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E. E. GOLD.

THERMOSTAT.

APPLICATION FILED OCT. 22, 1909.

1,042,104. Patented Oct. 22, 1912.

4 SHEETS—SHEET 1.

Fig. 1.

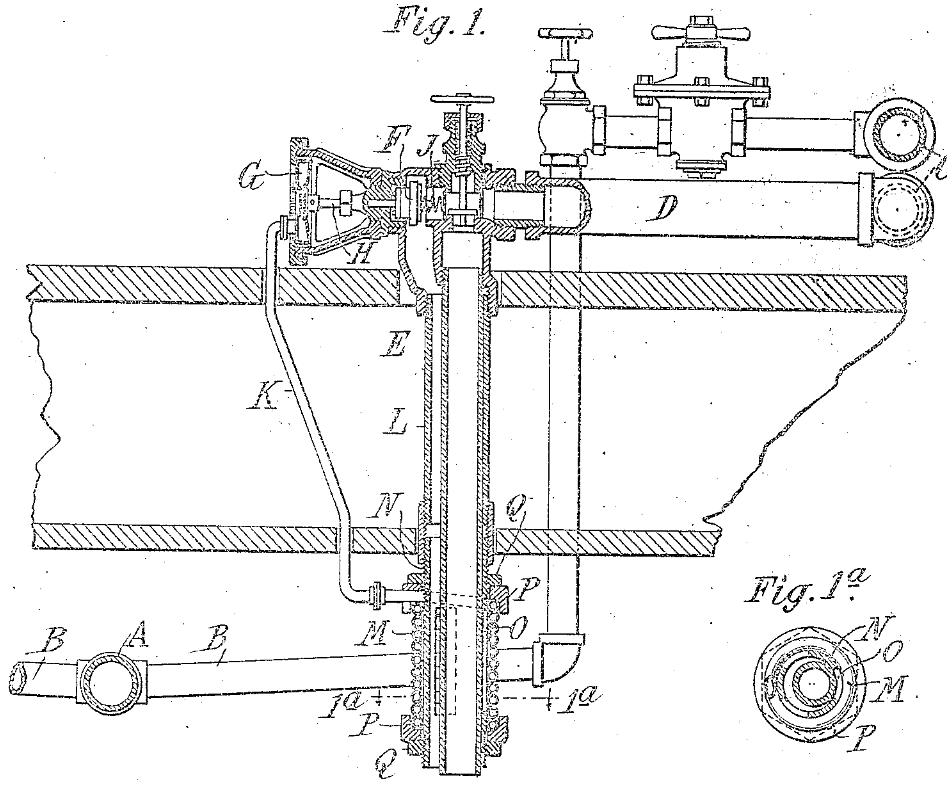


Fig. 1a.

Fig. 2.

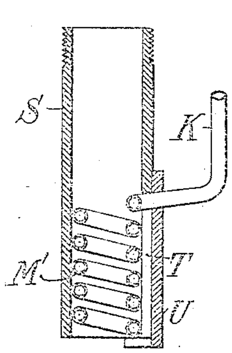
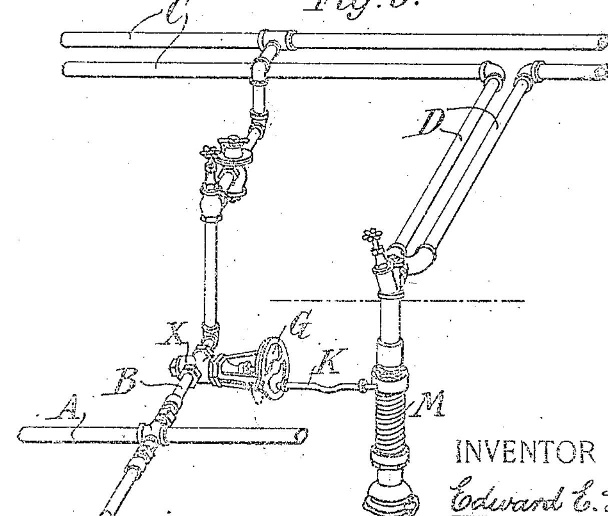


Fig. 5.



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4 SHEETS—SHEET 2.

Fig. 3.

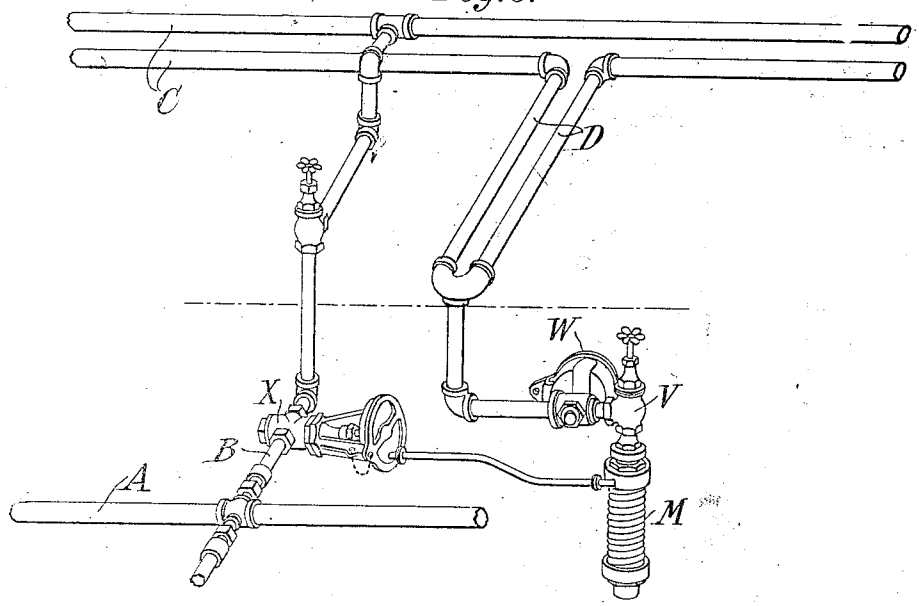
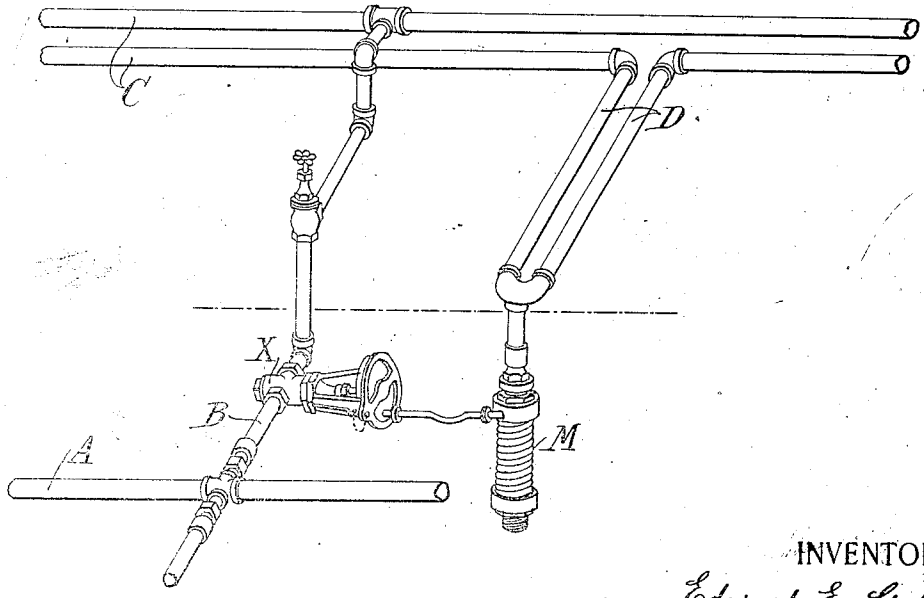


Fig. 4.



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4 SHEETS—SHEET 3.

Fig. 6.

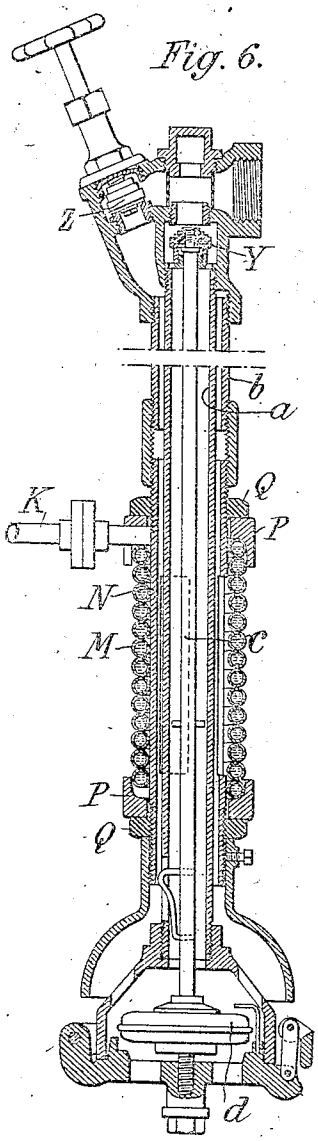


Fig. 8.

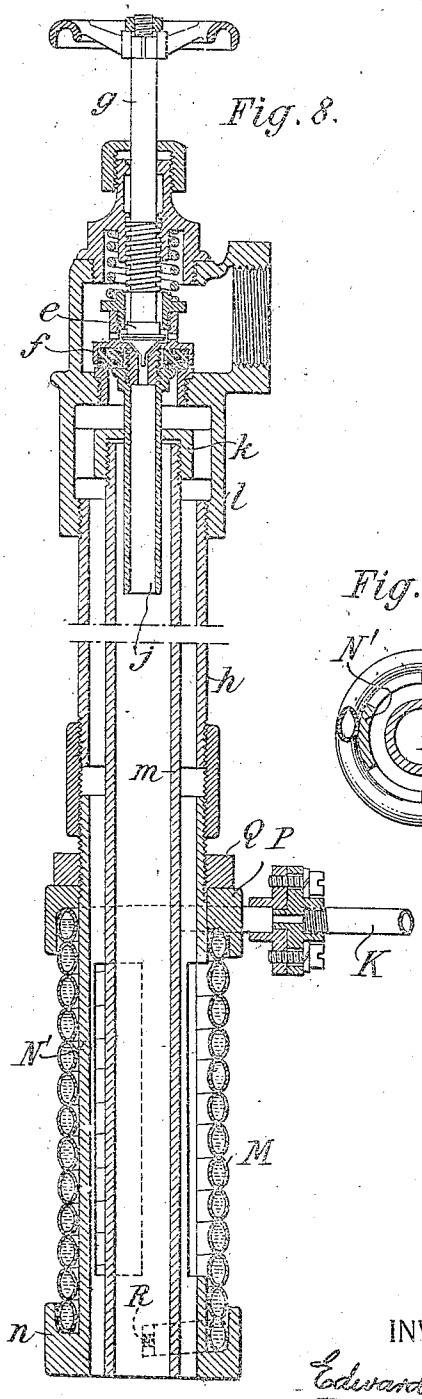
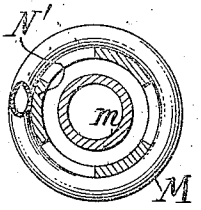


Fig. 9.



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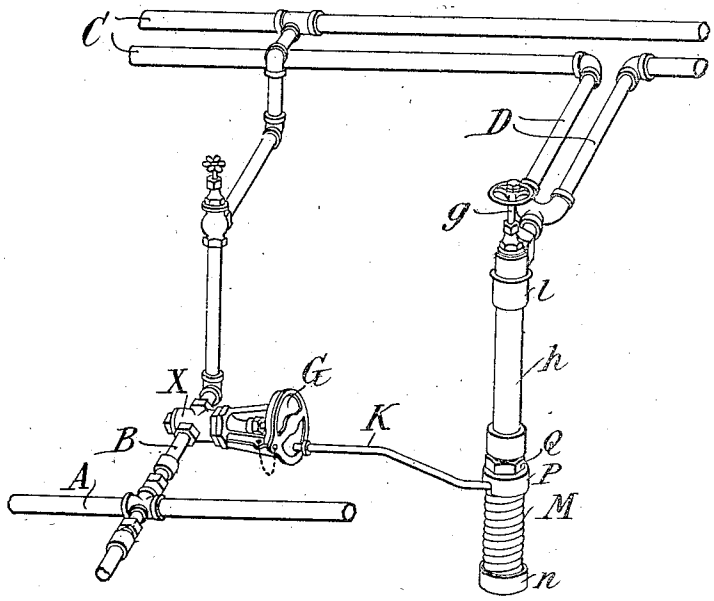
4 SHEETS—SHEET 4.

Fig. 7.



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UNITED STATES PATENT OFFICE.

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THERMOSTAT.

1,042,104. Specification of Letters Patent. Patented Oct. 22, 1912.

Original application filed November 17, 1903, Serial No. 468,109. Divided and this application filed October 28, 1909. Serial No. 525,203.

To all whom it may concern:

Be it known that I, EDWARD E. GOLD, a citizen of the United States, residing in the borough of Manhattan, city, county, and State of New York, have invented certain new and useful Improvements in Thermostats, of which the following is a specification.

In a previous application No. 468,109 I have described an improved heating system especially adapted for heating railway cars, and in which the steam admission valve or discharge valve or both valves are automatically controlled by the temperature of the escaping steam or water of condensation and by the atmosphere, and in the aforesaid application and other applications I have claimed the valves of the systems disclosed. But the present application is in large part carved out of the aforesaid application and is based upon the thermostat described, which thermostat is of especial utility in railway car heating generally and especially in the systems above referred to and is also of general applicability.

The accompanying drawings illustrate embodiments and particular applications of the invention:—

Figure 1 is a sectional view showing the thermostat applied to the operation of a discharge valve or trap of a steam heating system for railway cars. Fig. 1ª is a cross section of the same on the line 1ª—1ª of Fig. 1. Fig. 2 is a sectional view of another style of thermostat. Figs. 3, 4 and 5 are respectively views showing the application of the thermostat to other systems for the heating of cars. Fig. 6 is a longitudinal section of the discharge end of the system of Fig. 5. Fig. 7 is a perspective view showing the application of the invention to still another style of heating apparatus. Fig. 8 is a longitudinal section of the discharge end of the same. Fig. 9 is a cross section of Fig. 8.

Referring to the embodiments of the invention illustrated and first to Figs. 1 and 1ª, the usual train pipe A carrying a pressure of steam reduced from that in the locomotive boiler and varying from 40 to 80 pounds generally, extends the length of the car and is provided with suitable branches B leading to the radiating systems of the separate sides of the car. The radiating pipes are represented at C and the discharge pipe at D. The trap through which the water of condensation is allowed to escape is indicated as a whole by the letter E. It includes a valve body F which, when the system is being operated as a pressure system, normally closes the discharge end of the pipe so as to prevent escape of steam and fall of pressure; and which opens at intervals when the water of condensation has accumulated in the discharge end of the pips, so as to permit the escape of such water. Ordinarily this valve body is arranged within the car and has a stem extending down through the double floor of the car to an expansible vessel situated somewhat below the lower floor and which contains a thermostatic liquid such as alcohol, ether, or the like. Then when the valve is opened the water of condensation escapes and is followed by steam which is directed upon the expansible vessel and vaporizes the liquid therein and causes the vessel to expand and move the valve stem in a direction to close the valve and prevent the further escape of steam. When the valve has been closed for a time the temperature of the outer air to which the expansible vessel containing the thermostatic liquid is exposed effects the condensation of the thermostatic liquid and the contraction of the expansible vessel, and opens the valve. The exposure of the expansible vessel outside of the car introduces complications in order to protect it from injury and in order to prevent the protecting structure from causing it to become clogged with ice. Its position also is one in which it is not readily accessible. In my previous application above referred to these disadvantages are eliminated by dividing the thermostatic valve and controlling mechanism into two parts, one of which comprises an expansible vessel adjacent to the valve and the other of which comprises the thermostat located at a point in the path of the heating medium, and where it is exposed also to the outside atmosphere. The claims of the present application are limited to an advantageous form of such a thermostat. The valve, in so far as this invention is concerned, may be any valve controlling the flow of steam and the expansible vessel may be such as is shown at G for example made of thin sheet metal adapted when expanded to force the stem H of the valve inward to close the valve against the

spring J by which it is opened; the expansible vessel communicating by means of a pipe K with the thermostat at the end of the vertical pipe L through which the valve discharges.

In the construction shown in Fig. 1 the thermostat consists of a cylindrical coil M of copper or brass tubing, the lower end of which is sealed and the upper end of which communicates through the tube K with the expansible vessel G for operating the valve. The coil is arranged for the freest access thereto of the escaping steam and of the outside atmosphere by supporting it upon a pipe or tubular support N which directs the discharging heating medium to the inner surface of the coil, being coupled to the lower end of the discharge pipe L and provided with openings O through which the steam can reach the surrounding coil M; the coil being fastened in place by means of cup-shaped washers P and nuts Q screwed upon opposite ends of the tubular support N. The nuts Q may be adjusted so as to hold the convolutions of the coil in contact with each other and prevent the passage of steam or of air between them, or these nuts may set the coil with greater or smaller passages between the convolutions. The cold air is blowing on the coil at all times that the train is running, and the effect of separating the convolutions would be to expose the coil more extensively to the cooling action of the air and to render the system more sensitive to the coldness of the outer air.

The use of a coil of pipe as the vessel for carrying the thermostatic fluid and exposing it to the heat and cold has great advantages, especially in that it expands and contracts freely and can be made free from joints except the single joint which connects it with the expansible vessel adjacent to the valve, in that it exposes a large surface to the steam at one side and to the air at the other side, and in that it can be readily and cheaply applied to traps or heating systems already in use. To permit the escape of air from the coil while filling it a small orifice is left near the lower end which when the necessary quantity of the thermostatic liquid is introduced is closed by a screw or other plug R (Fig. 8) which is sufficiently tight to permit the coil to be soldered, so as to close the opening hermetically.

It has always been a difficult matter to provide for the proper ventilation or exposure to the atmosphere of the vessel carrying the thermostatic liquid. In practically all the traps employed in car heating this vessel has been inclosed to a greater or less extent, and efforts have been made to secure as full an exposure to the atmosphere as possible. With the present system and especially with the coiled pipe serving as the vessel for carrying the thermostatic liquid, there is a perfect exposure to the atmosphere. This is of importance in determining the sensitiveness of the system. For theoretical perfection the system should operate so sensitively as to maintain as nearly as possible the same temperature at the discharge end of the radiator as at its admission end, thus getting the greatest efficiency out of the piping whose radiating surface is designed for a standard temperature. With a thermostat of the kind shown in Fig. 1 I have succeeded in securing, without appreciable waste of steam and working at atmospheric pressure, a temperature at the discharge end of the radiator approximately 12 per cent. greater (above zero Fahrenheit) than can be secured under the same conditions with the best traps of the type in which the thermostat is inclosed.

Various modifications of the specific construction shown in Fig. 1 may be used, some of which are referred to hereinafter. For example some of the advantages of using a coiled pipe may be obtained by the construction shown in Fig. 2 in which such a coiled pipe is shown at M', supported frictionally or otherwise in the vertical discharge pipe S, the connecting tube K which leads therefrom being passed through a slot T which may be covered by a plate U. Fig. 3 shows a manner of applying the thermostat to an interchangeable high and low pressure system. The discharge through the thermostat M is controlled by a hand blow-off valve V. When this is closed the discharge is through an ordinary trap W. When the blow-off valve is opened, however, the discharge through the thermostat M causes the latter to control the admission valve X in order to keep the latter open sufficiently to supply steam only as rapidly as it is condensed in the radiator.

Fig. 4 shows the application of the thermostat to a system of the so-called "vapor type" in which the discharge is continuously open through the thermostat, and the consumption of steam is limited by reason of the control of the thermostat over the admission valve X.

Figs. 5 and 6 show a system operating similarly to that of Fig. 3, the trap which secures the high pressure operation being inclosed mainly within the blow-off pipe which is used in the automatic control of the admission valve X. The trap valve (Fig. 6) is shown at Y, and the blow-off valve at Z. The former discharges through an inner pipe *a* and the latter through a surrounding pipe *b*, the lower end of which is coupled to a tubular support N similar to that described in connection with Fig. 1, and which carries the coil M communicating by the tube K with the fluid-pressure expansible vessel G controlling the admission valve. The trap valve is automatically controlled

through the rod *e* resting at its lower end on a thermostat *d* of the ordinary type containing the thermostatic liquid which is vaporized by the passing steam and expanded to close the valve and which is alternately cooled by its motion through the atmosphere when the valve is closed, so as to condense the vapor and again contract the vessel and open the valve.

Figs. 7, 8 and 9 show a similar application of the invention to an interchangeable system. In this case the trap valve instead of being automatically controlled by a thermostat is a simple drip valve which when open maintains an orifice so small as to permit the escape of only the water of condensation, while holding back substantially all the steam so as to maintain the pressure. The drip valve is indicated at *e* resting on a seat surrounding an opening in the blow-off valve *f*. The screwing upward of the valve stem *g* for a short distance opens the drip port so that the system will operate as a pressure system. The further screwing up of the stem *g* raises the blow-off valve *f* from which the steam escapes by way of the outside pipe *h* and through the tubular support N′ coupled to its lower end and carrying the coil M. The drip is through a tubular extension *j* of the blow-off valve which slides through a ring *k* cast within the casing *l* and to which is attached the inner discharge pipe *m* extending downwardly to approximately the same length as the outer pipe *h* so as to keep the discharge of steam and water of condensation clear of the thermostat.

The tubular support N′ in this case is provided with a lower flange *n* upon its lower end, the whole being conveniently made of a casting of malleable iron so that only a single movable washer P and nut Q are needed, these being at the upper end.

What I claim is:—

1. A thermostat for controlling a heating system comprising a cylindrical coil M of pipe carrying a thermostatic fluid, and a supporting means for said coil passing therethrough and permitting contact therewith of the heating medium passing through the inner side of the coil.

2. A thermostat for controlling a heating system comprising a coil M of pipe carrying a thermostatic fluid, a tubular support about which said coil passes and having openings for permitting steam passing through said tubular support to come into contact with said coil, washers carried by said tubular support engaging and holding the ends of said coil and motion-transmitting means operated by the expansion of said fluid.

3. A thermostat for controlling a heating system comprising a cylindrical coil M of pipe carrying a thermostatic fluid, and a support within said coil permitting contact therewith of the heating medium passing through the inner side of the coil, means for adjusting the spaces between the convolutions of said coil and motion-transmitting means operated by the expansion of said fluid.

In witness whereof, I have hereunto signed my name in the presence of two subscribing witnesses.

EDWARD E. GOLD.

Witnesses:
D. ANTHONY USINA,
THOMAS F. WALLACE.