Jan. 2, 1923. 1,440,701.

E. A. RUSSELL.

AUTOMATIC CAR HEATING SYSTEM.

FILED DEC. 31, 1920.

3 SHEETS—SHEET 1.

Fig. 1.

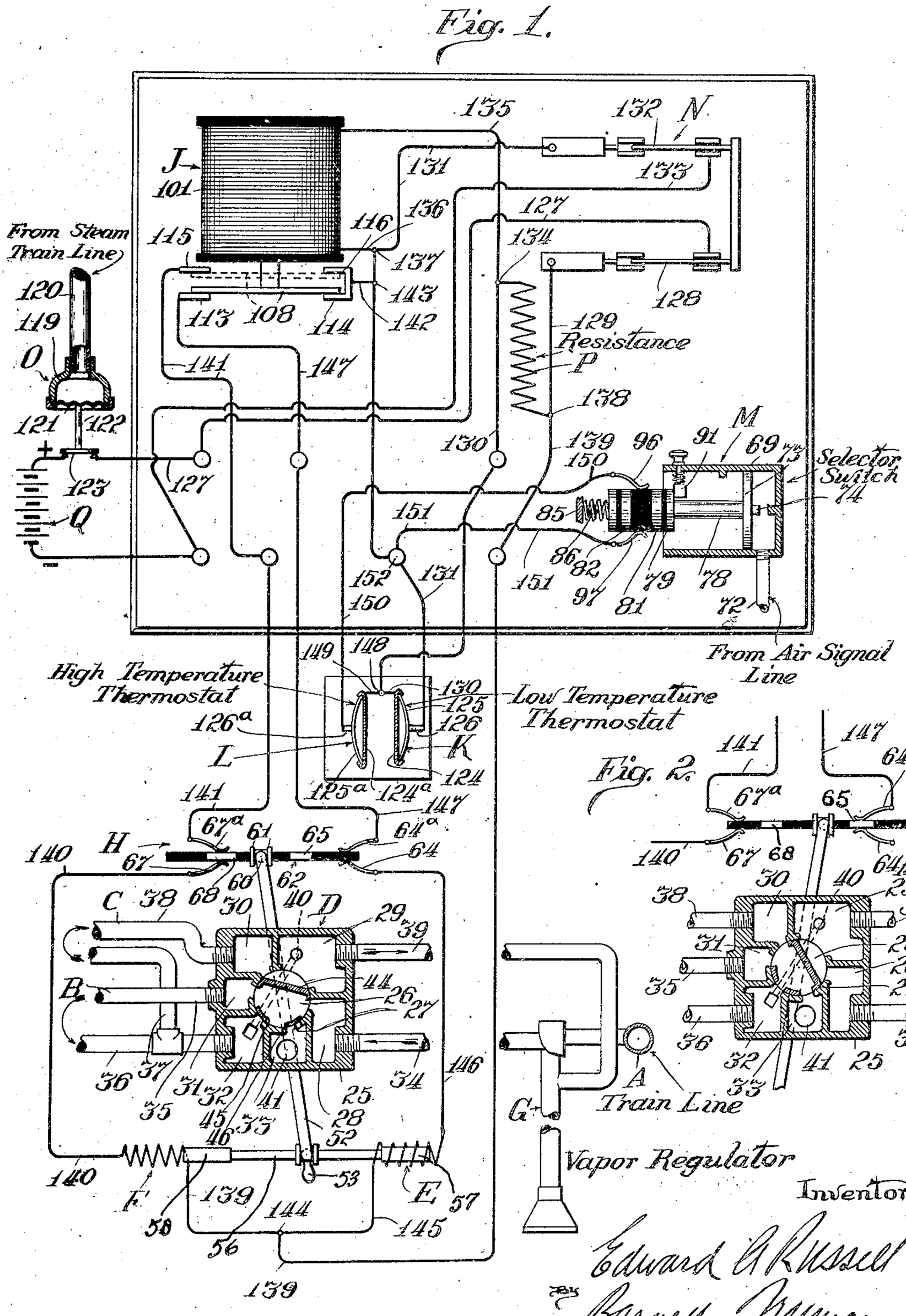

Fig. 2.

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3 SHEETS—SHEET 2.

Fig. 3.

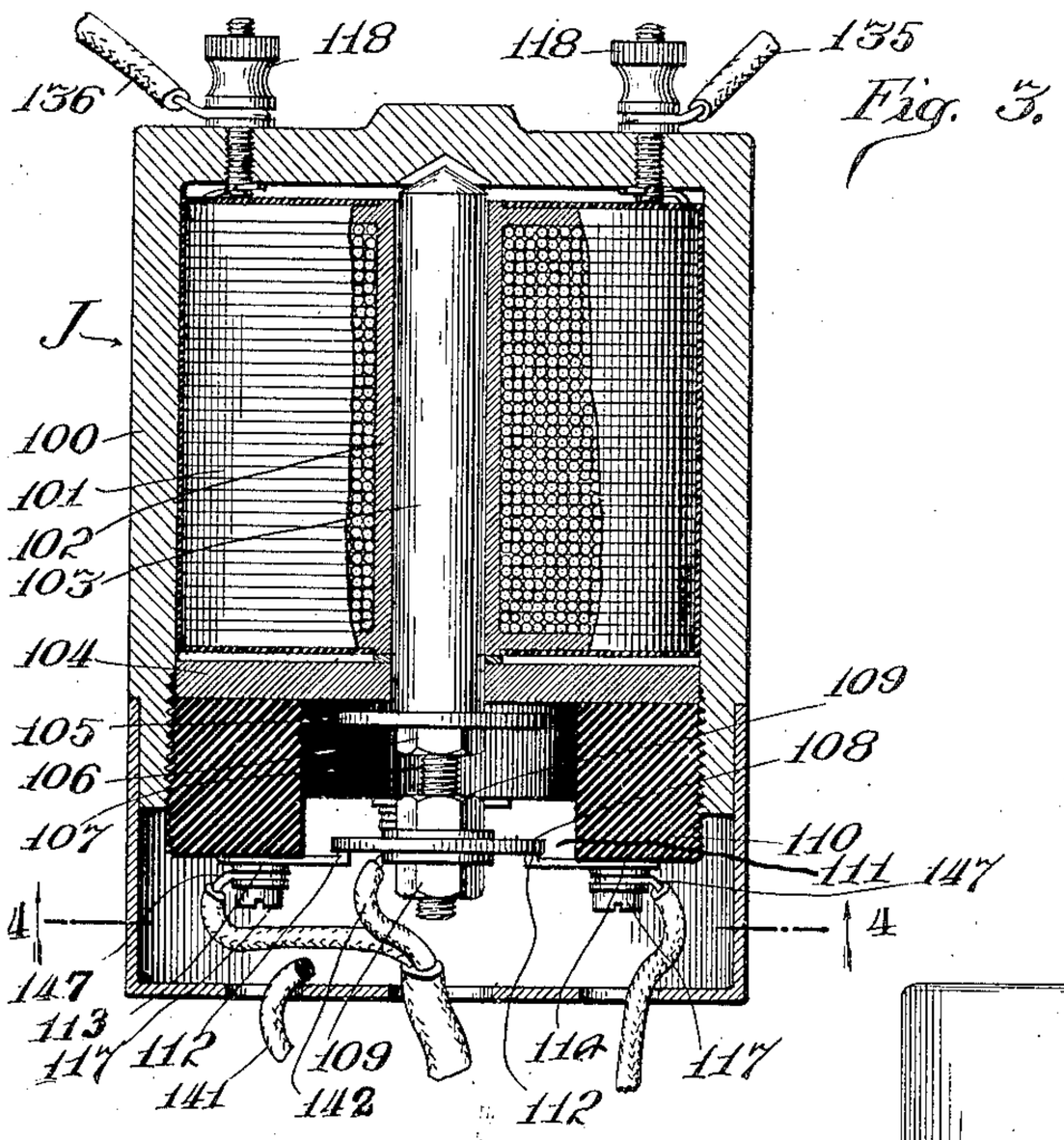

Fig. 5

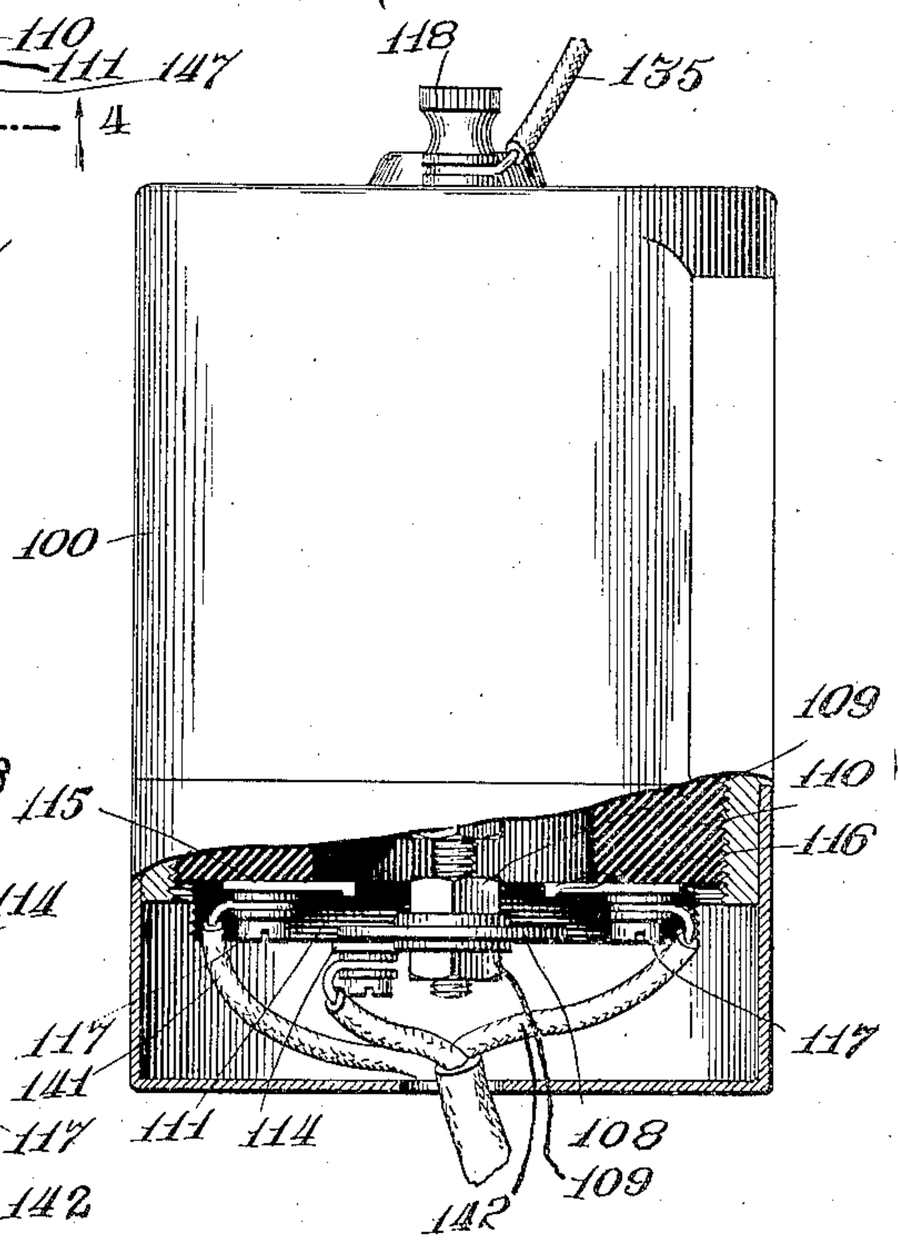

Fig. 4.

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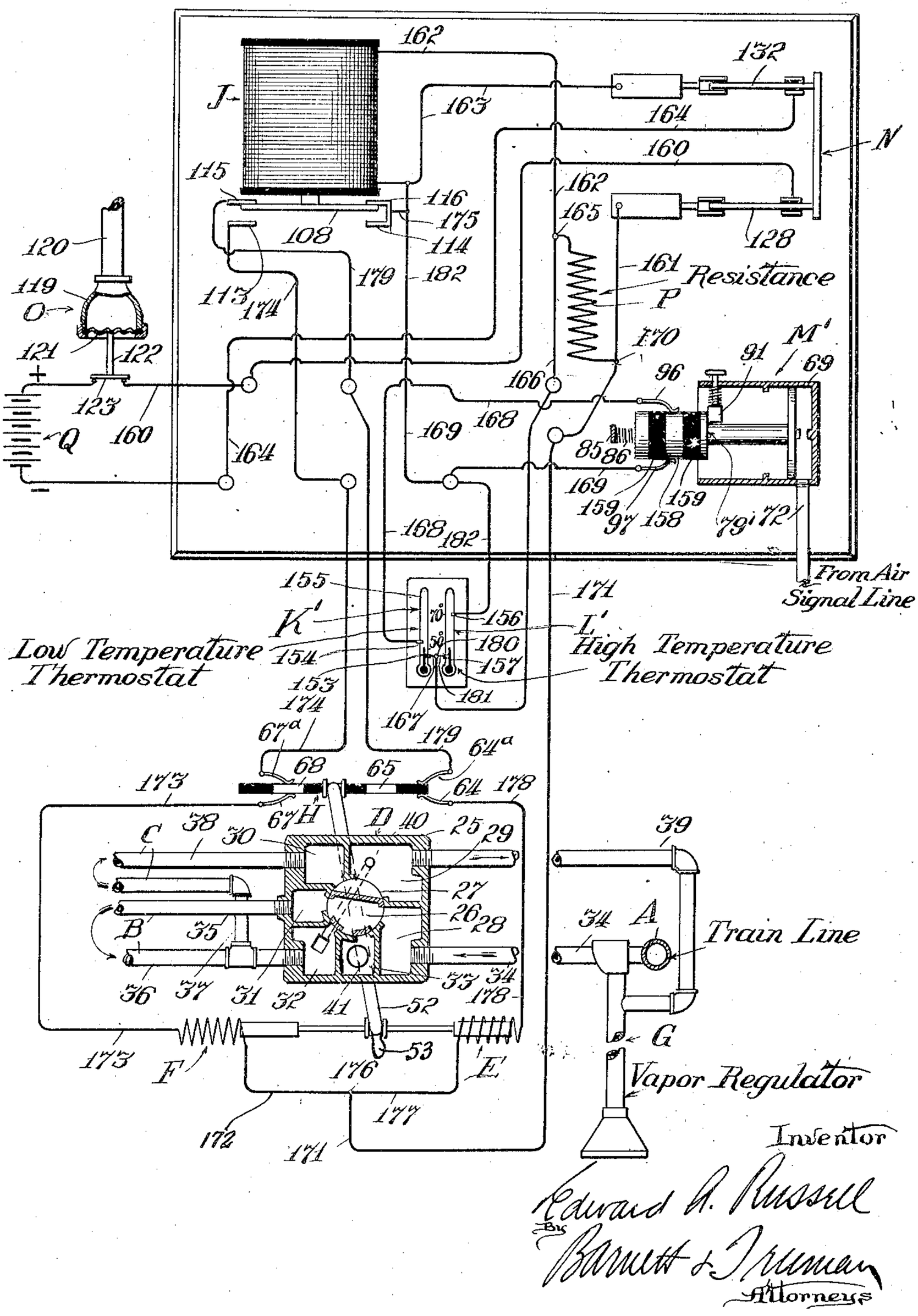
3 SHEETS—SHEET 3.

Fig. 6.



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Patented Jan. 2, 1923. 1,440,701

UNITED STATES PATENT OFFICE.

EDWARD A. RUSSELL, OF CHICAGO, ILLINOIS, ASSIGNOR TO VAPOR CAR HEATING COMPANY, INC., OF CHICAGO, ILLINOIS, A CORPORATION OF NEW YORK.

AUTOMATIC CAR-HEATING SYSTEM.

Application filed December 31, 1920. Serial No. 434,179.

To all whom it may concern:

Be it known that I, EDWARD A. RUSSELL, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Automatic Car-Heating Systems, of which the following is a specification.

My invention relates to a car heating system and more especially to a car heating system which is automatically regulated to maintain the car atmosphere at one of two selected temperatures, for example, at the high temperature during periods of occupancy and at low temperature when the car is standing vacant in the train yard.

A car heating system controlled so as to be capable of such operation is disclosed in the joint application of Edward A. Russell and Harry G. Geissinger, Serial No. 362,339, filed March 1, 1920; and a primary object of the present invention is to make certain improvements in the controlling apparatus of a system of the type disclosed in the joint application just mentioned. More specifically, the invention has for certain of its objects the following: To provide operating mechanism for the steam valve which functions to open and close the valve by positively acting mechanical means instead of relying upon gravity to effect one of said valve movements; to employ a rotary valve instead of a piston valve for governing the inflow of heating medium to and the outflow of the same from the radiator or radiators, this change involving certain novel arrangements in the controlling apparatus; to provide new and improved means for effecting the selection of the temperature, low or high, at which the car atmosphere is to be maintained; to provide a device whereby the entire control system is disabled when there is no steam in the steam train line, the use of this device being desirable because in the preferred embodiment of the invention the controlling apparatus is actuated electrically and involves a normally closed circuit; and to provide certain other incidental features of improvement to be hereinafter referred to.

The invention is illustrated, in a preferred embodiment, in the accompanying drawings wherein—

Fig. 1 is a diagram illustrating the controlling apparatus as a whole.

Fig. 2 is a fragmentary, diagrammatic view of the steam valve and associated parts, in positions which are the reverse of the positions of the corresponding parts as shown in Fig. 1.

Fig. 3 is a vertical sectional view of a relay forming part of the controlling apparatus.

Fig. 4 is a sectional view on line 4—4 of Fig. 3 looking upwardly as indicated by the arrows.

Fig. 5 is a side view of the relay, with parts in section, taken at right angles to the plane of Fig. 3.

Fig. 6 is a diagrammatic view similar to Fig. 1 showing the electrical connections in a system employing mercurial thermostats instead of the thermostats of the type employed in the apparatus illustrated in Fig. 1.

Referring first to Fig. 1: A designates the steam train pipe of a railway car constituting the main for supply of steam to the heating apparatus of the car. The car is shown as furnished with a radiator consisting of two sections B and C. D is a valve opened and closed by electric motors E and F for controlling the inflow of steam to and outflow from the radiator. In one position steam passes from the train line through the vapor regulator G to the radiator and therefrom to the thermostat chamber of the vapor regulator. In the other position of the valve the inlet and discharge ends of the radiator are closed, a drain port from the radiator is opened and steam is supplied to the vapor regulator in sufficient quantities to keep the same from freezing. H is a limit switch which operates in connection with a relay J for bringing about the alternate energization of the valve operating motors E and F. K is a low temperature thermostat preferably located within the car which, when connected so as to be in control, functions to maintain the car atmosphere temperature at a relatively low point, say 50° Fahrenheit. L is a high temperature thermostat which, when in control of the system, maintains the car at any desired temperature of occupancy, say 70° Fahrenheit. Thermostats K and L constitute the governing circuit breakers of the system. Functioning alternately, these devices govern the movements of the radiator valve by opening and closing the circuits in which they are respectively located. M is a selector switch pneumatically actuated preferably by pressure taken from the air signal line of the car

for determining whether the low temperature thermostat K or the high temperature thermostat L shall be in control. N is a double pole circuit breaker which is preferably provided so that the apparatus may be disabled when desired, and O is a pressure operated circuit breaker connected with the steam train line for breaking the electric circuit through the controlling apparatus when there is no steam in said train line. P is a resistance arranged to be in circuit with the relay J and the high temperature and low temperature thermostats K and L at such time as the current flows through these devices.

The valve device D comprises a casing 25 divided by webs into a central circular valve chamber 26 in which a rotary valve 27 is arranged, and around the central valve chamber 26, chambers 28, 29, 30, 31, 32 and 33. A supply pipe 34 leads from the train pipe A through vapor regulator G to chamber 28. The inlet end 35 of radiator coil B leads from chamber 31. The return end 36 of coil B leads to chamber 32. The inlet end 37 of coil C is connected with the return pipe 36. The return end 38 of coil C leads to chamber 30. 39 is a pipe leading from chamber 29 to the thermostat casing of the vapor regulator. The vapor regulator is a device in common use, and consists of a valve governing the flow through the supply pipe 34 and a thermostat which is actuated by the heat of the medium discharged through pipe 39. For details of construction of the vapor regulator reference is made to the patent to Gold No. 1,077,525, dated November 4, 1913. 40 is a duct leading from chamber 32 to chamber 29. 41 is a drain pipe from chamber 33. The valve 27 comprises webs 44, 45 and 46, and is rotated by a lever 52 terminating in a handle 53. The lever 52 is engaged with the piece 56 which connects the cores 57, 58 of solenoids E and F which are mounted on the top of the valve casing 25 and have been referred to as the valve operating electric motors. The opposite end of lever 53 engages the movable element 62 of limit switch H. A pair of spring contacts 64, 64ª are adapted to bear against the contact element 65 on member 62. A similar pair of contact springs 67, 67ª are adapted to engage a contact element 68 on the other end of member 62. The arrangement is such that when the contact springs 67, 67ª bear against the contact element 68 the contact element 65 is out of contact with the springs 64, 64ª, and vice versa.

The selector switch M comprises a cylinder 69 closed at its outer end and connected with a pipe 72 leading from the air signal line of the car. Within the cylinder is a piston 73 having a stud 74 adapted to bear against a stud 75 on the inner end of the cylinder. The switch member 79 is fixed to a stem 78 on piston 73 and consists of an annular body of insulation 80 into which are set the spaced contact rings 81, 82. 86 is a spring interposed between the switch member 79 and a stationary element 85. A spring pressed lock 91 is arranged in the cylinder against which the inner end of the switch member 79 is adapted to bear. A pair of contact springs 96, 97 are adapted to bear against either insulation 80 or one or other of the contact rings 81, 82. When pressure is exerted through pipe 72 against piston 73 the contact springs 96, 97 bear against ring 81. When the lock 91 is raised spring 86 forces the switch member and piston 73 to the right (assuming, that is, that there is no air pressure against the piston) bringing the springs 96, 97 into contact with ring 82. With the lock in the position shown in the drawings the spring contacts bear against the insulation 80 and the circuit through the selector switch is broken.

The relay J is preferably constructed as follows: 100 is a metal casing in which is arranged a magnet coil 101 wound on a spool 102 which is hollow to receive a core 103. 104 is a disc of the same magnetizable metal as casing 100, arranged just below the coil. The core 103 carries a pole piece 105 held in place by a nut 106 on a screw 107 set into the end of the core. On the lower end of this screw is a contact plate 108 held in place by nuts 109. An annular fibre block 110 is fixed to the lower end of casing 100 and is formed on its under side with a transverse recess 111. The contact plate 108 on the core is adapted, in the lower position of the core, when the relay is deenergized, to bear upon a pair of silver contact points 112 on oppositely disposed contact plates 113, 114. When the relay is energized the contact plate 108 bears against corresponding contact points on a pair of contact plates 115, 116, diametrically arranged with respect to each other, at right angles to the contact plates 113, 114 and secured to the recessed portion 111 of the annular member 110. The contact plates are provided with any suitable binding posts 117. 118 are binding posts for the wires leading to and from the coil 101.

The circuit breaker O consists of a casing 119 arranged at the end of a pipe 120 which communicates with the steam train line A, the outer end of the casing being closed by a flexible diaphragm 121 provided with a stem 122 carrying a switch member 123 adapted to close the circuit through any one of the electrical conductors which always carries current at such times as the control apparatus is in operation.

The switch N is shown as an ordinary bipolar knife switch.

The thermostats K and L are shown as

consisting of chord members 124, 124ª, arc members 125, 125ª and contact points 126, 126ª. When the temperature is below a certain point (determined by the setting of the thermostat by adjusting devices not shown), the arc member will be in contact with the corresponding contact point. When the car temperature reaches the point at which the thermostat is set as above stated, the expansion of the chord member draws the arc member out of contact with the contact point. In other words, a rise of temperature breaks the thermostat circuit while a fall in temperature closes this circuit.

The operation of the apparatus above described is as follows:

It will be assumed that the car is standing in a railroad yard with its train pipe connected to a source of supply of steam. Under these circumstances the car should be kept heated but there is no occasion for maintaining a temperature as high as that desirable when the car is occupied. It will be assumed that it is desired to keep the car at a temperature of 50° Fahrenheit and that the car atmosphere is below such temperature. Under these conditions the valve D will be in the open position, as shown in Fig. 1, and the low temperature thermostat K will be in control, that is to say, in readiness to act to close valve D and shut off steam to the radiator when the temperature reaches 50°. This condition, however, is dependent upon there being steam in the train line so that switch 123, operated by the circuit breaker O, is closed.

Under these circumstances the course of the steam will be as follows: From the train line A through pipe 34 and reducing valve of the vapor regulator G to chamber 28 of valve D, through valve chamber 26, chamber 31, and to inlet pipe 35 of coil B. Inlet pipe 37 of the coil C leads from the coil B near the discharge end thereof. Steam, therefore, passes from coil B through coil C and through chambers 30 and 29 to the outlet pipe 39 leading to the vapor regulator. Water of condensation from radiator B passes through duct 40 (which is water sealed against passage of vapor) chamber 29 and pipe 39 to the outlet provided by the vapor regulator.

While the parts of the apparatus are in the position which they assume with the steam operating as above described, electric current is flowing over a circuit containing the low temperature thermostat K as follows:

Circuit No. 1.—Battery Q, conductor 127 (and switch 123), member 128 of switch N, conductor 129, resistance P, conductor 130, thermostat K, conductor 131, member 132 of switch N, conductor 133, battery Q.

When the temperature reaches 50° Fahrenheit circuit No. 1 is broken at 125, 126 of thermostat K and current passes through a shunt circuit containing relay J. The resistance of the relay is greater than that of the thermostat K and, therefore, so long as there was a path for the electricity through thermostat K the current through the relay circuit was insufficient to energize the relay. But with the circuit broken at K the entire current is diverted through the relay and the relay energized. The relay circuit is as follows:

Circuit No. 2.—Circuit No. 1 to binding post 134 (farther end of resistance P), conductor 135, coil of relay J, conductor 136 to binding post 137 connected with conductor 131, thence through circuit No. 1 as above, to the battery.

The contact plate 108 of the relay is raised to its upper position against contacts 115, 116 and a circuit is closed through the steam valve operating motor F which does not include the resistance P and, therefore, allows the flow of current of amperage sufficient to energize motor F. This circuit is as follows:

Circuit No. 3.—Circuit No. 1 to binding post 138 (on the near side of resistance P), conductor 139, coil of motor F, conductor 140, contact spring 67 of the limit switch H, contact element 68, contact spring 67ª, conductor 141, contact 115 of the relay, contact plate 108 on the relay armature, contact plate 116, conductor 142 to binding post 143 connected with conductor 131, thence through circuit No. 1 to the battery as above.

Motor F now moves the valve D to its closed position as shown in Fig. 2, steam is shut off from the radiator, water of condensation in the inlet pipe 35 of coil B drains through chamber 31, chambers 26, 33 and drain pipe 41. Water in the discharge end 36 of coil B drains through chamber 32, duct 40, chamber 29 and discharge pipe 39. The outlet end 38 of coil C drains through chamber 30, chamber 26, chamber 33 and drain pipe 41. Steam from the train pipe and valve regulator is short circuited to the thermostat chamber of the regulator through chambers 28, 26 and 29 of valve D and pipe 39. Just enough steam will be allowed to pass, through operation of the vapor regulator thermostat, to keep the vapor regulator hot.

The limit switch H is moved, it will be observed, to break circuit No. 3 at 67, 67ª and to bring contact springs 64, 64ª against contact element 65 whereby when valve D is to be opened again current can pass to motor E over this path. This takes place when the temperature in the car falls below 50°. When this fall in temperature takes place circuit No. 1 is closed through low temperature thermostat K and relay J is

deenergized, dropping contact plate 108 against contacts 113, 114. A momentary circuit is closed through the motor E, as follows:

Circuit No. 4.—Circuit No. 1 to binding post 138, conductor 139 to binding post 144, conductor 145, winding of motor E, conductor 146, contact spring 64 of the limit switch, contact element 65, contact spring 64ª, conductor 147 contact 113 of the relay, contact plate 108, contact 114, conductor 142 to binding post 143 in conductor 131, and thence by circuit No. 1 to the battery.

Valve D is moved to its open position and the circuit just described is broken at 64, 64ª by movement of the limit switch.

When the car is to be occupied the high temperature thermostat L is put in control of the heating system. This is preferably accomplished automatically through pressure in the signal line of the train. As soon as a train is made up and the cars connected with the locomotive the signal train line sections are coupled and air let into the signal line. This circumstance is taken advantage of in order to automatically shift the control of the heating system from thermostat K to thermostat L. The latter, it will be assumed, functions to maintain the car temperature at 70° Fahrenheit. Air pressure from the signal line passes through pipe 72 to cylinder 69 of the selector switch and moves piston 73 to the left bringing contact springs 96, 97 against the contact ring 81. The selector switch is arranged in circuit with the high temperature thermostat L.

Let it be assumed now that the high temperature thermostat is in control and the car temperature below 70°. The arc member 125ª of high temperature thermostat L will be in contact with contact point 126ª and selector switch springs 96, 97 in contact with contact ring 81. Valve D will be open and the radiator receiving steam. The electric circuit through the high temperature thermostat will be as follows:

Circuit No. 5.—Circuit No. 1 as before traced to binding post 148, then conductor 149, high temperature thermostat L, conductor 150, contact spring 96 of selector switch M, contact ring 81, contact spring 97, conductor 151, to binding post 152 in conductor 131, thence by circuit No. 1 to battery.

When this circuit is broken at 125ª, 126ª, which occurs if the car temperature reaches 70°, current will be shunted through relay J as described in connection with the low temperature control, the current flowing through the relay circuit described, namely, circuit No. 2. As a result there will be a momentary circuit established through motor F to close valve D, namely, circuit No. 3.

When the temperature again falls to a point below 70° the high temperature thermostat will close its circuit and a momentary circuit will be established through the valve opening motor E, namely, circuit No. 4.

Although during the control by the low temperature thermostat K the arc member 125ª of the high temperature thermostat L was in contact, necessarily, with contact point 126ª, the high temperature thermostat was disabled because its circuit was opened at 96, 97 of the selector switch. When the temperature of the car is above 50° and the circuit through the high temperature thermostat closed at the selector switch so that the high temperature thermostat is in control, its intended functioning is not interfered with by the low temperature thermostat, the circuit through which is necessarily broken at 125, 126. If the selector switch be put under pressure while the car temperature is below 50° circuits will be closed through both high and low temperature thermostats, but this will not do any harm. When the circuit through the low temperature thermostat is broken at 50° the circuit through the high temperature thermostat will remain closed, and valve D open until 70° is reached.

It may happen that the car will be brought to a station and there stand for some time before the locomotive is attached to the train. In such case it may be desirable to bring the car temperature up to the temperature of occupancy without waiting for the attachment of the locomotive and the consequent pneumatic actuation of selector switch M. For this reason the selector switch is provided with the locking device 91 which, when disengaged from the switch member 79, allows spring 86 to force the switch member to a position which will bring contact springs 96, 97 against the contact ring 82, thus closing the high temperature thermostat circuit at the selector switch. When this is done the high temperature thermostat L will be in control to raise the temperature to 70° and maintain it at that point. As soon, however, as air from the train signal line enters the cylinder, which is when the locomotive is attached to the train, the switch member will be moved to the other extreme position in which the high temperature thermostat circuit will be completed through the selector switch at 96, 81, 97. The locking device 91 will drop into its holding position in readiness to stop the switch member at neutral when pressure from the signal line is cut off. By this arrangement the high temperature thermostat can be put in control by manual operation of the selector switch but as soon as pressure in the signal line is re-established the continued control of the thermostat depends upon the existence of the signal line pressure.

The control apparatus above described, it will be observed, involves the employment

of certain electric circuits which are normally closed circuits. In order to prevent the waste of current at such times as there is no steam in the train line the circuit breaker O is provided which is closed by steam line pressure and is so arranged, for example, in conductor 127, that when open it disables the entire apparatus.

Valve D is provided with a handle 58 so that the valve may be manually opened and closed in case the automatic control apparatus gets out of order. When the automatic control apparatus is operative any attempt to manually operate valve D is ineffective because of the association of the limit switch H with the valve movements. For example, if the parts are in the position shown in Fig. 1 and the valve is closed manually, circuit No. 4 is closed at 64, 65, 64ª, energizing motor E which immediately returns the valve to its open position.

If it is desired to control the system manually the electric control apparatus may be put out of operation by opening the switch N, in which case the valve D may be operated by hand in the same way as the four-way valve in the ordinary vapor car heating system is operated.

When the electrical control system is employed, as contemplated, the consumption of current is relatively small. It has been estimated at about .08 amperes, on the average for the time the system is in operation. The current required for moving valve D is a momentary current. No current is used for holding the valve in either position. This is possible because of the low pressure of the steam handled by the valve.

Thermostats of any suitable type may be used in place of the thermostats K and L. In Fig. 6 I have shown a wiring arrangement for thermostats of the mercurial type which close their respective circuits on rise of temperature to given points. Except for the wiring and a certain change, to be described, in the contacts of the switch member of the selector switch, the apparatus is the same as that shown in the preceding figures and in Fig. 6 the same reference numerals and letters used in connection with the preceding figures are employed for designating corresponding parts of the apparatus. In the arrangement shown in Fig. 6, K′ is a mercurial thermostat, the mercury column 153 of which is adapted to make contact with a contact point 154 in the tube 155 at a relatively low temperature, for example, 50° Fahrenheit. L′ is a high temperature thermostat of similar construction but with the contact point 156, with which its mercury column 157 is adapted to contact, at a higher level. The switch member 79′ of the selector switch M′ is provided with a single contact ring 158 arranged between two insulating bodies 159, 159. The brushes 96, 97 bear on the contact ring 158 when there is no air pressure in the signal line. That is to say, when the low temperature thermostat is in control the circuit is closed by the selector switch instead of being open as in the other form of the apparatus, the selector switch breaking this circuit when the signal line is under pressure so as to place the high temperature thermostat in control.

Fig. 6 shows the apparatus in the position which the parts assume when the temperature is below 50° Fahrenheit and there is no air pressure in the signal line (yard temperature). The radiator is receiving steam. The current is flowing through relay J along a circuit as follows:

Circuit No. 6.—Battery Q, conductor 160, member 128 of switch N, conductor 161, resistance P, conductor 162, relay J, conductor 163, member 132 of switch N, conductor 164 to the battery.

The relay being energized has raised its armature 108 against the upper contacts 115, 116.

As soon as the mercury column 153 of low temperature thermostat K′ reaches contact 154 the circuit is closed (the low temperature thermostat circuit) which deenergizes the relay J. This circuit is as follows:

Circuit No. 7.—Circuit No. 6 to binding post 165, conductor 166, conductor 167 in contact with the mercury column, contact point 154, conductor 168, brush 96, contact ring 158, brush 97 (of the selector switch M′) conductor 169, conductor 163, switch arm 132 and conductor 164 to battery.

The relay armature falls to the lower contacts 113, 114, and a circuit is closed, momentarily, through the motor F operating valve D, which circuit is as follows:

Circuit No. 8.—Circuit No. 6 to binding post 170, conductor 171, conductor 172, motor F, conductor 173, brush 67, contact 68 and brush 67ª (of the limit switch H) conductor 174, contact 113, armature 108 of the relay, contact 114, conductor 175, conductor 163, switch member 132 and conductor 164 to the battery.

This circuit is broken by the limit switch H as soon as valve D has been operated to shut off inflow of steam to the radiator.

If temperature falls below 50° the low temperature thermostat circuit (circuit No. 7) is broken and relay J energized to raise its armature, current flowing to the relay along circuit No. 6, a momentary circuit is now closed through motor E which is as follows:

Circuit No. 9.—Circuit No. 8 to binding post 176, conductor 177, motor E, conductor 178, brush 64, contact 65, and brush 64ª (of the limit switch), conductor 179, contact 115, armature 108 of the relay, contact 116, con-

ductors 175, 163, switch arm 132 and conductor 164 to the battery.

The motor E now reopens valve D, the circuit through E being broken at 64. 64ª through operation of the limit switch.

Assuming now that the selector switch M′ has been moved, either manually or by air pressure from the air signal line through pipe 72 to bring brushes 96, 97 in contact with the insulation 159, for the purpose of putting the high temperature thermostat in control of the system, and assuming further that the temperature of the car is between 50° Fahrenheit and 70° Fahrenheit, the radiating coils will be receiving steam and the armature relay J raised. The circuit through the relay under these conditions is the same as that described as circuit No. 6.

As soon as the mercury column 157 of the high temperature thermostat reaches its contact point 156 a circuit will be closed (high temperature thermostat circuit) deenergizing the relay, this circuit being as follows:

Circuit No. 10.—Circuit No. 7 to binding post 180, conductor 181, which is in contact with the mercury column 157, contact point 156, conductor 182, conductors 169, 163, switch member 132 and conductor 164 to battery.

The relay now drops its armature to contacts 113, 114, and a momentary circuit is established through the motor F heretofore described as circuit No. 8.

When the temperature falls to break the high temperature thermostat circuit at the thermostat L′ motor E is energized by a current flowing over the circuit described as circuit No. 9.

I claim:

1. In a car heating system, the combination with a source of supply of heating medium and a radiator, of electrically actuated apparatus for controlling the circulation of the heating medium through the radiator having a normally closed circuit and comprising a circuit breaker for governing the operation of said apparatus, and means independent of said circuit breaker whereby the electric current of the controlling apparatus is shut off in the absence of heating medium in said source of supply.

2. In a car heating system, the combination with a source of supply of steam and a radiator, of electrically actuated apparatus having a circuit adapted to be closed when the heating system is not in operation for controlling the circulation of steam through the radiator comprising two circuit breakers, a thermostat for operating one of said circuit breakers, and means governed by the pressure of steam in said source of supply for operating the other circuit breaker.

3. In a car heating system, the combination with a steam train pipe and a radiator, of an electrically actuated apparatus for controlling the circulation of steam through the radiator having a normally closed circuit and comprising a governing circuit breaker, and pressure actuated means which permits a flow of electric current through said controlling apparatus only when there is steam pressure in the train pipe.

4. In a car heating system, the combination with a source of supply of heating medium and a radiator, of means for controlling the circulation of heating medium through the radiator comprising a valve member, electric motors for moving the valve member in opposite directions, a limit switch operated by the movements of said valve member which breaks the circuit through each motor as soon as such motor has completed the movement of the valve, thermostatic means in the car which governs the energizing of said motors, and selecting means whereby the thermostatic means may be made to maintain the car atmosphere at either one of two different temperatures.

5. In a car heating system, the combination with a source of supply of heating medium and a radiator, of a valve to control the circulation of medium through the radiator, electrically operated means having two circuits adapted to be closed alternately to move the valve first in one direction and then in the other, a relay to close one of said circuits and open the other in alternation, and a circuit breaking thermostat to control the energization of said relay.

6. In a car heating system, the combination with a source of supply of heating medium and a radiator, of a valve to control the circulation of medium through the radiator, electrically operated means having two circuits adapted to be closed alternately to move the valve first in one direction and then in the other, a relay to close one of said circuits and open the other in alternation, and a circuit breaking thermostat to control the energization of said relay, the relay circuit being in parallel with the thermostat circuit and the current requirement of the relay such that it is energized only when the thermostat circuit is broken.

7. In a car heating system, the combination with a steam train pipe and car radiator, of a valve to control the circulation through the radiator, two electric motors, one to open the valve and the other to close the same, a relay having a switch member which opens and closes in alternation the circuits through said electric motors, and a thermostat to govern the energization and deenergization of said relay.

8. In a car heating system, the combination with a steam train pipe and a radiator, of a valve for controlling the circulation of steam through the radiator, a low temperature circuit breaking thermostat in the car, which closes its circuit with a rise of the car temperature above a certain point, a high temperature circuit breaking thermostat in the car which closes its circuit with a rise of the car temperature to a higher point, a pressure actuated selector switch in circuit with the high temperature thermostat, a pair of electric motors for moving the valve in opposite directions, a limit switch operated by said valve for breaking the motor circuits at the completion of the valve movements, and a relay for opening and closing said motor circuits in alternation, the thermostat circuits and relay circuit being in parallel, and the current requirement of the relay such that it is not actuated while current is flowing through either of the thermostat circuits.

9. In a car heating system, the combination with a steam train pipe and a radiator, of a valve for controlling the circulation of steam through the radiator, a low temperature circuit breaking thermostat in the car, which closes its circuit when the car temperature rises to a certain point, a high temperature circuit breaking thermostat in the car which closes its circuit when the car temperature rises to a higher point, a pressure actuated selector switch in circuit with the high temperature thermostat, a pair of electric motors for moving the valve in opposite directions, a limit switch operated by said valve for breaking the motor circuits at the completion of the valve movements, a relay for opening and closing said motor circuits in alternation, the thermostat circuits and relay circuit being in parallel, and the current requirement of the relay such that it is not actuated while current is flowing through either of the thermostat circuits, and a pressure actuated circuit breaker in one of the common leads of the aforesaid electrically operated mechanisms which is subject to pressure in said steam train pipe and which breaks its current in the absence of steam in said train pipe.

10. In a car heating system, the combination with a steam train pipe and car radiator, of a valve to control the circulation through the radiator, two electric motors, one to open the valve and the other to close the same, a relay having a switch member which opens and closes, in alternation, the circuits through said electric motors, a pair of circuit breaking thermostats, functioning at different temperatures and comprising, in each case, a mercury column and a contact point, said thermostats being adapted to control the energization of the relay, and a selector switch for determining which of said thermostats shall be in control of the system.

11. In combination with the radiator, source of supply of heating medium and control valve of a railway car heating system, a circuit breaking thermostat in the car, an electrically actuated motor for operating the control valve, the circuit of which motor is in parallel with the thermostat circuit, a relay for opening and closing the motor circuit arranged in a closed shunt from the thermostat circuit, the current requirement of the relay being such that it is energized only when the thermostat circuit is broken, and means for breaking the motor circuit at the end of the valve movement.

12. In combination with a radiator, source of supply of heating medium and control valve of a railway car heating system, a circuit breaking thermostat in the car, an electrically actuated motor for operating the control valve, the circuit of which motor is in parallel with the thermostat circuit, a relay for opening and closing the motor circuit arranged in a closed shunt from the thermostat circuit, the current requirement of the relay being such that it is energized only when the thermostat circuit is broken, and means operated by the valve for breaking the motor circuit at the end of the valve movement.

13. In combination with the steam and air train pipes of a railway car, a radiator having a valve and mechanism for controlling the operation of said valve comprising two circuit breaking thermostats one of which closes its circuit at a higher temperature than the other, a relay in parallel with said thermostats, the current requirement of which is such that it is energized only when the circuits of said thermostats are open, and a circuit breaker actuated through change of pressure in the air train pipe.

14. In combination with the steam and air train pipes of a railway car, a radiator having a valve and mechanism for controlling the operation of said valve comprising a pair of electric motors for opening and closing the valve respectively, a relay to direct the current to one or other of said motors, two circuit breaking thermostats one of which closes its circuit at a higher temperature than the other, said relay being in parallel with said thermostats and its current requirement such that it is energized only when the circuits of said thermostats are open, and a circuit breaker actuated through changes of pressure in said air train pipe in the circuit of the low temperature thermostat.

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