E. H. GOLD.

LOW PRESSURE FLUID HEATING SYSTEM.

APPLICATION FILED JAN. 26, 1906.

912,467.

Patented Feb. 16, 1909.

2 SHEETS—SHEET 1.

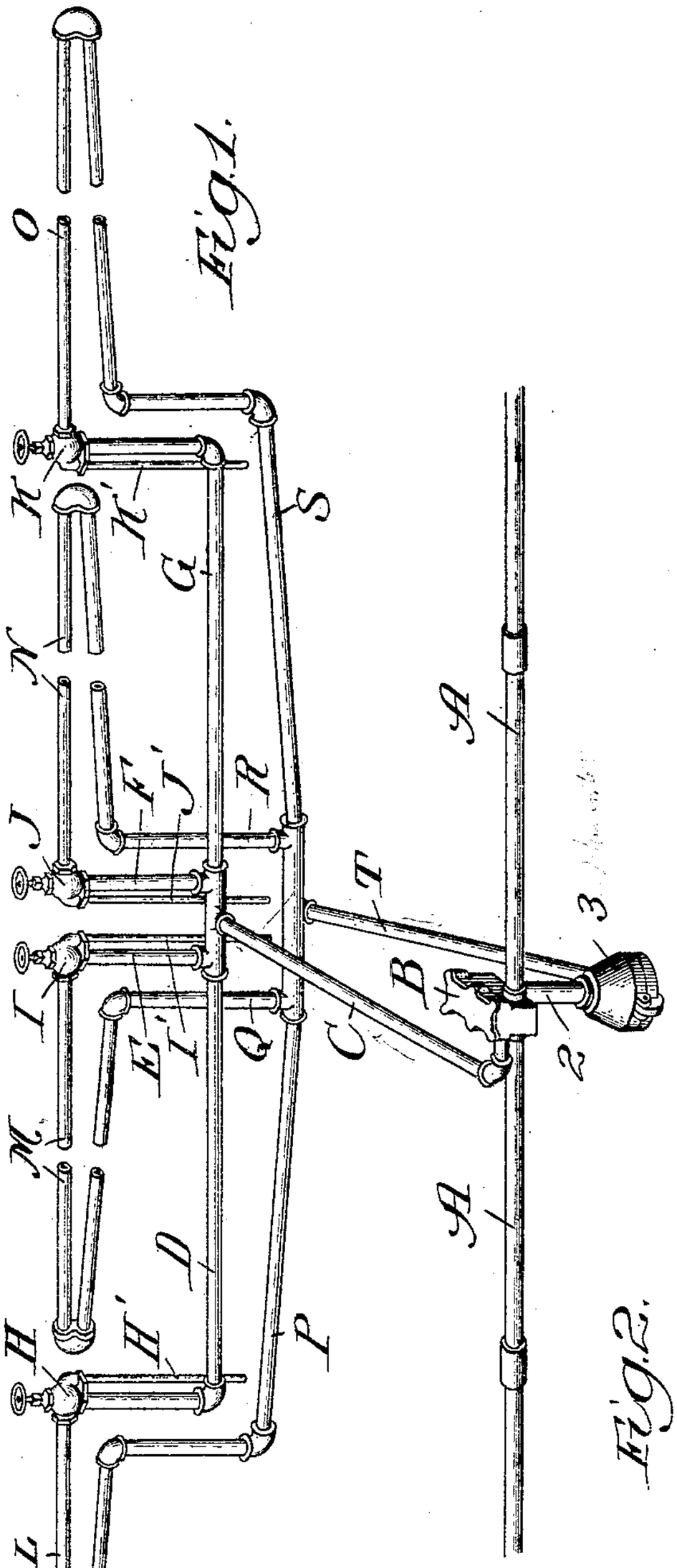

Fig. 1.

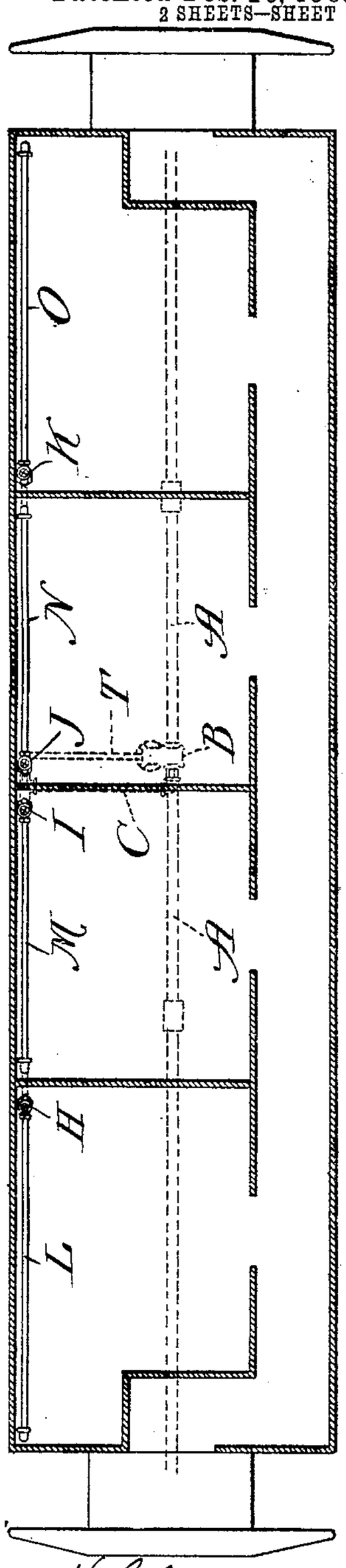

Fig. 2.

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2 SHEETS—SHEET 2

Fig. 3.

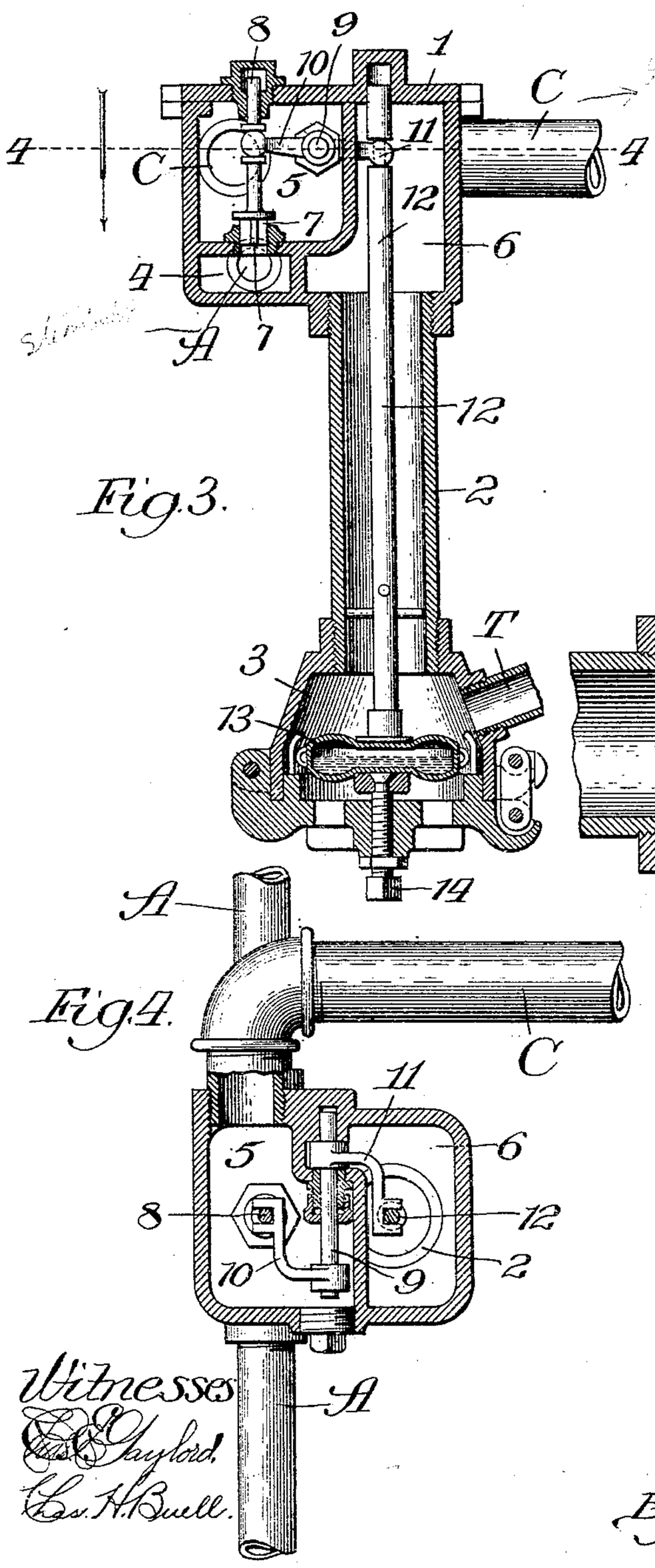
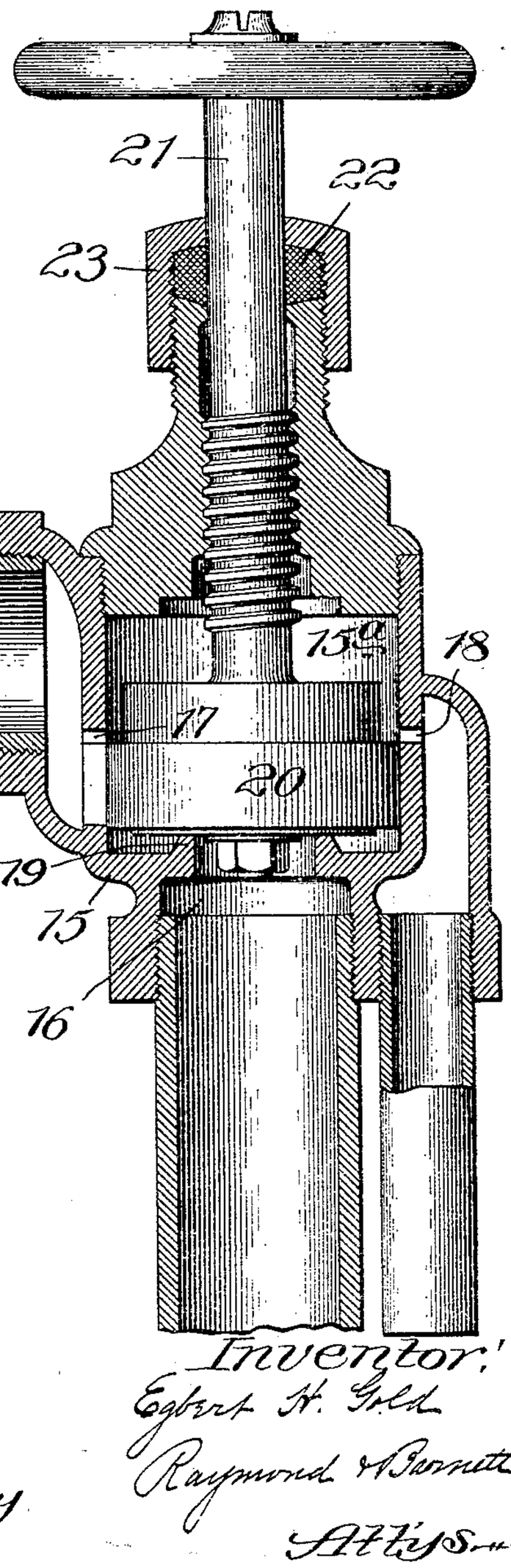


Fig. 4.

Fig. 5.



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LOW-PRESSURE FLUID-HEATING SYSTEM.

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To all whom it may concern:

Be it known that I, EGBERT H. GOLD, 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 Low-Pressure Fluid-Heating Systems, of which the following is a specification.

This invention relates to improvements in low-pressure fluid-heating systems and has special reference to a heating system wherein fluid is received at a high pressure and reduced by suitable automatically-operating means to a predetermined lower pressure before being admitted to the radiating pipes. Such a heating system is particularly adapted to car heating, in which case the heating fluid consists of live steam at high pressure from the locomotive boiler. As is well understood, the pressure in the train-pipe which conducts the steam from the locomotive boiler to the various cars along the train, varies through wide limits.

In a fluid-heating system of the general class to which the present invention relates, the pressure of the steam from the train-pipe is reduced by suitable means adapted to be controlled by thermostatically-actuated means influenced by the thermostatic condition of the steam within the radiating pipes.

The principal object of the present invention is to provide a system of car heating of the general class above outlined, in which the radiating pipes of a car are divided into independently operating sections or sets, one or more of which may be shut off without affecting the other sets. Heretofore this result has been accomplished by duplicating the automatically-operating means for reducing and regulating the pressure of the steam so as to have one such controlling device for each section or set of the radiating pipes.

By the use of my invention I am enabled to divide the radiating pipes of the car into independent sections or sets, each of which may be shut off or turned on independently of the others, and to have the pressure in the pipes of these various sets of radiating pipes or radiators and the amount of steam passing into and through each of said radiators, governed by one and the same controlling device for the whole car. Obviously this feature is of special advantage and value in a car-heating system for use in a car containing compartments, as the necessity of multiplying certain parts of the device is obviated.

In the accompanying drawings, Figure 1 is a perspective view of an illustrative form of car-heating system embodying my invention. In this system the radiating pipes are divided into four independently operated sets. Fig. 2 is a plan view of the floor of a four-compartment car, showing the radiating pipes in each compartment and the valves for admitting or shutting off steam to said pipes. Fig. 3 is a vertical, longitudinal, sectional view of the automatically-operating controlling device which regulates the amount of steam passing to the radiating pipes of the car and the pressure in said pipes. Fig. 4 is a horizontal, cross-sectional view of the same, the section being taken on the line 4—4 of Fig. 3. Fig. 5 shows in central vertical section the valve used in this heating system for shutting off or admitting steam to a set of radiating pipes.

Referring now particularly to Fig. 1, A is the train-pipe conducting high-pressure steam from the locomotive boiler. B is the controlling device for reducing the pressure of the steam and regulating the flow of the same to the radiating pipes. C is a pipe leading from the low-pressure side of the controlling device B to the radiating pipes. This pipe branches into the four pipes D, E, F, and G, each of which leads to a valve, H, I, J, and K, respectively. L, M, N, and O are four sets of radiating pipes served by the pipes D, E, F, and G. Each of these sets of radiating pipes is provided with a return pipe, P, Q, R, and S, respectively, these pipes leading into a common outlet pipe T. This outlet pipe T opens into the lower part of the controlling device B. The valves H, I, J, and K are each provided with a vent-pipe, H′, I′, J′, and K′, respectively. These vent-pipes extend downward through the floor of the car and open to the atmosphere below said floor.

The controlling device B, shown in detail in Figs. 3 and 4, comprises an outer casing 1, a pipe 2 extending downwardly therefrom, and a thermostat casing 3 at the lower end of this pipe. The casing 1 is divided by suitable partitions into a high-pressure chamber 4, into which the train-pipe A opens, a low-pressure chamber 5, and an outlet chamber

6. The pipe C, leading from the controlling device B to the radiating pipes, opens from the low-pressure chamber 5. A valve 7 is adapted to control the flow of fluid from the high-pressure chamber 4 to the low-pressure chamber 5. This valve 7 is carried upon the lower end of the spindle 8. Mounted in the low-pressure chamber 5 and having an end extending into the outlet chamber 6, is the rocking-shaft 9. This rocking-shaft carries on one of its ends an arm 10 which engages at its outer end the spindle 8. Upon the opposite end of the rocking-shaft 9 is fixed the arm 11. Extending vertically through the pipe 2 and low-pressure chamber 6, is a rod 12, the upper end of which engages the arm 11, its lower end engaging a thermostat 13. This thermostat, as herein shown, comprises an expansible box containing a volatile fluid such as alcohol. An adjusting screw 14 serves as means by which the thermostat 13 and rod 12 may be raised or lowered in adjusting the device.

The valves H, I, J, and K, are similar and are shown in detail in the sectional view Fig. 5. This valve comprises a valve casing 15 having therein a valve-chamber 15[a]. Opening into this valve-chamber is the inlet-port 16 for the admission of steam, the outlet-port 17 leading to a set of radiating pipes, and a vent-port 18 from which leads downwardly the vent-pipe, opening below the floor of the car as hereinbefore explained. The bottom of the valve chamber is adapted to form an annular valve-seat 19 for the valve-disk 20. The valve-disk is carried upon the inner end of a valve-stem 21, this valve-stem being provided with screw threads adapted to engage suitable screw threads in the upper part of the valve-casing and to move longitudinally when rotated. The valve-stem 21 is surrounded by suitable packing material 22 in a gland 23 of familiar form. The valve-disk 20 is adapted to move up and down over the outlet-port 17 and vent-port 18 when the valve-stem 21 is rotated to move it in and out of the casing. The port 17 is adapted, by reason of its vertical length, to be always open, being wide open when the valve-piece is at its open position, and restricted when the same is at its closed position. The port 18 is adapted to be open when the valve-disk 20 is at its closed or inward position and to be closed when the latter is at its open position.

The operation of a fluid-heating system when constructed in accordance with my invention is as follows: Suppose the valves H, I, J, and K, to be open. Steam at high pressure from the train-pipe A is admitted to a high-pressure chamber 4 of the controlling device B. The valve 7 will be forced open by the pressure of the steam or will be already open by reason of the weight of the rod 12. Steam will pass from the high-pressure chamber 4 to the low-pressure chamber 5, and will find its way through the pipe C and by means of the pipes D, E, F, and G, to the valves H, I, J, and K. The radiators L, M, N, and O, will be filled with steam which will find its way out through the outlet pipes P, Q, R, and S, to the common outlet pipe T, and will flow therethrough to the thermostat casing 3 of the controlling device B. When the pressure in the radiating pipes begins to approach that at which the temperature of the steam flowing through the pipe T into the thermostat chamber 3 is substantially 200° Fahrenheit (if alcohol be used in the thermostat 13) the thermostat will begin to expand, the rod 12 and arm 11 will be raised, the rocking-shaft 9 will be rotated and the arm 10 will be forced down carrying with it the spindle 8 and valve 7, the steam passing through the valve 7 will be throttled, and steam will be shut off. In practice the device will shortly adjust itself so that there will be a constant flow of steam through the controlling device B in just sufficient quantity to maintain the steam within the radiating pipes at the proper temperature. Any sudden variations in the pressure of the steam in the train-pipe A will be compensated for by the controlling device B, the valve 7 opening or closing slightly as required. Suppose, now, that one of the valves, for instance, that designated J, be closed by the rotation of its valve-stem 21. The valve-disk 20 being in its lowered or inward position will shut off the flow of steam from the inlet-port 16. The port 18 will be open. Communication will thus be established between the radiating pipe N and the atmosphere through the port 17 which is always slightly open, the valve-chamber 15[a], the port 18 and the pipe J′ leading downwardly therefrom. The steam from the pipe C will flow into each of the other radiating pipes, H, I, and K, returning by the pipes, P, Q, and S, to the common return pipe T and thence to the thermostat chamber 3. Inflow of steam having been shut off from the radiator N, the steam therein as it condenses will continue to find its way in the form of water through the pipe R, into the common outlet pipe T, while at the same time air will be drawn into and up through the pipe J′ and after passing through the chamber of the valve J will find its way into the radiator N whereby the steam therein will be more readily condensed. There is thus maintained the circulation of cold air through the pipe J′, valve J, radiating pipe N, and outlet-pipe R, to the common outlet-pipe T. As the combined condensation of steam within the pipes, L, M, and O, is considerable, and as the flow of water of condensation finding its way out through the pipe T and the bottom of the thermostat casing 3 is considerable, there is a constant tendency to exhaust the radiating pipe N. This tends to maintain the

circulation of air through this radiator N, and prevents the backing up of the steam from the pipe T into this radiator.

It will be seen that the principle involved in the operation of a system of steam-heating constructed in accordance with the present invention is that of supplying steam to one or more sets of radiating pipes, these sets of pipes having their outlet ends in communication with a thermostatically-actuated device for controlling the admission of fluid to the same whereby the thermostatic condition of said sets of pipes governs the admission of steam thereto; and having also one or more other sets of radiating pipes having their outlet ends also in communication with the controlling device, and having their inlet ends shut off from communication with the source of steam and at the same time open to the atmosphere, whereby a circulation of air is permitted in such sets of pipes as are shut off. It will be seen further that through the capacity of the common controller to respond to varying conditions in the radiating pipes, the cutting out of the radiator for any one or more compartments will result at once in a decreased supply of steam from the train pipe; and, conversely, that opening of any one or more radiators, by increasing the aggregate contents of the radiating pipes being supplied with steam and thus decreasing the temperature of the medium in contact with the thermostat, will cause at once an increased supply to pass into the radiating pipes through the controller. The system, therefore, provides for the control by a single, automatic controller of several separate and distinct radiators or sets of radiating pipes for the separate compartments of the car, which results in an economy in the original installation, facility in the care of the heating apparatus and in making repairs, with, what is very important, a material decrease in the chances of a freeze-up, since the single combined outlet device and controller is likely to be under more constant influence of steam than where each set of radiating pipes has its own controller and outlet:—this without materially interfering with perfect independence between the several sets of radiating pipes.

I claim:

1. The combination with a plurality of radiators having a common outlet, of a valve for controlling the flow of a fluid to all of said radiators, a thermostat in operative communication with said outlet adapted to operate said valve, said thermostat adapted to be actuated by the thermostatic condition of one or more of said radiators, each of said radiators being provided with means whereby fluid may be shut off from said radiator, and means whereby air is admitted to said radiator when fluid is shut off therefrom.

2. The combination with a plurality of radiators, of a valve adapted to control the flow of fluid to all of said radiators, a thermostat adapted to actuate said valve, a return pipe leading from each of said radiators to the thermostat, each of said radiators being provided with a valve for admitting to or shutting off steam from said radiator, said valve being adapted also when in its closed position to establish communication between the atmosphere and its radiator.

3. The combination with a plurality of radiators each provided with a valve to shut off or admit fluid to the same, of a single thermostatic device to regulate the flow of fluid to all of such radiators as are in operation, said thermostatic device being responsive to thermostatic conditions at the exhaust end of such radiators as are in operation.

4. The combination with a plurality of radiators having a common outlet, each of said radiators provided with a valve to shut off or admit fluid to the same and also, when in its closed position, to establish communication between the atmosphere and its radiator, of a single thermostatic device in operative communication with said outlet for controlling the flow of fluid to all such radiators as are in operation.

5. The combination with a plurality of radiators, of a source of high-pressure steam, a valve adapted to control the flow of fluid from said source of steam, thermostatically-actuated means for operating said valve, each of said radiators having a return pipe for conducting fluid therefrom to the thermostatically-actuated means, a valve adapted to shut off or admit fluid to each of the radiators, said valve adapted, when in its closed position, to establish communication between the atmosphere and its radiator.

6. The combination with a plurality of radiators, of a valve adapted to control the flow of fluid to said radiators, thermostatically-actuated means adapted to operate said valve, said thermostatically-operated means being arranged to be influenced by the thermostatic condition of the heating medium at the exhaust end of such of the radiators as are in operation, means for shutting off the flow of steam to each of the radiators, and means adapted to open communication between the atmosphere and such radiator as is shut off.

7. The combination with a plurality of radiators, of a common controlling device to control the supply of heating fluid to said radiators, and means for shutting off the radiators separately from the supply, said controlling device operating automatically to maintain the heating fluid at the exhaust end of said radiators so supplied in a desired condition whether all or less than all of said radiators are supplied with fluid.

8. The combination with a plurality of

radiators, of a common controlling device to control the supply of heating fluid to said radiators, a common outlet for said radiators, and means for shutting off the radiators separately from the supply, said controlling device operated automatically by the condition of the heating fluid in said common outlet to automatically maintain the heating fluid in said radiators so supplied in a desired condition whether all or less than all of said systems are supplied with fluid.

9. A heating system, comprising a source of supply of heating medium, a plurality of radiators communicating therewith; and a single, automatic controller for controlling the inflow of medium to all of such radiators as are in communication with the source of supply, in accordance with thermostatic conditions in the exhaust end of said radiators, said controlling device being self-adjusting relative to the aggregate capacity of such of the radiators as are at any time being supplied with the heating medium.

10. A heating system, comprising a plurality of separate radiators having each its separate shut off valve, a train pipe carrying steam at high pressure, a common supply conduit with which the radiators are in communication when their shut off valves are open, a pressure reducing valve in said conduit, a common outlet for the radiators, and a thermostat in operative communication with said outlet for controlling the pressure reducing valve.

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