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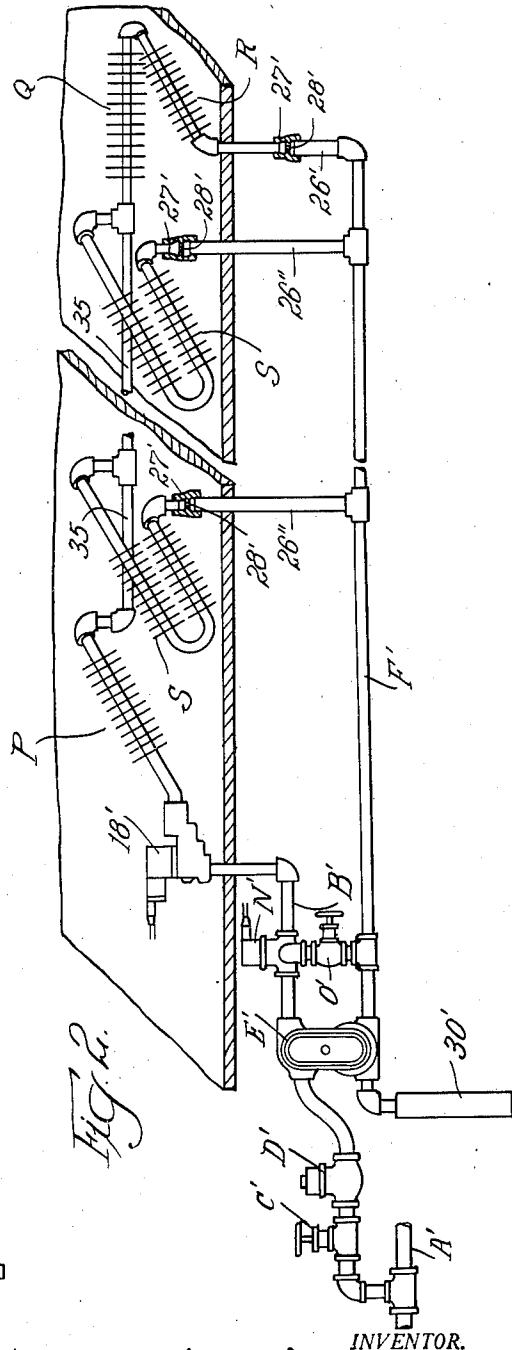
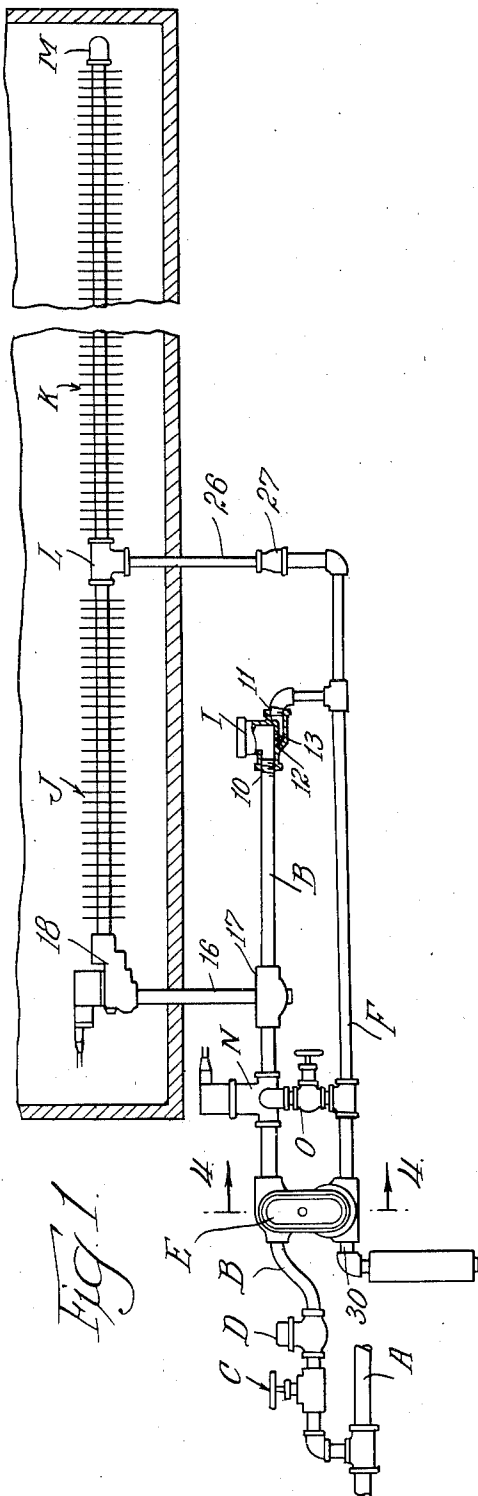
J. VAN VULPEN

2,467,350

END HEATING RADIATOR FOR RAILWAY CARS

Filed June 22, 1945

3 Sheets-Sheet 1



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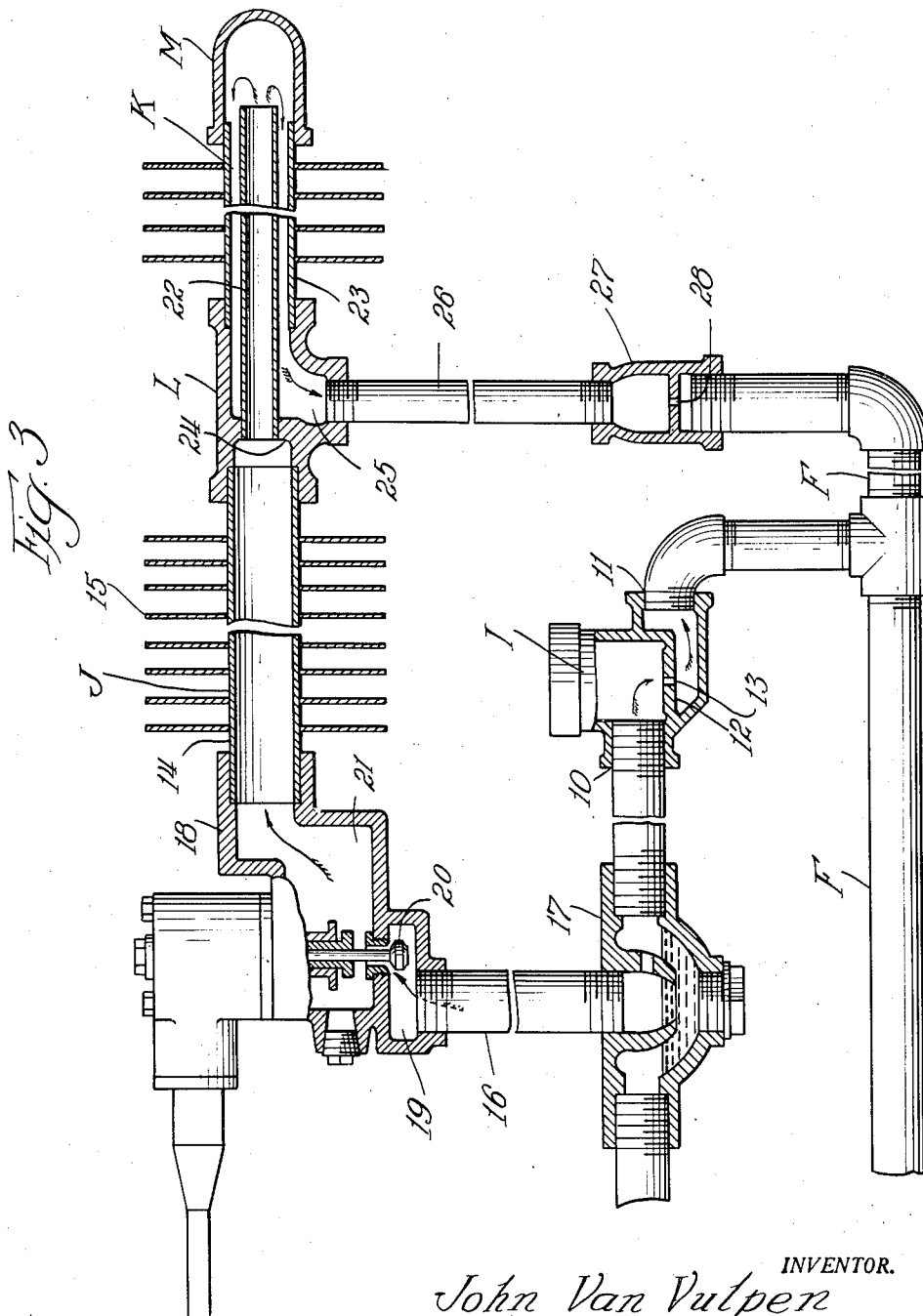
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3 Sheets-Sheet 2



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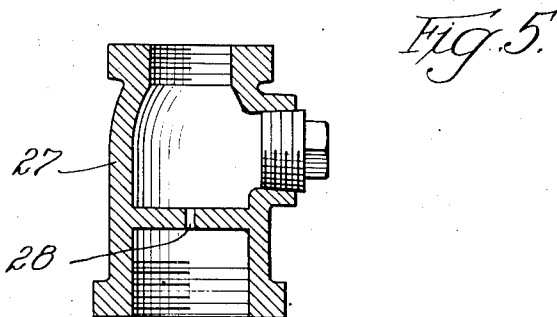
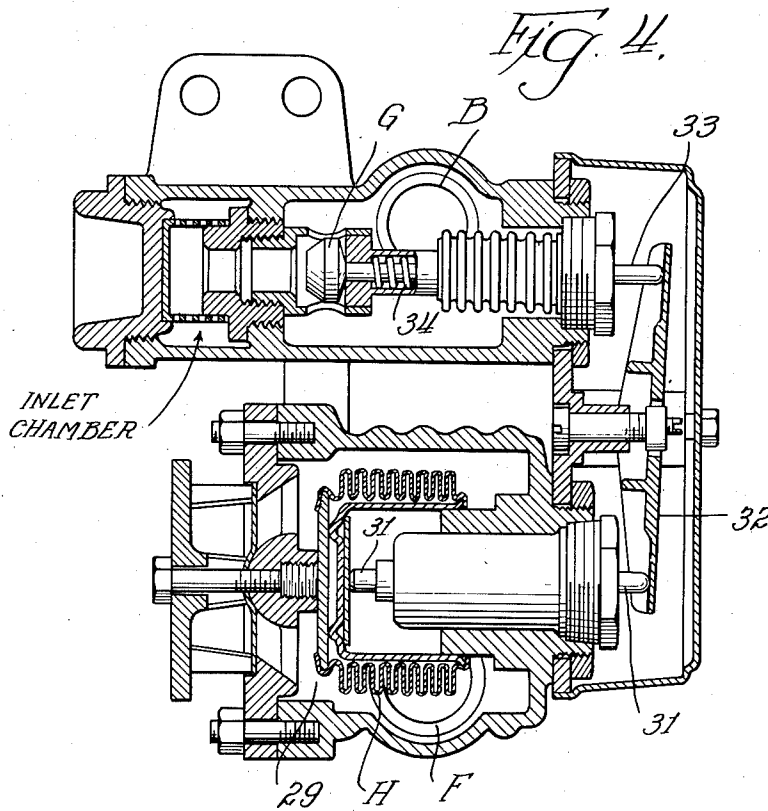
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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,467,350

END HEATING RADIATOR FOR RAILWAY CARS

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mesne assignments, to Vapor Heating Corpora-
tion, a corporation of Delaware

Application June 22, 1945, Serial No. 600,933

7 Claims. (Cl. 237—6)

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This invention relates to improvements in steam heating systems for railway passenger cars, and particularly to improved constructions and arrangements whereby heating medium is first delivered to the opposite ends of a radiator so as to heat the cooler end zones of a railway car before heating the central zone thereof.

The opposite ends of railway passenger cars are ordinarily cooler than the central zone. For this reason it has been customary in automatically controlled heating systems to arrange the control thermostats in the central zone of the car so as to avoid being cooled by cold drafts of air which enter the car when the doors are opened.

The problem of heating the end zones of a railway presented many difficulties. Previous efforts to solve the problem have usually included the provision of separate radiators arranged in the opposite ends and central zone of the car. The separate radiator units for the several zones of the car increase the original and maintenance cost to such extent that zone heating systems have not been adopted extensively for railway coach or other low cost transportation. In fact, each apparatus for heating the separate zones of the car requires a complete set of valves, regulators and thermostats and, therefore, constitute in effect independently controlled heating systems. If the delivery of steam to the radiators, according to prior developments, is controlled by a thermostat located near the center of the car, the thermostat is not readily influenced by the cold air entering the car when the doors are opened but is influenced by the higher temperatures of the central zone. Consequently the thermostats and valves controlled thereby frequently operate to shut off the delivery of steam to the radiators before the end zones of the car are sufficiently heated.

A principal object of the present invention is to provide improved arrangements and constructions of the heat radiating elements within the car so that the elements located in the cooler zones of the car, for example the end portions, and thereby requiring greater volume of steam, will receive the steam before it is permitted to flow into the portion of the heating system located in the warmer central zone of the car. In this way a larger percentage of the steam delivered is condensed in the cooler end portion of the radiator and thereby delivers more heat into the cooler end portions of the car than is delivered into the warmer central zone. The increased rate of condensation of steam compensates for the difference in demand for heat in the cooler and

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warmer zones of the car. According to the present invention the steam is delivered into the heating system at the extreme end portions of the car and is caused to flow from the said end portions toward the intermediate or central zone of the car.

A further object of the invention is to provide, in a steam heating system of the above character, simplified means for controlling the supply of steam to the radiating element or elements, as the case may be, whereby said elements will be quickly filled with steam when the occasion demands and thereafter will operate to maintain the elements filled with steam at substantially atmospheric pressure.

The invention is illustrated in connection with two specific embodiments in the accompanying drawings wherein:

Fig. 1 is a fragmentary diagram partly in section of a railway passenger car provided with a heating system constructed in accordance with this invention.

Fig. 2 is a diagrammatic fragmentary view illustrating a modified form of heating system embodying the principles of the invention.

Fig. 3 is an enlarged view of the radiator elements shown in Fig. 1 and the connections of the said elements with the main feed and return pipes underneath the car.

Fig. 4 is a sectional view taken on line 4—4 of Figs. 1 and 2 to illustrate the construction of a vapor regulator forming a part of the system; and

Fig. 5 is a sectional view of one of the flow restricting elements adapted to be interposed in the system at the outlet end of a radiator element to permit the return end of the radiator to be open without undue loss of steam.

Referring first to Figs. 1, 3, 4 and 5 of the drawings: the train pipe which constitutes the main source of steam supply for the system is indicated by the reference character A. The high pressure steam from the train pipe is delivered into the main feed pipe B. This steam is controlled by means of a hand valve C, an automatically operated pressure reducing valve D and a thermostatically controlled pressure regulator E. The last mentioned element is interposed in the main supply pipe and is also connected in a main return pipe F. It is of known construction and includes a valve G (Fig. 4) for controlling the flow of steam in the main feed pipe B and also includes a thermostatic bellows H which responds to changes in the temperature at the discharge end of the main return pipe F, to open and close the main feed pipe B. If steam escapes from the main return pipe into contact with the thermo-

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static bellows H, the bellows expands and imparts a closing movement to valve G. The main return pipe F connects with the remote end of the feed pipe B through a flow restricting device I. The device I is preferably in the form of a pipe fitting having end portions 10 and 11 for connecting the feed and return pipes, respectively. It is provided with an internal partition 12 in which is positioned an orifice 13 of suitable diameter, preferably $\frac{3}{4}$ of an inch, to insure building up of a slight pressure in the feed pipe B and to permit the discharge of only a small quantity of steam into the return pipe F.

The radiator elements designated J and K are arranged within the car preferably along one side wall thereof and are interconnected at a fitting L so that the sections J and K constitute, in effect, a single unit which extends substantially the full length of the car. The radiator element J is located in one end zone of the car and consists preferably of a conduit 14 provided on its outer surface with a plurality of vanes 15 adapted to increase the heat radiating area and between which the convection air currents will pass upwardly to carry off the heat from the radiator element J. The end of the radiator element J, nearest the end of the car, is connected with the main feed pipe B through a branch feed pipe 16 which leads from a water seal device 17 in the main feed pipe B to a radiator inlet valve 18. The valve 18 comprises a casing having an inlet chamber 19, a valve element 20 which controls the flow of steam from the chamber 19 into a chamber 21 which communicates directly with one end of the radiator J. The condensation from section J of the radiator will be discharged in part through the section K of the radiator. The end of radiator element J which is remote from inlet valve 18 is connected in one end of a T-shaped fitting L.

The radiator element K is composed of inner and outer concentric pipes 22 and 23. The outer pipe connects at one end with the fitting L and is closed at the outer end with a fitting M. The inner pipe 22 is connected into an opening formed in an inner wall 24 of the fitting L so as to receive steam from the pipe 14 of the radiator J. This steam is delivered into the outer pipe 23 of radiator K at the extreme outer end thereof and flows back through the said outer pipe toward the central zone of the car. The outer surface of pipe 23 is provided with a plurality of vanes similar to the vanes 15 previously described in connection with radiator element J.

It will be noted from the above description that steam is first supplied to the radiator elements J and K at their extreme ends and consequently at the opposite ends of the car. The steam flows into the radiator element J which is interconnected by means of the inner feed pipe 22 of radiator K with the extreme outer end of radiator K. The steam which is not condensed in the cooler end portions of the radiator flows toward the central portion of the radiator and consequently toward the central zone of the car. The condensate and steam will pass through outlet 25 of fitting L into a return branch 26 and thence into the main return pipe F. An orifice fitting 27 is interposed in the branch return 26 so as to permit free discharge of the condensate from the radiator, but will restrict the flow of steam therefrom. The orifice 28 is preferably $\frac{3}{4}$ of an inch in diameter, but the size of the orifice may be varied to suit the size of the radiator and the number of outlets in the heating system.

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The small amount of steam discharged through orifice 28, together with the steam which passes through the orifice 13 of the fitting I will enter the thermostat chamber 29 of the vapor regulator and be discharged from the system through the discharge pipe 30. The steam entering the thermostat chamber 29 will cause the thermal bellows H to expand. This bellows is operatively connected through a push rod 31 with one end of a rocking lever 32. The other end of said lever is operatively connected to the stem portion 33 of the valve G. It will be seen, therefore, that when the bellows H expands, it rocks the lever 32 about its pivot and thereby depresses the valve G toward its closed position. This valve is normally held open by means of a spring 34.

Interposed in the main feed pipe B is a pressure actuated valve N for by-passing steam to the thermostat H of the vapor regulator E and thereby control the flow of steam into the main feed pipe B. The said valve is connected through a by-pass O to the main return pipe F so that when the steam pressure in the main feed pipe B rises to a predetermined maximum, for example eight pounds, the valve N will open to by-pass the steam through passage O directly to the main return pipe F and thence to the thermostat H of the vapor regulator E. The valve N is of well known construction in the railway car heating art. It includes a valve element which is normally closed by a spring and is opened by the steam pressure exerted against the valve when the steam in the supply pipe B exceeds a predetermined maximum pressure. The connection of valve N in the main return pipe F is shown and described in the application of Lehane, Van Vulpen and Vlamings, Serial No. 598,280, filed June 8, 1945, and does not constitute a portion of the present invention.

Referring now to the embodiment shown in Fig. 2 of the drawings: the radiator elements located within the car consists of an inlet section P located at one end of the car and discharge sections Q and R located at the opposite end of the car. The said sections P, Q and R are interconnected by means of the pipe 35 so that the steam will flow directly from the section P of the radiator to said sections Q and R. Steam is supplied to the section P from a main feed pipe B' which is connected to the train pipe A' in substantially the same manner as described in connection with Figs. 1, 3, 4 and 5. The several devices for reducing the pressure of steam delivered into the main feed pipe B' are the same as those described in connection with Fig. 1 and are, therefore, designated in Fig. 2 with the same reference letter with the prime exponent. The steam is delivered from the main feed pipe B' through the riser 16' to the electrically controlled valve 18' and into end section P of the radiators and thence direct to sections Q and R of the radiator at the other end of the car. The end section R is connected to the main return pipe F' through the branch return 26'. A flow restricting device 27' is interposed in the said return branch 26' so that after the radiator elements P, Q and R are filled with steam, a small portion of steam will pass through the fitting 27' into the return pipe F' to the thermostatic chamber of the vapor regulator E'. This return steam will cause the bellows H to expand in a manner to partly or wholly close the valve G of the vapor regulator E'. The extent of the movement of the valve G will, of course, depend upon the volume and temperature of the returned steam.

Heat is supplied to the central zone of the car, preferably by means of a plurality of relatively small radiator elements S which may be positioned beneath the seats of the car. The elements S are connected directly to the pipe 35 so that the steam will flow from the said pipe 35 through each of the radiators S. Each of the said radiators S is connected by means of branch returns 26'' to the main return pipe F''. A flow restricting device 27'', corresponding in structure to the device 27, is interposed in the branch return 26'' so that when each of the several radiators S is filled with steam, a small portion of the steam will pass directly into the main supply pipe F' and thereby function together with the steam discharged from the other radiator sections to actuate the thermostatic bellows H of the vapor regulator E' to reduce or shut off the supply of steam, as the case may be, to the main feed pipe F'.

I claim:

1. In a steam heating system for a railway car, the combination of a source of steam supply, a radiator positioned in the car including a radiator section located in one end zone of the car and having steam inlet and discharge ports, means connecting the inlet port of said radiator section with said source of steam supply, a second radiator section including an outer pipe having a closed remote end extending into the end zone at the other end of the car, an inner feed pipe communicating with the discharge port of the first radiator section and extending within the outer pipe of the second section to a location near the remote end thereof, and means defining an outlet passage communicating with the inner end of said outer pipe, whereby steam is delivered into both ends of the radiator before it is effective to heat said intermediate portion thereof.

2. In a steam heating system for a railway car, the combination of a source of steam supply, a radiator positioned in the car including a radiator section located in one end zone of the car, a main feed pipe connecting one end of said radiator section with said source of steam supply, a vapor regulator including a valve for controlling the admission of steam to said main feed pipe, a thermostat chamber, a bellows thermostat located in said chamber for opening and closing said valve, a main return pipe for directing condensation and steam to said thermostat chamber, a second radiator section having a closed remote end extending into the other end zone of the car, an inner feed pipe communicating with the first radiator section and extending within the outer pipe of the second radiator section to a location near the remote end thereof for delivering steam from the first mentioned radiator section into the remote end of said second section of the radiator, and a return branch connecting the inner end of said outer pipe with the main return pipe, whereby steam flows into both outer ends of the radiator and thereafter into the inner end of said second radiator section and to the said main return pipe and thermostat chamber.

3. In a steam heating system for a railway car, the combination of a source of steam supply, a radiator positioned in the car including a radiator section located in one end zone of the car, a main feed pipe, a branch pipe leading from the main feed pipe to one end of said radiator section, a second radiator section connected with the inner end of said first mentioned section and extending through the middle zone and into the

other end zone of the car, said second section including an outer pipe having a closed end remote from said first section and an inner feed pipe communicating with the said inner end of the first section and extending within the outer pipe to a location near the closed end thereof, and means defining an outlet from said outer pipe at the inner end thereof, whereby steam is first delivered to the first mentioned radiator section and caused to flow therefrom into the remote portion of the second radiator section.

4. In a steam heating system for a railway car, the combination of a source of steam supply, a radiator positioned in the car including a radiator section located in one end zone of the car, a main feed pipe, a branch pipe leading from the main feed pipe to one end of said radiator section, a second radiator section connected with the other end of said first mentioned section and extending through the middle zone and into the other end zone of the car, said second section including an outer pipe having a closed end remote from said first section and an inner feed pipe, the latter of which is connected with the first section and extends within the outer pipe to a location near the closed end thereof, means defining an outlet from said outer pipe at the inner end thereof, whereby steam is first delivered to the remote ends of the radiator and caused to flow from one remote end portion into the middle portion of the radiator, a return pipe, means for controlling the flow of steam to the main feed pipe comprising a valve therein, a thermostat for operating said valve, a chamber for said thermostat, a main return pipe leading into said thermostat chamber, and flow restricting means for connecting the main feed pipe and said outlet of the radiator with said main return pipe, whereby a limited flow of return steam is delivered into said thermostat chamber.

5. In a steam heating system for a railway car, the combination of a source of steam supply, a radiator positioned in the car including a portion located in one end zone of the car, a main feed pipe, a branch pipe leading from the main feed pipe to one end of said portion of the radiator, a second portion of the radiator for heating the other end zone of the car, a feed pipe for directing steam from the first portion to the second portion of the radiator, an intermediate heat radiating portion communicating with said last mentioned feed pipe, a main return pipe, separate branch return pipes leading from an outlet of the second mentioned end portion and from an outlet of the intermediate heat radiating portion to said main return, a valve for controlling the flow of steam to the main feed pipe, a thermostatic bellows for operating said valve and arranged to respond to temperature changes at the discharge end of said main return pipe, and means connecting the main feed pipe with said main return pipe to permit a restricted flow of steam from the main feed pipe and from the radiator into said main return pipe.

6. In a steam heating system for a railway car, a radiator positioned in the car including heat radiating end portions for heating the zones at opposite ends of the car and including also a heat radiating intermediate portion having steam receiving communication with one of said end portions and adapted to heat a zone intermediate the end zones of the car, means for delivering steam into one end portion of the radiator, a feed pipe for delivering steam directly from the last mentioned end portion of the radiator to the

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other end portion thereof, and an orifice fitting associated with an outlet in one of said portions of the radiator to permit a limited outflow of steam therefrom.

7. In a steam heating system for a railway car, a radiator positioned in the car including heat radiating end portion for heating the zones at opposite ends of the car and including also a heat radiating intermediate portion having steam receiving communication with one of said end portions and adapted to heat a zone intermediate the end zones of the car, a valve structure having a thermostat chamber and including a valve for controlling the flow of steam to one end portion of the radiator, a feed pipe for delivering steam directly from the last mentioned end portion of the radiator to the other end portion thereof, a thermostat in said thermostat chamber for actuating said valve, a return pipe leading from an outlet in one of said radiator portions to said

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thermostat chamber, and an orifice fitting associated with said outlet to limit the outflow of steam therefrom.

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