Aug. 21, 1928. 1,681,911

J. A. SPENCER

TRAIN HEATING SYSTEM

Filed Oct. 25, 1924

Fig. 1

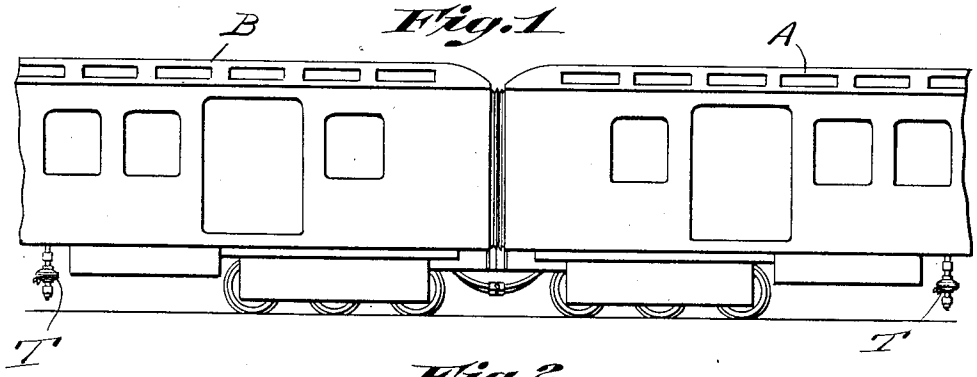


Fig. 2

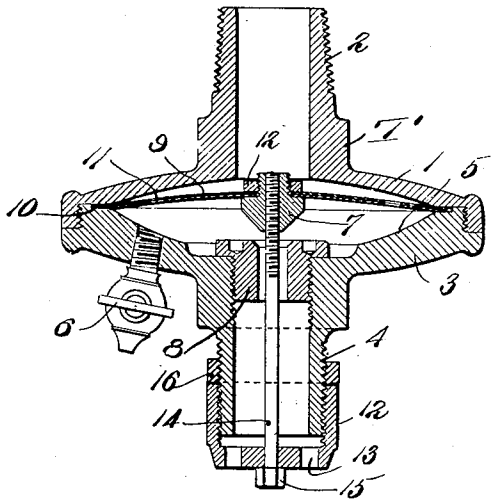
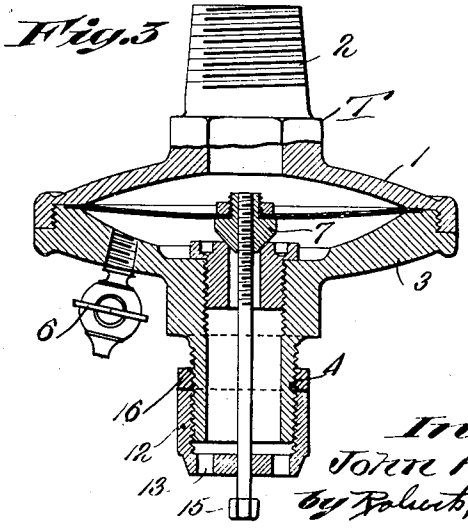


Fig. 3



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UNITED STATES PATENT OFFICE.

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TRAIN-HEATING SYSTEM.

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This invention relates to heating systems for steam driven railway trains and is particularly concerned with devices for enabling the cold fluid, viz, air and water, to be discharged from the heating pipes within a short period of time thereby quickly to heat a cold train after being made up.

In steam heating systems for trains in which steam generated by the locomotive is forced through heating pipes in the several cars, much time is consumed before all the cars are heated because the steam is ordinarily compelled to drive the cold air and water through the train to the last car where it is discharged. Usually this results in that the last car is heated considerably later than the remaining cars, and in fact if the steam pressure is insufficient, the last car is inadequately heated.

Objects of the invention are to overcome the above objections; to provide thermostatically controlled devices associated with the heating conduits of each car to permit the expulsion of cold fluid therefrom but operable automatically to prevent the escape of steam; and to provide a thermostatic device designed automatically to control the passage of fluid at different predetermined temperatures.

One concrete embodiment of the invention is illustrated in the accompanying drawings, in which:

Fig. 1 is a fragmentary elevation of a railway train equipped with thermostatic devices to control the expulsion of cold air from the heating conduits;

Fig. 2 is an axial section of the thermostatic device with the valve unseated; and

Fig. 3 is a similar view showing the valve seated.

In the embodiment of the invention illustrated the railway cars A and B are heated by conduits which are suitably arranged within the cars and are supplied with steam from the locomotive. The conduit of one car may be suitably connected to the conduit of the other car, such as by a flexible tube which is adapted readily to be coupled to one or the other of the conduits. As the steam is turned on from the locomotive it passes successively from the front to the rear car through the heating conduits but first it is necessary to expel the cold air and possibly water within these conduits before the steam is enabled to enter to provide the necessary heat. In accordance with the invention a thermostatic device T is associated with the heating conduit of each car, preferably extending beneath the cars as indicated in Fig. 1. Such device is designed to permit the expulsion of the cold fluid by the incoming steam but automatically to close when the steam comes in contact therewith.

The thermostatic device T comprises a casing consisting of an upper section 1 having a projection 2 which is externally threaded for connecting the device to the heating conduit of the car and a lower section 3 which is screwed into the upper section 1 and is provided with a tubular externally threaded projection 4 in axial alignment with the projection 2. The interior of the casing is formed with a cavity 5 which may be drained by a manually operable valve 6.

The passage of fluid through the casing is controlled by a valve 7 which is adapted to cooperate with a valve seat 8 threaded into the casing section 3. The valve 7 is normally held open but upon the entrance of steam into the casing it is automatically closed. For this purpose a thermostatic disk 9, to which the valve 7 is clamped by a nut 12, is loosely mounted in an annular recess 10 formed in the casing section 3 and is provided with perforations 11 through which fluid from the heating conduit is adapted to pass through the cavity 5 into the outlet projection 4.

The disk 9 is a composite bi-metallic sheet made up of two materials, such as iron and brass having different coefficients of expansion so that a change in temperature will cause unequal expansion and contraction of opposite faces of the sheet. The disk 9 is normally cupped (as by swaging) in such direction that the component part having the higher coefficient of expansion is on the concave side. Consequently when the disk is heated it tends to snap through to reverse position. The movement of the disk in either direction is decidedly abrupt

and owing to the relatively great inherent strength and resilience of the metal the disk will operate efficiently and reliably for a prolonged period of time without attention. The materials and thickness of the component parts and the degree of curvature are so chosen that the disk will snap through when heated to the desired temperature (e. g. 210° F.) and will snap back at a lower temperature (e. g. 180 F.). Suitable materials are sheet brass and nickel steel having thickness of 0.20″ and 0.20″ respectively and suitable cupping for a disk 4″ in diameter is ⅛″.

It should be understood that the present invention is not limited to any particular combination of materials having different thermal coefficients of expansion but is intended to embrace in its scope any combination of materials having dissimilar thermal coefficients of expansion sufficient to cause the characteristic reversal of curvature. Furthermore, the two materials comprising the composite thermostatic sheet may be secured together in any desired manner by riveting, soldering, brazing or otherwise although it is preferred to unite the materials comprising the sheet by welding or similar means to secure a substantially indivisible sheet.

From the foregoing it will be evident that in one aspect the invention involves a thermostatic device characterized by portions arranged to react upon each other with change of temperature to set up stresses the magnitude of which changes upon change of temperature, at least one of the portions being formed of different metals or other components having different coefficients of expansion, the device reaching a condition of instability at a predetermined temperature by virtue of the arrangement of said portions and as a result of the differential expansion of the components due to change of temperature, whereupon said stresses becomes effective to change abruptly the relative position of said portions.

Closing the outer end of the tubular projection 4 is a cap 12 threaded thereon and provided with a plurality of holes 13 through which fluid is adapted to flow from the casing. Extending through the end of the of the cap 12 is a stem 14 having a head 15, the opposite end of which is in threaded engagement with the valve 7 so that by manipulating the stem 14 the amount of opening and closing of the valve may be controlled. In order to lock the stem 14 in the position desired a lock nut 16 may be screwed tightly against the cap 12 thereby to prevent relative movement between the cap and projection 4.

In accordance with the illustrated embodiment the range of flexure or arching of the disk is limited to control the range of temperature at which the disk will snap from one shape to another. The valve seat 8 serves as a stop for limiting the arching of the disk 9 in one direction and by adjusting the valve seat relative to the disk or valve 7 the temperature at which the disk snaps through may be varied. This action may be compared to a toggle which requires less force at the pivoted point to align the toggle members when the angle therebetween is relatively great than when the angle is small. Similarly the arched disk will snap from one position to another more easily if it is initially flexed a certain amount, or as is the case with the seat 8 it will resume its initial position at a relatively higher temperature when the seat 8 is closer to the valve then when farther away from it. Likewise the stem 14 may be adjusted by the cap 12 and thus vary the range of flexure in the opposite direction, so that in one sense the stem serves as a stop to limit the flexing or arching of the disk 9 in the opposite direction.

It will be evident that by providing each car with such thermostatic device the steam will force cold air and water from the heating conduits of the train successively and as soon as steam comes in contact with the thermostatic disk the latter will abruptly snap the valve closed and hold it closed until the steam is turned off when it will again return the valve to open position in the same positive and abrupt manner.

An outstanding characteristic of the invention consists in that the passage of fluid is thermostatically controlled, the thermostatic member operating abruptly to unseat and seat the valve at different predetermined temperatures. Preferably the valve is held in open position until the temperature of the fluid entering the casing rises to a predetermined degree when it automatically operates positively to seat the valve. The abrupt action of the thermostatic member insures the positive seating and unseating of the valve thereby preventing waste of fluid.

I claim:

1. An escape valve for train heating systems and the like comprising a casing having a threaded nipple at its upper end for connection to the under side of a conduit, the casing having a vertical passageway to drain the conduit, a cupped sheet-metal thermostat disposed horizontally in said casing, and a valve connected to said thermostat for closing said passageway.

2. An escape valve for train heating systems and the like comprising a casing having a threaded nipple at its upper end for connection to the under side of a conduit, the casing having a vertical passageway to drain the conduit, a cupped sheet-metal thermostat disposed horizontally in said casing, and a valve connected to said thermostat for closing said

passageway, said sheet-metal thermostat extending across said passageway and having a drain opening therethrough.

3. An escape valve for train heating systems and the like comprising a casing having a vertical passageway to drain the system, the casing being formed in upper and lower parts, a sheet-metal thermostat clamped between said parts and having a drain opening therethrough, and a valve connected to the thermostat for closing said passageway.

4. A device of the character described comprising a casing containing a thermostatic sheet cupped to snap abruptly from one shape to another upon change of temperature, and an adjusting screw extending through an opening in the casing for adjusting the sheet to snap at different temperatures, the casing having an abutment therein cooperating with said screw to limit the cupping of the sheet.

5. A device of the character described comprising a casing having an axial passageway, a temperature responsive device comprising a sheet cupped to snap abruptly from one shape to a different shape, the sheet extending across said passageway and carrying a valve coaxial with the passageway, and an adjusting screw extending along said passageway and threading into said valve, the casing having an abutment cooperating with said screw to limit the cupping of the sheet.

6. A railway heating system comprising a steam line extending longitudinally of a car, a conduit depending from said line with an outlet beneath the car, a thermostatic sheet extending across said passageway and having a drain opening therethrough, and a valve operatively associated with said sheet coaxial with the conduit, said sheet being cupped to snap the valve into closed position in response to steam escaping through said conduit.

7. A railway heating system comprising a steam line extending longitudinally of a car, a conduit depending from said line with an outlet beneath the car, a thermostatic sheet extending across said passageway and having a drain opening therethrough, a valve operatively associated with said sheet coaxial with the conduit, said sheet being cupped to snap the valve into closed position in response to steam escaping through said conduit, and an adjusting screw extending downwardly from the valve through said conduit, the conduit having an abutment cooperating with said screw to limit the cupping of the sheet.

8. A water drain for steam systems comprising tubular inlet and outlet members with cupped flanges secured together at their peripheries, a thermostatic sheet having its periphery confined between said flanges, a valve actuated by the central portion of the sheet, the sheet being cupped to snap the valve into closed position at a predetermined temperature, and an adjuster extending from the sheet through said outlet, the outlet having an abutment cooperating with said adjuster to limit the movement of the sheet.

9. A device of the character described comprising two nipples having flanged bases secured together, a thermostatic sheet having its periphery confined between said flanges, a valve seat at the base end of one of the nipples, and a cooperating valve carried by said sheet, the sheet being deformed to snap abruptly between two positions in one of which the valve is tightly pressed against said seat.

10. In a device of the class described, the combination with a fluid conduit having an outlet, of temperature controlled means to control said outlet, said means including a valve and a perforated thermostatic disk designed normally to hold said valve open to permit the passage of fluid through the disk and abruptly to close said valve when the temperature of the fluid passing through the conduit reaches a predetermined degree.

11. A device of the class described comprising a casing having a fluid passageway, a valve for controlling said passageway, a curved thermostatic sheet for actuating said valve, said sheet being constructed abruptly to reverse its curvature in one direction at one end of a predetermined range of temperatures and in the other direction at the other end of said range, and means for limiting the flexure of said sheet to control said range.

12. A device of the class described comprising a casing having a fluid passageway, a valve for controlling said passageway, a curved thermostatic sheet for actuating said valve, said sheet being constructed abruptly to reverse its curvature in one direction at one end of a predetermined range of temperatures and in the other direction at the other end of said range, and means for limiting the flexure of said sheet in both directions thereby to control both limits of said range.

13. A device of the class described comprising a casing having a fluid passageway, a valve for controlling said passageway, a curved thermostatic sheet for actuating said valve, said sheet being constructed abruptly to reverse its curvature in one direction at one end of a predetermined range of temperatures and in the other direction at the other end of said range, and a stop for restricting the range of flexure of said sheet to control said range of temperature.

14. A device of the character described comprising two nipples having flanged bases secured together, a thermostatic sheet having its periphery confined between said flanges, a valve seat at the base end of one of the nipples, a cooperating valve carried by said sheet, the sheet being deformed to snap abruptly between two positions in one

of which the valve is tightly pressed against said seat, and an adjusting screw extending along the axis of one of the nipples to vary the temperature range of said sheet, the associated nipple having a cooperating abutment to limit the movement of the sheet.

15. A device of the class described comprising a casing having a fluid passageway, a valve for controlling said passageway, a curved thermostatic sheet for actuating said valve, said sheet being constructed abruptly to reverse its curvature in one direction at one end of a predetermined range of temperatures and in the other direction at the other end of said range, and a stop for restricting the range of flexure of said sheet to control said range of temperature, said stop being adjustable thereby to vary the flexure of the sheet and accordingly vary the temperature at which said sheet changes curvature in one direction.

16. A device of the class described comprising a casing having a fluid passageway, a valve for controlling said passageway, a curved thermostatic sheet for actuating said valve, said sheet being constructed abruptly to reverse its curvature in one direction at one end of a predetermined range of temperatures and in the other direction at the other end of said range, and stops for restricting the range of flexure of said sheet in both directions to control both limits of said range of temperature, said stops being adjustable thereby to vary the flexure of said sheet and accordingly vary the temperature at which said sheet changes curvature in both directions.

17. The combination of a valve seat, a bimetallic concavo-convex disk arranged so that changes of temperature cause its center portion to warp, with snap action, to opposite sides of the plane of its periphery, and a valve on the disk adapted to be seated and unseated through said warping movements of the disk, and means whereby, when the disk is in the valve unseating position, the distance between the center of the disk and the plane of the periphery thereof may be varied.

18. The combination of a valve seat, a bimetallic concavo-convex disk arranged so that changes of temperature cause its center portion to warp, with snap action, to opposite sides of the plane of its periphery, a valve on the disk adapted to be seated and unseated through said warping movements of the disk, and an adjusting device to variably limit the flexing movements of the disk away from the valve seat.

Signed by me at Cambridge, Massachusetts, this second day of October, 1924.

JOHN A. SPENCER.