 and rearwardly in the body 1. In this manner a very large volume of air is not merely heated and discharged rearwardly into the body 1, but is set in motion in the said body in such a manner that a definite flow cycle is established. The heater air flows to the rear of the body substantially horizontally at a low level, turns upwardly at the back and returns at a higher level. As soon as the temperature of the air within the body immediately adjacent the thermostatic switches 22, 23, and 24 reaches the temperature at which the switch 22 is set to close, the fans 19 in the inlet housings 12 rotate relatively slowly and deliver some air into the top of the body. Moreover due to the curvature of the outer annular portion of the walls 18 and the arrangement of the plates 20 the air discharged into the body from the said inlet housings 12 to a large extent flows immediately adjacent the inner side of the roof 4, though it shortly mingles with some of the forwardly returning air originally discharged by the fans 34, 35, 36, 41 and 42. Moreover this forward air flow, both of the fresh air and of the circulated, heated air, is expedited by the tendency for it to pass out through the vent housing 5. As the temperature of the air immediately adjacent the thermostatic switches further increases, first the switch 23 is closed whereupon the speed of rotation of the fans 19 is increased, and then, when the temperature reaches a still higher point, the switch 24 is closed so that the fans then rotate at their maximum speed. The volume of air then delivered into the body 1 is such that in spite of leakage around the windows 3 and doors 74 and 75 a slight but measurable pressure is maintained within the said body. This pressure, due to the provision of the vent housing 5, further insures maintenance of the flow cycle. Consequently during winter weather irrespective of the fact that a very large volume of heated air is discharged by the fans in the heating units 30 and 37 enough fresh air is discharged into the body by the fans 19 to offset the heat given off by the heater cores 31 and 40, with the result that when my air freshening system is installed in a bus which may be crowded with passengers in dirty working clothes the air is always fresh and clean. Moreover all the heat that may be satisfactorily withdrawn from the water in the heater cores may be advantageously utilized.

During milder weather if the temperature within the body rises above a predetermined temperature, say 70 degrees adjacent the switch 43, the latter opens so that a materially less amount of air passes through the heater cores 31 and 40 for reheating and recirculation. Even then, however, sufficient circulation is maintained by the fans 34, 36 and 41, which remain in operation so long as the second switch 44 is closed, to insure a proper flow cycle as above outlined. However at a higher temperature or at the temperature at which the switch 23 is opened, the bypass passage 50 is opened, so that some of the air discharged by the fans 34, 36 and 41 is discharged unheated from the units 30 and 37. In some cases of course this lowers the temperature of the air immedi-

ately adjacent the switch 43 so that it is again closed; such a drop in temperature would of course also result in the closing of the passage 50.

In summertime operation of the fans 19 in the inlet housings 12 insures a plentiful supply of fresh air, and as this air is drawn from above the top of the roof it is relatively clean and sweet. In this way too the interior of the body is kept relatively cool.

In parts of the country where very severe cold is experienced it is sometimes desirable to warm the fresh air somewhat prior to its discharge into the body 1 from the inlet housings 12. In that case, as shown in Figure 10, lateral passages 80 may extend outwardly between the inner and outer roof portions 4a and 4b and terminate at their outer extremities in louvers 81 opening into the upper part of the body on opposite sides thereof. The collar 18a is mounted around the inner, upper extremities of the passages 80 so that air from within the body is drawn in by the fan 19 to mix with the fresh air and raise the temperature of the latter prior to its discharge into the body by the fan.

What I claim is:

1. An air freshening system for closed bodies including a plurality of spaced heating units arranged adjacent floor level for heating air withdrawn from within the body, fans in the units for withdrawing the air and discharging it substantially horizontally in a rearward direction in the body whereby this heated air rises at the rear and flows forwardly at a higher elevation, a plurality of separate, spaced air inlet housings mounted in the top of the body, each housing opening directly to the outside and also into the body, fans in the housings for drawing in outside air and discharging it into the body, means in each housing for balancing the tendency for air to flow there-through in either direction when the fan therein is stationary, so that then air flows in neither direction through the housing, thermostatic means for increasing the speed of rotation of the housing fans as the temperature of the air in the body increases whereby when said fans are operating at relative high speed a slight positive pressure is maintained in the body, means in the housings for directing incoming air whereby it flows forward in the body adjacent the top thereof and gradually mixes with the forwardly flowing heated air, and a vent housing in the top of the body adjacent the front having outlet passages so arranged therein whereby some air within the body escapes through them when a slight positive pressure is being maintained in said body.

2. An air freshening system for closed bodies including a plurality of spaced inlet housings mounted on the roof of the body, a separate fan in each inlet housing for discharging fresh air into the body through an opening in the roof, means for guiding the air from the fans whereby it is discharged into the body immediately beneath the underside of the roof and parallel

therewith, an air tempering unit in the body adjacent the front thereof having inlet and outlet openings discharging immediately into the body near the bottom, heating means and fans therein, said fans being adapted to induce a flow of air into the unit and to discharge it through the heating means rearwardly in the body to the back thereof where it rises and then flows back at a higher elevation and mixes with the fresh air to maintain a flow cycle within the body, and thermostatically controlled means for decreasing the number of fans in operation in the tempering unit as the temperature of the air in the body increases.

3. An air freshening system for closed movable bodies including a plurality of spaced air inlet housings mounted on the top of the body, openings formed in the top of the body communicating with the interior of the body and the housings, forwardly facing openings in the housings communicating with the atmosphere, independent means in each housing for discharging fresh air therethrough into the body to maintain a slight air pressure in the latter, an air tempering unit having an air inlet and outlet and a heater core therein, means in the unit for inducing a flow of air from within the body through the inlet and discharging it through the heater core and outlet and rearwardly in the body to the back thereof where the air rises and then flows toward the front at a high elevation, and a vent housing on the top of the body through which some air is adapted to escape from within said body.

EDMUND E. HANS.

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