No. 758,436. PATENTED APR. 26, 1904.

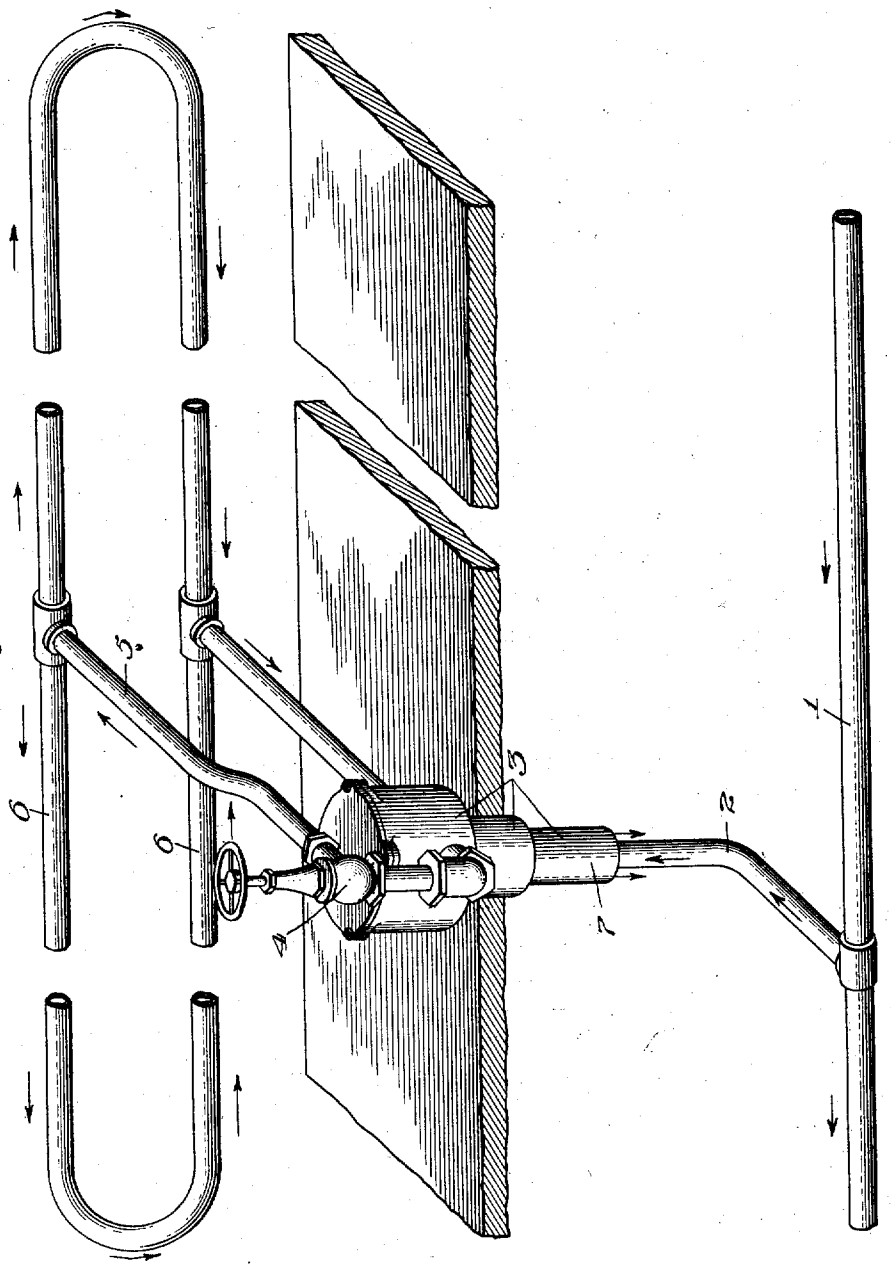
E. H. GOLD.

LOW PRESSURE HEATING SYSTEM.

APPLICATION FILED AUG. 24, 1903.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.



Witnesses:
Robert H. Weir
R. Asher.

Inventor.
Egbert H. Gold
By Raymond & Barnett.
Attys.

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NO MODEL. 2 SHEETS—SHEET 2.

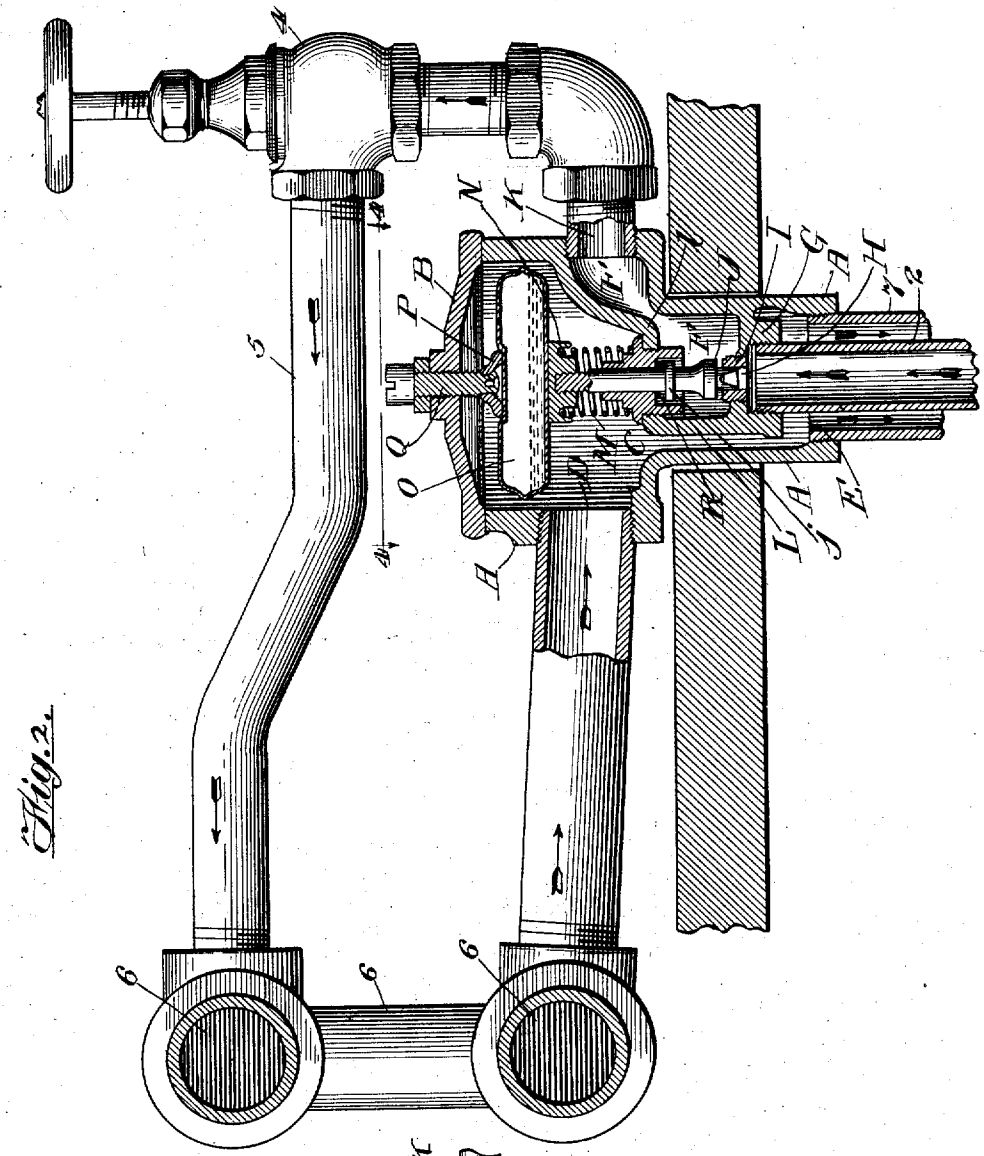

Fig. 2.

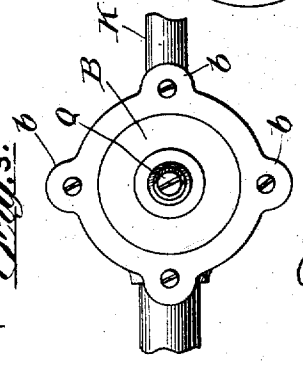

Fig. 3.

Witnesses:
O. M. Wernick
Robert H. Wells

Inventor:
E. H. Gold.
By Raymond & Arnett
Attorneys.

No. 758,436. Patented April 26, 1904.

UNITED STATES PATENT OFFICE.

EGBERT H. GOLD, OF SHELBY, INDIANA.

LOW-PRESSURE HEATING SYSTEM.

SPECIFICATION forming part of Letters Patent No. 758,436, dated April 26, 1904.

Application filed Apr. 24, 1903. Serial No. 170,639. (No model.)

To all whom it may concern:

Be it known that I, EGBERT H. GOLD, a citizen of the United States, residing at Shelby, in the county of Lake and State of Indiana, have invented certain new and useful Improvements in Low-Pressure Heating Systems, of which the following is a specification.

The object of my invention is to provide a heating system especially adapted for use in heating passenger-cars in which the steam-supply and the pressure can be so controlled and regulated that the pressure within the radiating-pipes of the heating system may be maintained at substantially atmospheric pressure regardless of the normal presssure within the train-pipe. As is well understood, the normal pressure in the train-pipe, which is commonly supplied with live steam from the locomotive-boiler, is high, running frequently in the neighborhood of sixty to eighty pounds, and with systems for heating cars now in use the steam within the radiators located in the cars is at substantially the same pressure as that within the train-pipe. This necessitates maintaining this high pressure throughout the entire heating system at an unnecessary loss of power, which must be supplied by the engine. So, also, this unnecessarily high pressure subjects the radiating-pipes and other pipes of the heating system to an unnecessary and constant strain, with a constant liability of breakage and with the necessity of providing radiating and steam pipes of greater weight and of higher cost than would be necessary if there were no such pressure within the radiating-pipes, and for these reasons the cost of installation and of maintenance of a heating system is higher than it would be if this pressure within the radiating-pipes could be dispensed with. So, also, as is well known, the higher the pressure of the steam the higher the temperature, so that where steam heat is used in railroad-cars it is a frequent complaint that the temperature is entirely too high for the comfort of the passengers, and where the steam is necessarily at high pressure within the radiating-pipes it becomes difficult and to a degree impossible to satisfactorily regulate the temperature of the air within the car. So, also, the sudden filling of the cold radiating-pipes with steam at high pressure when the train-pipe of a car is first connected with the locomotive frequently results in damage to the radiating-pipes, due to the sudden and extreme expansion thereof by filling the same with this high-pressure steam, which is necessarily at a high temperature.

It is therefore among the objects of my invention to so control the steam-supply that radiating-pipes and connections of lighter weight may be used, thereby lessening the cost of installation, that the danger of damage to the pipes owing to the high pressure of steam therein may be eliminated, thereby reducing the cost of maintenance, and that the radiating-pipes may be filled with steam at a comparatively low temperature, thereby facilitating the proper regulation of the temperature within the car. These and such other objects as may hereinafter appear are attained by the devices shown in the accompanying drawings.

As is hereinafter explained in detail, the broad underlying principle of my invention lies in controlling the supply of steam to a radiating system opening freely to the atmosphere by the temperature within the radiating system, so that, for instance, whenever the temperature within the radiating system shall exceed 212°, which is approximately the temperature of steam at atmospheric pressure, the steam-supply will be automatically shut off.

In the accompanying drawings, Figure 1 is a diagrammatic representation of one side of a car-heating system fitted with one embodiment of my invention. Fig. 2 is an enlarged detail showing the steam-control device in its preferred form, and Fig. 3 is a detail on the line 4 4 of Fig. 2.

Like characters of reference indicate the same parts in the various figures of the drawings.

1 is a train-pipe of the usual form, to which steam is supplied from the locomotive.

2 is a feed-pipe branching from the train-pipe to the side of the car.

3 is the control-valve.

4 is the shut-off valve for manually shutting off the steam-supply from any car at will.

5 is the connecting-pipe between the shut-off valve and the radiating-pipes.

6 represents the radiating-pipes, and 7 is the drip-pipe for the discharge of the water of condensation.

When using an automatic control-valve of the thermostatic type, it may be conveniently constructed as shown in detail in Fig. 3, in which A is the casing of the device, provided with the cap B, which is secured thereto by screws passing through lugs *b*. The casing A is provided with a main chamber C, connecting with the exhaust end of the radiating system at the port D and connecting with the drip-pipe 7 at the port E. The casing A is also provided with a chamber F, which when the parts are assembled is shut off from connection with the chamber C. The bottom of the chamber F is formed by a web G, into which is screwed the upper end of the feed-pipe 2, which has access to the chamber F through a port H. This port H is preferably provided by an opening through a nipple I, which is screwed into the web G and the upper surface of which furnishes a seat for the valve J. The chamber F leads to the pipe connecting with the shut-off valve 4 through a port K. The valve J is provided with a collar *j*, which is preferably of polygonal outline and arranged to loosely engage the downwardly-projecting wall of the nipple L, which is screwed into the web *l* and which is provided upon its upper surface with a shoulder, which affords a seat for the spring M. This spring M carries a collar N, into which is screwed the stem of the valve J and upon which rests the expansion-diaphragm O, partially filled with alcohol or like volatile fluid and arranged to react against the button P, which is held in any desired adjusted position by the threaded stem Q, which projects through the cap B and is operated and locked in any desired position by nuts in any familiar manner.

Mounted upon the stem of the valve J and between the collar *j* and the nipple L is a packing-washer R, which loosely fits upon the stem of the valve J.

The operation of the device as so constructed and assembled is as follows: With the valve 4 closed to shut off steam from the car the full train-pipe pressure will be exerted against the valve J through the port H and will force the valve J upwardly, carrying with it the packing-washer R and tightly clamping the washer R between the collar *j* and the nipple L, thereby making a tight joint at that point and preventing the passage of steam around the stem of the valve J and into the radiating system. If now the valve 4 be opened, steam will flow freely through the pipe 2, the port H, the chamber F, the port K, the valve 4, the pipe 5, into the radiating system or pipes 6, and downwardly through the drip-pipe 7, around the inlet-pipe 2, and out to the atmosphere. As soon, however, as the radiating-pipes become filled with steam at atmospheric pressure or approximately at the temperature of 200° Fahrenheit the expansion of the volatile liquid within the diaphragm O will close the valve J and shut off the steam-supply. It is of course understood that the relative areas of the valve J and of the diaphragm O are so adjusted as to attain this result. As soon, however, as the temperature of the steam or vapor surrounding the diaphragm O falls below about 200° the diaphragm O will begin to contract, the spring M will open the valve J, and steam will be admitted through the port H.

In practical operation the apparatus will shortly so adjust itself that the amount of steam admitted through the port H will be just enough to compensate for the cooling and expansion of the steam within the radiating-pipes, so that the steam or vapor surrounding the diaphragm O will be maintained at such a temperature that the valve J will be left open just enough to secure this equilibrium. Of course any sudden increase of temperature within the radiating-pipes will result in the prompt closing of the valve J, while any sudden cooling will result in the wider opening of the valve J and the freer supply of live steam from the train-pipe.

While I have thus shown one form in which my broad invention may be embodied, it is evident that the broad idea is independent of any particular form in which it is embodied, and so as a matter of skill or shop expediency my broad invention of controlling the supply of a heating medium to a radiating system by means of thermostatic device exposed within the radiating system may be embodied in many different forms of apparatus without departing from the spirit of my invention.

While in the specification and in the claims hereto attached I have referred to the thermostatic device as being located within the radiating system, it will be understood that the term "radiating system" as used in this connection is a very elastic one and covers the location of the thermostatic device or of any effective portion thereof at any point between the point at which steam is supplied to the radiating system and the ultimate outlet for the discharge of the water of condensation. In other words, for the broad purposes of my invention it is only necessary that some effective part of the thermostatic device shall be located either within the radiating-pipes proper or within any pipe, chamber, or pocket connected therewith. So, also, while I have particularly described my apparatus as applied to the heating system of trains, for which it is especially intended and adapted, it is my intention to hereby cover its use in any ap-

plication to any heating system to which it may be adapted; but I have not herein entered into a detailed description of its application to other uses—such, for instance, as house-heating—because the broad invention is sufficiently disclosed in its application to train-heating.

While in the claims I have specified radiating-pipes and a radiating system, open at one end to the atmosphere, it will be understood that such a device comes within the spirit and meaning of my invention and claims if the radiating system or pipes are so freely open to the atmosphere as to bring about the cooperation of the parts as shown, so as to produce the result described, whether or not such opening be literally at one end of the pipes in question.

I claim—

1. In a heating system, the combination with a system of radiating-pipes open at one end to the atmosphere, of means for supplying a heating medium thereto, and means located within a compartment communicating with the radiating-pipes for controlling the supply of said heating medium to the radiating system, said means being actuated by the temperature of the heating medium within the radiating-pipes.

2. In a heating system, the combination with a radiating system open at one end to the atmosphere, of means for supplying a heating medium thereto, and thermostatic means located beyond the radiating system and within the compartment communicating with the radiating system for controlling such supply.

3. In a car-heating system, the combination with a radiating system open at one end to the atmosphere located within a car, of a feed-pipe for supplying a heating medium to said system, a discharge-pipe for the discharge of water of condensation, said discharge-pipe connecting with the radiating system and surrounding the feed-pipe, and means for controlling the feed of the heating medium from the feed-pipe to the radiating system, said means comprising a valve and a valve-operating device actuated by the temperature of the heating medium at a given point within the radiating system.

4. In a car-heating system open at one end to the atmosphere, the combination with a train-pipe, of a feed-pipe leading from the train-pipe, a radiating system connected with said feed-pipe, a drip-pipe leading from the radiating system and surrounding the feed-pipe, and means for controlling the feed of the heating medium from the feed-pipe to the radiating system, said means comprising a valve and a thermostatic valve-actuating device exposed within the radiating system.

5. The combination with a heating-circuit comprising a radiator and means for supplying a heating medium thereto, of means for controlling the admission of the heating medium to said circuit, and thermostatic means located within a chamber in said circuit, and at a point beyond the radiator, arranged to automatically operate said controlling means, said chamber being in open communication with the atmosphere.

6. The combination with a heating-circuit open at one end to the atmosphere comprising a radiator and means for supplying a heating medium thereto, of means for controlling the admission of said heating medium to said radiator, and a thermostatic device located within a chamber in said circuit at a point beyond the radiator and arranged to automatically operate said controlling means.

7. The combination with a radiator open at one end to the atmosphere, of a casing provided with a chamber communicating with the supply end of said radiator and also provided with a chamber communicating with the discharge end of said radiator, of means for closing direct communication between said chambers, a thermostatic device located in said last-named chamber, a valve located in said first-named chamber and arranged to control the flow of a heating medium into said radiator, and a rigid connection between the valve and the thermostatic device, whereby the valve shall be operated by the thermostatic device.

8. In a heating system, the combination with a system of circulating-pipes open to the atmosphere at one end, of means arranged adjacent to the inlet end of said system to control the inflow of a heating medium into said system, and thermostatic means for operating said controlling means, but located within a compartment adjacent to and communicating with the discharge end of said system.

9. In a car-heating system open at one end to the atmosphere, the combination with a car, of a system of radiating-pipes arranged within said car to heat the same, a train-pipe arranged to supply a heating medium to said radiating-pipes, a valve interposed between the train-pipe and the radiating-pipes, a discharge-pipe leading from the radiating-pipes to the atmosphere, and thermostatic valve-operating mechanism located between the radiating-pipes and the free end of the discharge-pipe, and within a compartment communicating with the radiating-pipes, said operating mechanism being adapted to be actuated by the condition of the heating medium within said compartment, and being arranged to automatically operate said valve.

10. In a car-heating system, the combination with a car, of a radiator located within the car, a train-pipe arranged to supply steam to the radiator, a valve interposed between the train-pipe and radiator to control the flow of steam into the radiator, a fluid-conduit leading from the radiator and open to the atmosphere, and a thermostatic device located within said conduit and connected with said valve.

11. In a heating system, an automatic con-

trolling device comprising a casing provided with an inlet-chamber, said inlet-chamber being provided with ports adapted to be connected with a source of supply and with a radiating system in open communication with the atmosphere, said casing being also provided with an outlet-chamber, said outlet-chamber being provided with ports adapted to connect with the discharge end of a radiating system and with the atmosphere, respectively, a valve mounted within said inlet-chamber and arranged to control the flow of a heating medium therethrough, a thermostatic device mounted within said outlet-chamber, connections between said thermostatic device and said valve, whereby said valve will be automatically operated by said thermostatic device, and means for preventing the flow of the heating medium directly from the inlet-chamber to the outlet-chamber.

12. In a device of the class described, the combination with a radiator opening to the atmosphere and with a source of supply, of a casing which is interposed between the radiator and the source of supply and is also interposed between the radiator and its outlet to the atmosphere, said casing being provided with an inlet-chamber connecting with the source of supply and with the inlet end of the radiator, and with an outlet-chamber connecting with the discharge end of the radiator and with the atmosphere, of a valve mounted within the inlet-chamber so as to control the flow of the heating medium therethrough, a thermostatically-operating device mounted within the outlet-chamber and arranged to operate said valve, and means for preventing the flow of a heating medium directly from the inlet-chamber to the outlet-chamber, said means comprising a collar mounted upon the stem of said valve, and a packing-washer also mounted upon the stem of said valve, between said collar and that wall of the inlet-chamber through which the valve-stem passes, all so arranged that the opening of said valve will tightly clamp said washer between said collar and said wall of the inlet-chamber.

13. In a heating system open at one end to the atmosphere, the combination with a radiator, of means for supplying a heating medium thereto, and means for controlling such supply, said controlling means being actuated by thermostatic conditions within said system at a location adjacent to, and in free communication with, the outer atmosphere.

14. In a car-heating system, the combination with a car, of a radiator located within said car and discharging to the outer atmosphere, of a train-pipe containing steam at high pressure and arranged to supply steam to said radiator, valve mechanism interposed between the train-pipe and the radiator to control the flow of steam from the train-pipe to the radiator, and a controlling device inclosed within said system and connected with said valve mechanism so as to automatically operate the same, said controlling device being adapted to be operated by thermostatic conditions within said system at a location adjacent to, and in free communication with, the outer atmosphere.

15. In an apparatus of the class described, the combination with a supply-pipe adapted to contain a heating medium at high pressure, of a radiating system open at one end to the atmosphere, a feed-valve arranged to control the flow of the high-pressure heating medium into the radiating system, a thermostatic controlling apparatus located within the radiating system adjacent to the open end thereof and operated by thermostatic conditions in the radiating system at said location, and connections, between said controlling apparatus and the feed-valve, whereby the flow of the high-pressure heating medium through the feed-valve is controlled by the automatic action of said controlling apparatus.

16. The combination with a system of radiating-pipes in free communication with the atmosphere, of a valve for controlling the supply of a heating medium thereto, a thermostat exposed within said system and connections between said thermostat and said valve whereby said valve is operated by said thermostat.

17. The combination with a car of a system of radiating-pipes in free communication with the atmosphere and arranged to heat said car, a train-pipe arranged to supply a heating medium to said system of radiating-pipes, a valve arranged to control the flow of said heating medium from the train-pipe into said radiating-pipes, a thermostat exposed within said system of radiating-pipes and connections between said thermostat and said valve whereby said valve is actuated by the operation of said thermostat.

18. The combination with a train of cars, of a train-pipe, means for supplying a heating medium at high pressure to said train-pipe, an independent system of radiating-pipes in free communication with the atmosphere located in each car, a valve connected with each of said radiating systems, and arranged to control the flow of the heating medium from the train-pipe to each of said radiating systems, respectively, a thermostat exposed within each of said radiating systems and connections between each thermostat and its corresponding valve so arranged that each valve is actuated by the operation of its corresponding thermostat.

EGBERT H. GOLD.

Witnesses:
G. Y. DANKWARD,
M. E. SHIELDS.