Oct. 4, 1949. W. B. DEAN ET AL 2,483,995

HEATING SYSTEM FOR MULTIPLE-ROOM VEHICLES

Filed March 17, 1945 2 Sheets-Sheet 1

FIG. 1

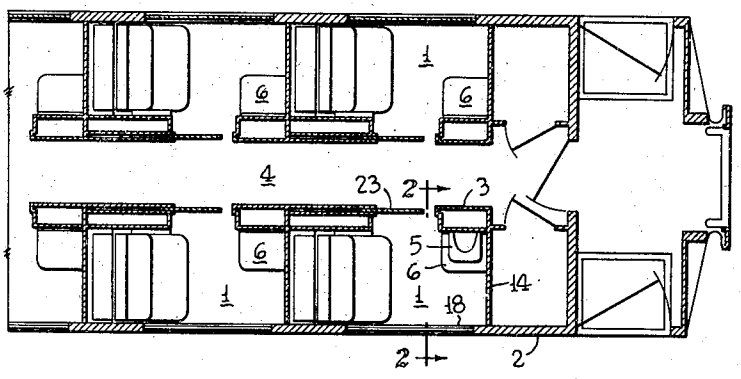

FIG. 2

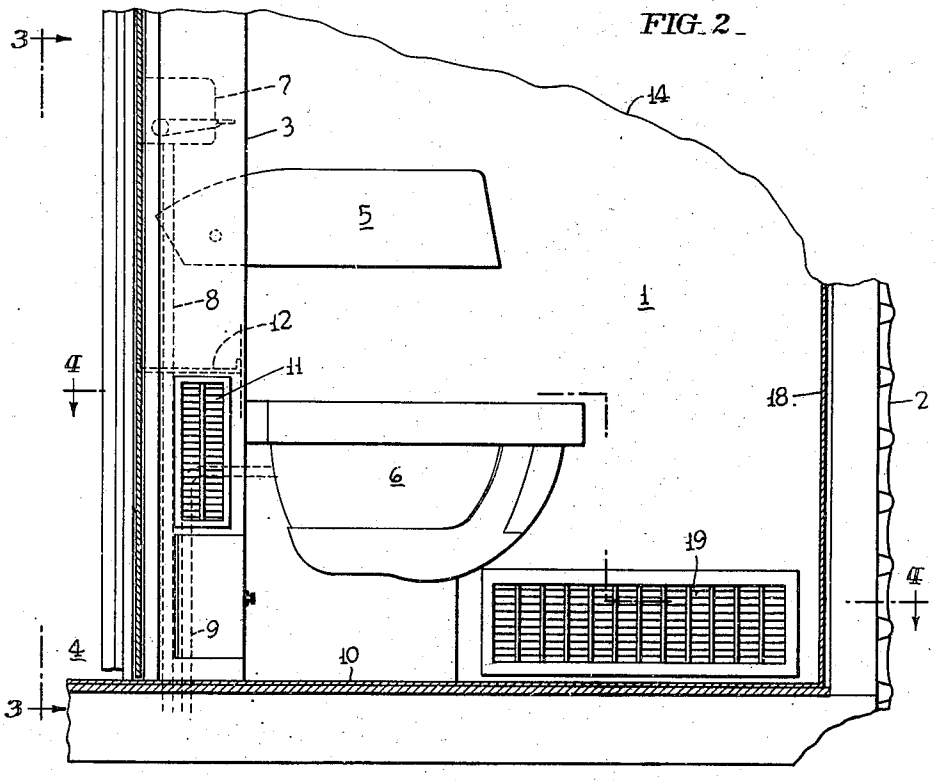

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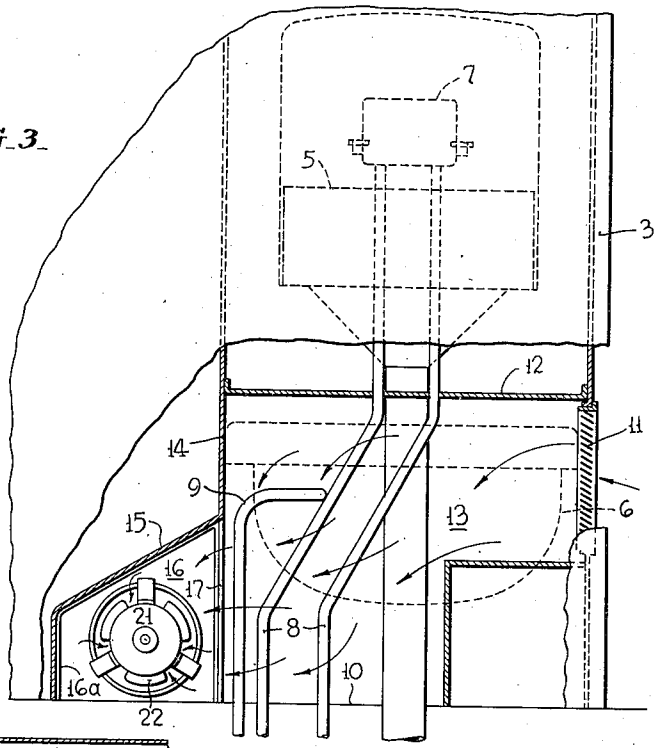
FIG. 3.



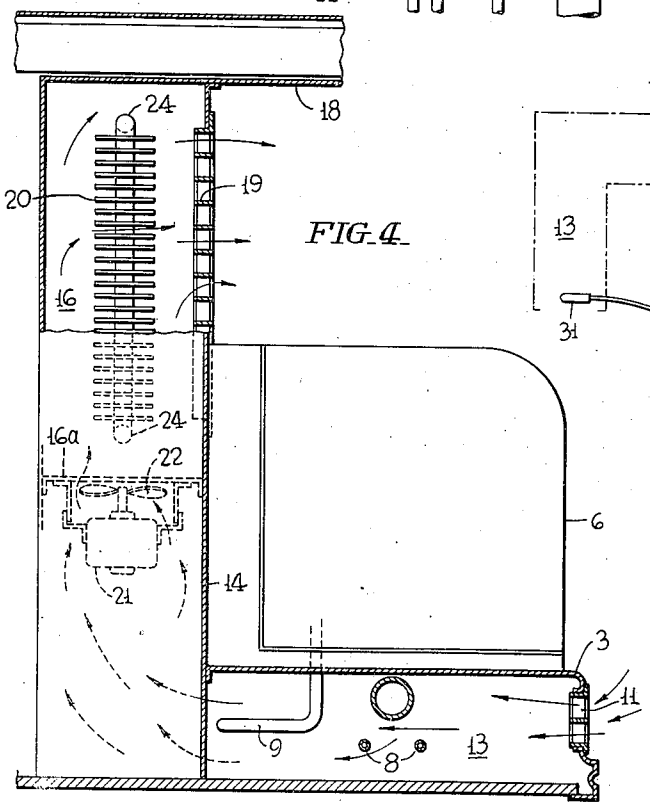


FIG. 4.

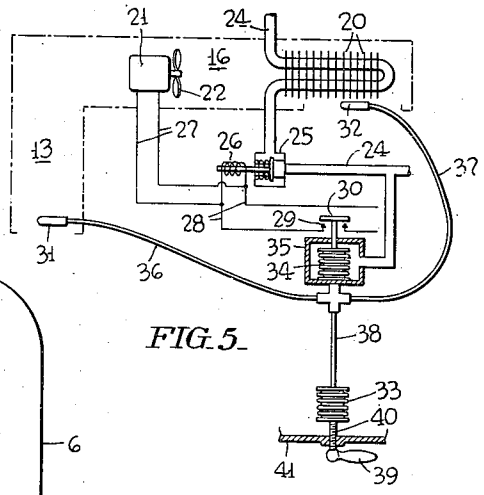


FIG. 5.

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HEATING SYSTEM FOR MULTIPLE-ROOM VEHICLES

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9 Claims. (Cl. 237—6)

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This invention relates to a heating system, particularly to a heating system for heating the individual rooms of a multiple-room railway car or other vehicle.

As is well known, it is common practice to provide a railway car or other transportation vehicle with a plurality of individual rooms for single or multiple occupancy. The present invention is directed to individual unit floor heaters for the rooms of vehicles of this character and has for one of its objects the provision of a new and novel heating system wherein the temperature of each room can be controlled independently of the temperatures of the other rooms.

Another object is to provide a vehicle room heating arrangement wherein certain of the walls of each room are arranged to provide an air circulating duct within which a heating unit is positioned.

Another object is to provide such a room heating arrangement wherein a forced-air circulating duct extends along the floor of the vehicle in association with certain walls of the room and is provided with an air outlet which opens into the room adjacent the floor and an air inlet from the room which is remotely located from but at a level above the air outlet, and, further, wherein the water pipes for the toilet facilities may be located in the duct and in which, in the absence of forced circulation, the air in the room may circulate by thermo-syphon action back through the duct and about such water pipes.

A further object is to provide a floor heating unit of the foregoing character with an improved control means of such nature that operation of the heating unit is responsive to predetermined temperature relations between the temperature of the air at the duct inlet and the temperature of the air at the duct outlet.

With the above and other objects in view which will be apparent from the following description to those skilled in the art to which the invention appertains, the present invention consists in certain features of construction and combinations of parts to be hereinafter described with reference to the accompanying drawings, and then claimed.

In the drawings which illustrate the present invention in one of its preferred forms,

Figure 1 is a fragmentary diagrammatic plan view of a multiple room railway car;

Figure 2 is a fragmentary transverse vertical section through one of the rooms, taken substantially on the line 2—2 of Figure 1;

Figure 3 is a fragmentary side elevation taken

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in the direction of lines 3—3 of Figure 2, a portion of the side wall of the room being broken away to show the air circulating duct arrangement;

Figure 4 is a section taken approximately on line 4—4 of Figure 2; and

Figure 5 is a schematic diagram of the control means for the heating unit.

Referring to the accompanying drawings in which like numerals refer to like parts throughout the several views, the present invention is directed to a system and arrangement for individually heating the individual rooms 1 of a multiple room vehicle, such as a railway car 2.

In the particular arrangement shown for illustration, the wall 3 of the room 1 adjacent the car aisle 4 is of hollow construction and supports a wash basin 5 which is pivotally movable into the wall, and a toilet bowl 6. The wall 3 also supports a hot and cold water fixture 7, shown in broken outline in the drawings, which is concealed by the basin 5 when the basin is folded into the wall.

The water pipes 8 for the fixture 7 and the water pipe 9 for the toilet bowl 6 extend from the car floor 10 upwardly within the wall 3 as shown in Figures 3 and 4.

The door jamb end of the hollow wall 3 is provided with an air inlet grille 11 which is elevated above the floor 10 and disposed above the grille 11 and extending for the length of the wall 3 between the sides thereof is a horizontal partition 12, the pipes 8 extending upwardly through the partition 12. The wall space within which the water pipes 8 and 9 are located and which is defined by the floor 10, the partition 12, and the spaced sides and ends of the wall provides an air circulating chamber 13 which receives air from the room and from the aisle 4 through the grille 11.

Associated with the end wall 14 which joins with the one end of side wall 3 but located in the next adjacent room is a partition member 15 which extends between the side walls of the next adjacent room and forms with the end wall 14 an air passage 16. The wall 14 is provided with an opening 17 which places the passage 16 and the chamber 13 in communication with each other. The end wall 14 adjacent the floor 10 and the other side wall 18 is provided with an air outlet opening which is covered with an air outlet grille 19.

A steam heating coil or unit 20 is located within the passage or duct 16 adjacent the outlet grille 19, and supported by an apertured parti-

tion 16a which extends across the duct 16 is an electric motor 21 which drives a circulating fan 22.

The fan 22 draws air from the floor region inwardly through grille 11, through the chamber or duct 13 about the water pipes 8 and 9 and thence into duct 16, forces the same about the heating unit 20 and discharges the same in heated condition into the room 1 adjacent the floor through the grille 19.

It is to be understood, of course, that when the door 23 for the room is open some air from the aisle 4 of the car may be drawn by fan 22 through the grille 11. It is also to be understood that fresh air may be admitted into the car and individual rooms at any convenient location, as is well known practice, which mixes with the air in the room and recirculates through the ducts described.

The circulation of the air in the manner described insures the maintainence of a desired temperature at the floor region since some of the heated air travels diagonally from grille 19 across the floor before entering the inlet grille 11. Another advantage of the construction described is that the passage of the recirculating heated air over the water pipes 8 and 9 maintains the duct 13, in which the pipes are located, relatively warm all the way to the floor. This is a material aid in cold weather in preventing the pipes from freezing. When the fan 22 is not in operation, some of the heated air from the room will, by reason of the fact that the inlet grille 11 is disposed at a level above the outlet grille 19, thermosyphon back through grille 19 and thence through duct 16 into duct 13 and out through grille 11 to maintain the duct 13 substantially at the temperature of the room.

One preferable control for the heating system is diagrammatically shown in Figure 5. In this control arrangement, the steam pipe 24 for the heating unit 20 is provided with a normally closed valve 25 which is actuated to open position by a solenoid 26, the solenoid being in parallel with the electrical leads 27 to the motor 21. Arranged in one of the leads 28 for the solenoid 26 and motor leads 27 is a pair of contacts 29 arranged to be bridged by a switch element 30 in order to energize the circuit described.

The system is thus under the control of switch element 30. The switch element 30 is controlled by a differential temperature control system, which system includes a bulb 31 located in the duct 13 at the air inlet, a bulb 32 located in the duct 16 at the heated air outlet, a manually adjustable bellows 33, and a bellows 34 contained within a box 35 connected to the steam conduit 24, the switch element 30 being connected to the bellows 34 for actuation by the expansion and contraction of the bellows 34.

The bulbs 31 and 32 and bellows 33 are connected by conduits 36, 37 and 38, respectively, with the bellows and this bulb, bellows and conduit arrangement contains a volatile liquid, which through the bulbs 31 and 32 is responsive to the temperature of the air entering through grille 11 and exhausting through grille 19, respectively. When the temperature of the air adjacent the floor is below normal, that is, below the temperature for which the system is adjusted, bellows 34 is contracted and switch element 30 bridges the contacts. In this condition, solenoid 26 is energized to open the steam valve 25 and the motor is energized to operate fan 22, whereby the air is circulated over the heating unit 20. The heated air exhausting through grille 19 causes the liquid in bulb 32 to volatilize to increase the pressure in the control system. Likewise, the temperature of the recirculating air entering through grille 11 causes a similar volatilization of the liquid in bulb 31 and thus when there is a proper temperature of the air leaving the duct system through grille 19 and the temperature of the air entering the duct system through grille 11, or both, the pressure developed by the volatilization of the liquid causes the bellows 34 to expand and open the switch contacts 29 whereby the motor 21 and solenoid 26 are deenergized and the steam valve 25 automatically closes.

The temperature to which the control system is responsive can be varied at will by changing the pressure on the liquid by expanding or contracting the bellows 33 through rotation of the manual control lever 39 which has a shaft 40 threaded through a wall portion 41 of the room and engaged with the bellows 33.

The system and arrangement described provides an efficient and novel floor heating unit for the individual rooms of a railway room car by means of which it is not only possible to maintain a substantially uniform temperature in the floor region of the car but also in which a safe guard is provided for preventing freezing of the toilet facility water pipes in cold weather. It is to be understood of course that the water pipes may be located in the end wall instead of the side wall of the room.

It is to be understood that various changes may be made in the detailed arrangement and construction of the parts described without departing from the spirit and substance of the invention, the scope of which is defined by the appended claims.

What is claimed is:

1. In a transportation vehicle having a room provided with a door opening in an aisle side wall thereof, a closure for said opening, an air duct in said wall and having an inlet opening in the door jamb end thereof on the room side of the closure, a second air duct in an end wall of the room, said second duct being in communication with said first duct, extending horizontally along the floor of the vehicle and having an air outlet adjacent the floor of the vehicle and near the side wall of the room opposite the door and adjacent the outside of the vehicle, a heating unit within one of said ducts, and means for causing air from the room to flow therefrom through said inlet, thence over said heating unit and through said outlet into the room, said air inlet in said door jamb end of said wall being located at a level above said air outlet.

2. In a transportation vehicle having a room, toilet facilities within the room and water pipes for the toilet facilities, an air duct associated with certain walls of the room, said duct being adjacent the floor of the vehicle and enclosing a portion of the water pipes, said duct having an air inlet and an air outlet, heating means within said duct, and means for circulating air from the room through said inlet, thence through said duct, in heat exchange relation with said heating unit and through said outlet, the circulating air being in contact with said pipes adjacent said floor.

3. In a transportation vehicle having a room, toilet facilities within the room and water pipes for the toilet facilities, an air duct associated with certain walls of the room, said duct being adjacent the floor of the vehicle and enclosing

a portion of the water pipes, said duct having an air inlet and an air outlet, heating means within said duct, and means for circulating air from the room through said inlet, thence through said duct, in heat exchange relation with said heating unit and through said outlet, the circulating air being in contact with said pipes adjacent said floor, said air outlet being located adjacent said floor, and said air inlet being elevated relative to said air outlet whereby in the absence of operation of said circulating means air from the room will thermo-syphon through said outlet into said duct and thence from said duct through said inlet into the room.

4. In a transportation vehicle having an aisle and a plurality of rooms adjacent the aisle and in which each room has a door opening in its aisle-adjacent wall, a closure for said opening, individual floor heating units for each room comprising an air duct extending adjacent the floor of the vehicle and along the aisle-adjacent wall and the adjacent end wall of the room, said duct having an air inlet and an air outlet, said air inlet opening being located in the door jamb on the closing side of the closure, said outlet opening from said end wall into the room adjacent the floor thereof, said air inlet opening from the room through said side wall into said duct being located at a level above said outlet, a heating unit within said duct adjacent said outlet, and fan means within said duct between said heating means and said inlet for drawing air into said duct through said inlet, forcing the same over said heating unit and thence into the room through said outlet.

5. In a transportation vehicle having a room provided with a door opening, a heating system for the room comprising an air duct extending along the floor of the vehicle in association with certain walls of the room, said duct having an air outlet into the room adjacent said floor and an air inlet from the room located at a level above said outlet, a heating unit within said duct, motor-driven means within the duct for effecting forced circulation of air through said duct in heat exchange relation with said heating means, an electrically operatable valve for said heating unit, an electrical circuit, including a switch, for said valve and the motor of said fan means, and means for actuating said switch including a pair of inter-dependent temperature-responsive elements, one of said elements being responsive to the temperature of heated air leaving said outlet and the other of said elements being responsive to the temperature of the air entering said inlet.

6. In a transportation vehicle having a room provided with a door opening, a heating system for the room comprising an air duct extending along the floor of the vehicle in association with certain walls of the room, said duct having an air outlet into the room adjacent said floor and an air inlet from the room located at a level above said outlet, a heating unit within said duct, motor-driven fan means within the duct for effecting forced circulation of air through said duct in heat exchange relation with said heating means, an electrically operatable valve for said heating unit, an electrical circuit, including a switch, for said valve and the motor of said fan means, and means for actuating said switch including a hollow expansible element connected to said switch and first and second bulbs connected with said expansible element, said element, said bulbs and the connections between said bulbs and said expansible element containing a volatile liquid, one of said bulbs being located adjacent said inlet and the other of said bulbs being located adjacent said outlet, the liquid in said bulbs being volatizable in response to the temperature of the air at said inlet and outlet to increase the pressure within said expansible element whereby to actuate said switch.

7. In a transportation vehicle having a room provided with a door opening, a heating system for the room comprising an air duct extending along the floor of the vehicle in association with certain walls of the room, said duct having an air outlet into the room adjacent said floor and an air inlet from the room located at a level above said outlet, a heating unit, within said duct, fan means within said duct for effecting forced circulation of air through said duct in heat exchange relation with said heating means, an electric motor for said fan means, an electrically operatable normally-closed automatically-closable valve for said heating means, an electric circuit for said valve and motor, a normally open switch in said circuit, and temperature-responsive means for controlling the operation of said switch, said temperature responsive means being conjointly responsive to a predetermined low temperature condition of the air at said inlet and the air at said outlet to close said switch and to a predetermined high temperature condition of said inlet and outlet temperatures to open said switch.

8. In a transportation vehicle having a room provided with a door opening, a heating system for the room comprising an air duct extending along the floor of the vehicle in association with certain walls of the room, said duct having an air outlet into the room adjacent said floor and an air inlet from the room located at a level above said outlet, a heating unit, within said duct, fan means within said duct for effecting forced circulation of air through said duct in heat exchange relation with said heating means, an electric motor for said fan means, an electrically operatable normally-closed automatically-closable valve for said heating means, an electric circuit for said valve and motor, a normally open switch in said circuit, and temperature-responsive means for controlling the operation of said switch, said temperature responsive means being conjointly responsive to a predetermined low temperature condition of the air at said inlet and the air at said outlet to close said switch and to a predetermined high temperature condition of said inlet and outlet temperatures to open said switch, said temperature responsive means including a temperature responsive element adjacent said inlet and a temperature responsive element adjacent said outlet.

9. In a transportation vehicle having a room provided with a door opening, a heating system for the room comprising an air duct extending along the floor of the vehicle in association with certain walls of the room, said duct having an air outlet into the room adjacent said floor and an air inlet from the room located at a level above said outlet, a heating unit, within said duct, fan means within said duct for effecting forced circulation of air through said duct in heat exchange relation with said heating means, an electric motor for said fan means, an electrically operatable normally-closed automatically-closable valve for said heating means, an

electric circuit for said valve and motor, a normally open switch in said circuit, and temperature-responsive means for controlling the operation of said switch, said temperature responsive means being conjointly responsive to a predetermined low temperature condition of the air at said inlet and the air at said outlet to close said switch and to a predetermined high temperature condition of said inlet and outlet temperatures to open said switch, said temperature responsive means including manual means for varying the temperatures at which said temperature responsive means will respond.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
237,555	Laube	Feb. 8, 1881
1,707,547	Adams	Apr. 2, 1929
1,890,521	Mack	Dec. 13, 1932
1,985,636	Foss	Dec. 25, 1934
2,027,097	Hanson	Jan. 7, 1936
2,108,507	Parks	Feb. 15, 1938
2,135,300	Crago	Nov. 1, 1938
2,137,833	Crago	Nov. 22, 1938
2,156,322	Timmis	May 2, 1939
2,181,436	Madden	Nov. 28, 1939
2,229,277	Clements	Jan. 21, 1941
2,266,986	Murphy	Dec. 23, 1941
2,278,766	Brizzolara	Apr. 7, 1942
2,333,819	Raney	Nov. 9, 1943
2,348,834	Mueller	May 16, 1944
2,351,096	Blue	June 13, 1944
2,407,036	Snavely	Sept. 3, 1946