Nov. 22, 1949 W. M. WATKINS, JR 2,489,209

TEMPERATURE REGULATOR

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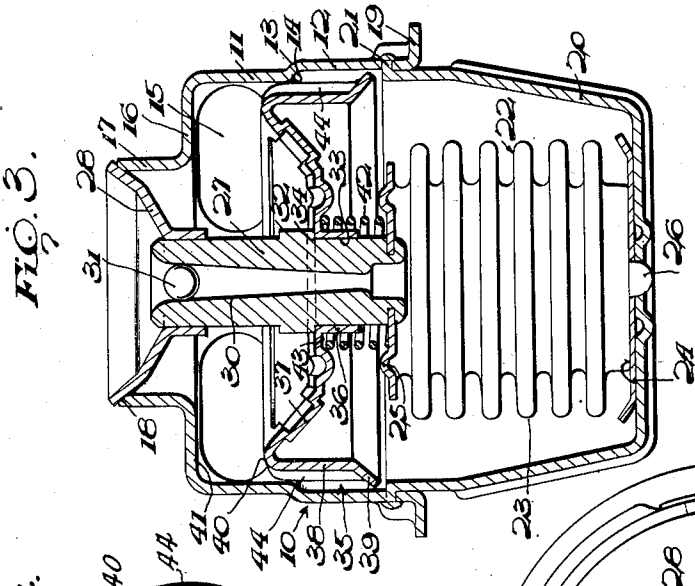


FIG. 3.

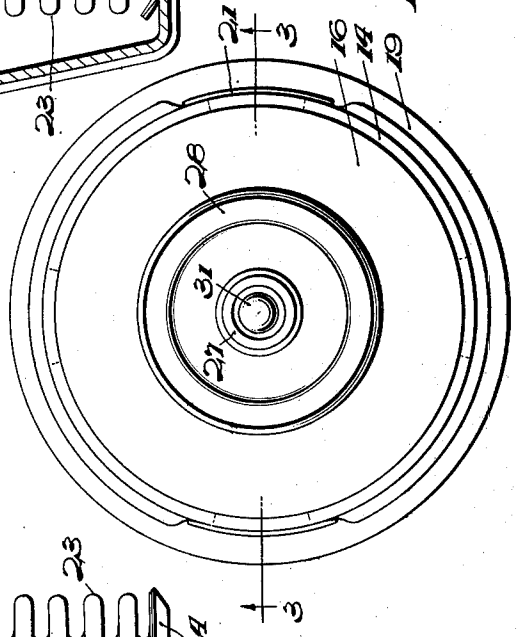


FIG. 2.

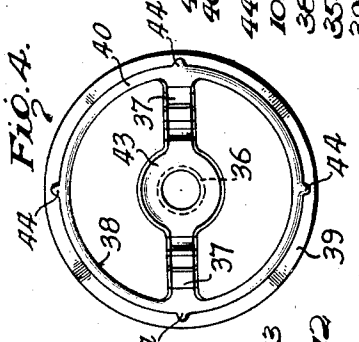


FIG. 4.

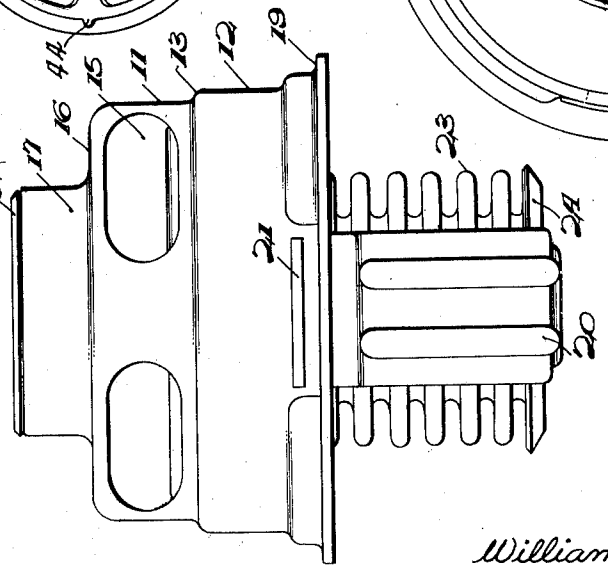


FIG. 1.

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TEMPERATURE REGULATOR

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7 Claims. (Cl. 236—34)

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This invention relates to temperature regulators, and more particularly to temperature regulators of the type employed for controlling the circulation of a cooling medium through an automobile cooling system including a by-pass.

It has heretofore been proposed to provide temperature regulators of the type referred to which employ coaxially arranged main and by-pass valve members operable by a thermostat suspended from a casing in which are main and by-pass openings controlled by said valve members, the by-pass valve member including a substantially cylindrical portion cooperating like a sleeve valve with by-pass openings in said casing and therefore guided by said casing as said valve moves by reason of the expansion and contraction of the thermostat. Constructions of this character have been criticized because of the danger that said valve member may stick in the casing as a result of corrosion, the deposition of sediment, etc., or because of variations in size arising from usual manufacturing tolerances.

To avoid the necessity of cylindrical members reciprocating one within the other it has also been proposed to make the casing and by-pass valve member, in whole or in part, of frusto-conical formation, so that the frusto-conical portions contact only at the limit of movement of the by-pass valve member. Structures of this character have been open to the criticism that until the by-pass valve member approaches the limit of its movement it is out of guiding relationship with the casing. Furthermore, if under manufacturing tolerances the by-pass valve member is stopped before the frusto-conical surfaces engage or the conicity of the by-pass valve member does not agree with that of the casing, undue clearance and resulting leakage may exist around the by-pass valve member.

An object of this invention is to provide a temperature regulator of the character referred to wherein the by-pass valve member and casing may be of cylindrical formation without introducing the difficulties heretofore encountered where sliding cylindrical surfaces are employed.

Another object of this invention is to provide a device of the type characterized in which the cooperating cylindrical portions of the by-pass valve member and its casing may have adequate clearance with respect to each other to avoid binding because of corrosion, sediment, etc., and yet the valve member may be guided throughout its opening and closing movements.

Another object of this invention is to provide a device of the type characterized in which the

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effect of variations in the clearance between said valve member and its casing may be minimized and by-pass flow terminated without undue leakage when said valve member has reached its extreme position without reliance on rubbing cylindrical surfaces during expansion and contraction of the thermostat and without reliance on mating frusto-conical surfaces coming into engagement at the limit of movement of the thermostat.

Another object of this invention is to provide a device of the type characterized in which the by-pass valve member may be so constructed and associated with respect to its casing that adequate closure of the by-pass valve member is assured under manufacturing tolerances and yet further expansion of the thermostat if the temperature continues to rise will not result in injury to the unit.

Other objects will appear as the description of the invention proceeds.

The invention is capable of receiving a variety of mechanical expressions, one of which is illustrated on the accompanying drawings, but it is to be expressly understood that the drawings are for purposes of illustration only and are not to be construed as a definition of the limits of the invention, reference being had to the appended claims for that purpose.

Referring in detail to the accompanying drawings wherein an embodiment of the present invention is illustrated somewhat schematically and wherein like parts are designated by corresponding reference characters,

Fig. 1 is an elevation of an embodiment of the present invention;

Fig. 2 is a plan of the structure of Fig. 1; and

Fig. 3 is a sectional elevation at right angles to Fig. 1; and

Fig. 4 is an end view of the by-pass valve member to smaller scale.

In the form shown the temperature regulator is composed of a single self-contained unit that may be readily installed at any suitable location at any suitable portion of an automobile cooling system of the by-pass type. To this end said regulator includes a generally cylindrical casing 10 having its peripheral wall composed of two cylindrical portions 11 and 12 connected by an outwardly extending shoulder 13 which, interiorly of the casing, provides a by-pass valve seat at 14. The portion 11 of said casing is provided with suitable apertures 15 which, when the casing is mounted in position, are designed to communicate with the by-pass of the system. Portion 11 of said casing has a shoulder 16 from which ex-

tends a generally cylindrical neck 17, the opening 18 at the end of said neck providing the main valve port as will hereinafter appear. The opposite end of the casing 10 is flanged at 19 so that it may be secured in position in any suitable way.

Suspended from the casing 10 in any suitable manner is a strap 20, here shown as of generally U-shaped formation, and attached to the cylindrical portion 12 of said casing in any suitable way as by upsetting or staking the ends of the strap in slots in said casing as shown at 21. Mounted on the central portion of said strap 20 and suitably secured thereto is a thermostat 22 of any suitable construction. As shown, said thermostat is composed of a corrugated expansible and collapsible corrugated wall for bellows 23 hermetically sealed to a stationary end wall 24 and a movable end wall 25. Stationary end wall 24 is secured to the strap 20 in any suitable way as by a threaded stem and nut or a projection on said wall sealed in an aperture in said strap as shown at 26. Attached to the movable end wall 25 of said thermostat is a post or valve stem 27 to the free end of which is attached a main valve member 28 of any suitable construction, here shown as of dished or frusto-conical formation so as to make line contact with the valve seat 18. Valve member 28 may be threaded, pinned, or otherwise secured to the end of stem 27 and, as shown, stem 27 has an interior passage 30 through which the thermostat may be charged after which said passage may be hermetically sealed as by a ball 31.

Valve stem 27 has its portion 32 of larger diameter than a portion 33 contiguous to movable end wall 25 so as to provide a shoulder at 34. Slidably mounted on said stem portion 33 is a by-pass valve member 35 shown as comprising a sleeve or collar portion 36 slidably mounted on the stem portion 33, a spider 37 extending from said sleeve 36 and providing the requisite apertures for the flow of cooling medium as hereinafter explained, and a cylindrical skirt like portion 38 having a plurality, preferably four, equally-spaced axially-extending outwardly-projecting beads 44 (shown with some exaggeration in Fig. 3) which provide guiding contact with the interior surface of casing portion 11, said skirt like portion 38 terminating in an outwardly flared portion 39. Said by-pass valve member may be formed in any suitable way but the construction illustrated has the advantage that it can be readily stamped from sheet metal in one piece. Portion 38 of the by-pass valve member between the beads 44 has a diameter sufficiently smaller than the inner diameter of the portion 11 of the casing 10 so that adequate clearance exists therebetween to prevent binding or freezing because of rust, dirt and the like, while the disadvantages of rubbing surfaces are avoided. The flared portion 39 of said valve member preferably projects closely to the portion 12 of the casing 10 but has an adequate clearance therewith. The length of the cylindrical portion 38 is such, when compared with the length of the cylindrical portion 11 of casing 10, that the flared portion 39 will engage the shoulder 14 at the same time within the limits of manufacturing tolerances that the portion 40 of said valve member engages the inner surface 41 of the shoulder 16. Thereby the flared portion 39 cooperates with said shoulder 14 as a seat functioning in the nature of a poppet valve.

The by-pass valve member 35 is normally held against the shoulder 34 by a coil spring 42 reacting between the movable end wall 25 of the thermostat and a suitable surface 43 at the inner extremity of the spider 37. Under normal operation the by-pass valve member 35 is held by the spring 42 in contact with the shoulder 34. If, however, the flared portion 39 of valve 35 should engage its seat 14 or the upper seating edge 40 should engage its seat 41 and thereafter the thermostat should continue to expand, the stem 27 and its main valve member 28 may continue to move upwardly as viewed in Fig. 3, the sleeve portion 36 sliding on the stem portion 33 against the resilient compression of the spring 42.

In operation, the unit is mounted in a housing having suitable interior walls for separating the main flow from the by-pass flow, and is retained in said housing by means of its flange 19 at one extremity and by a resilient gasket contacting the interior wall of the housing and the upper surface of shoulder 16 at its other extremity, as shown for example in Patent No. 2,165,355, granted to Dube on July 11, 1939. The thermostat 22 is suspended by its strap 20 in the down stream direction of flow of the cooling medium through the cooling system. When the engine is first started the thermostat 22 is contracted, holding the parts in the relative relationship shown in Fig. 3 with the by-pass valve member 38 in its wide open position and the main valve member 28 held in contact with its seat 18, preventing main flow through the radiator. When the cooling medium rises in temperature to a predetermined degree thermostat 22 begins to expand, moving the by-pass valve member 35 toward the shoulder 16 and correspondingly opening the main valve member 28. During this movement the beads 44 on the cylindrical portion 38 of said valve member are in sliding contact with the inner face of the cylindrical portion 11 of the casing, whereby said valve member is adequately guided but sufficient clearance exists between most of the surface of portion 38 and the inner face of portion 11 to prevent binding. When the temperature has risen to that point at which flow through the by-pass should be discontinued flared portion 39 contacts the shoulder 14 substantially simultaneously with the engagement of portion 40 with the surface 41 of the casing. Thereby all flow of the cooling medium is forced through the apertures in the spider 37 and out through the main valve port 18, the clearance between the surfaces 40 and 41 or 14 and 39 if simultaneous engagement does not occur under manufacturing tolerances being insufficient to permit undesirable leakage past the by-pass valve member into the openings 15. If after the by-pass valve member is thus closed the temperature continues to rise, the thermostat can continue to expand as before explained without injury to the unit. Upon cooling of the cooling medium the thermostat contracts and the operation as explained is reversed.

It will therefore be perceived that by the present invention a temperature regulator has been provided for automobile cooling systems which avoids cylindrical rubbing surfaces without loss of the guiding function, which assures adequate closure of the by-pass without reliance upon the engagement of correspondingly shaped frusto-conical surfaces, and which minimizes leakage through the by-pass by the engagement of a valve member with its seat in the nature of a poppet valve. Furthermore, the construction is such that stoppage of by-pass flow can be effected by the positive engagement of seating parts without danger to the unit arising from further increase of

temperature after the by-pass valve member has seated.

While the embodiment of the invention illustrated on the drawings has been described with considerable particularity, it is to be expressly understood that the invention is not restricted thereto as the same is capable of receiving a variety of mechanical expressions, as will now be apparent to those skilled in the art, while changes may be made in the details of construction, arrangement and proportion of parts without departing from the spirit of this invention. Reference is therefore to be had to the appended claims for a definition of said invention.

What is claimed is:

1. In a temperature regulator of the character described, the combination of a casing provided with at least two substantially cylindrical peripheral portions of different diameter connected by an outwardly directed interior shoulder intermediate the length of said casing, a thermostat suspended from said casing, said casing being formed to provide a main valve port at its end opposite from said thermostat, the cylindrical peripheral portion of said casing nearer said main port being apertured to have communication with a by-pass, a valve stem extending from said thermostat, a main valve member mounted on said stem for cooperation with said main port, and a generally cylindrical by-pass valve member mounted on said stem intermediate said main valve member and said thermostat, said by-pass valve member having circumferentially narrow means cooperating with said casing portion nearer said main port for guiding said valve member and having an outwardly flared extremity at its end nearer said thermostat adapted to engage said shoulder on the casing for discontinuing by-pass flow.

2. In a temperature regulator of the character described, the combination of a casing provided with at least two substantially cylindrical peripheral portions of different diameter connected by an outwardly directed interior shoulder intermediate the length of said casing, a thermostat suspended from said casing, said casing having a tubular neck terminating in a valve seat to provide a main valve port at its end opposite from said thermostat, the cylindrical peripheral portion of said casing nearer said main port being apertured to have communication with a by-pass, a valve stem extending from said thermostat, a main valve member mounted on said stem for cooperation with said main port, and a generally cylindrical by-pass valve member mounted on said stem intermediate said main valve member and said thermostat, said by-pass valve member including a substantially cylindrical portion provided with outwardly projecting, axially extending, circumferentially narrow guide portions and having a flared extremity adapted to engage said shoulder to discontinue by-pass flow.

3. In a temperature regulator of the character described, the combination of a generally cylindrical casing provided with a shoulder, a thermostat suspended from said casing, said casing being formed to provide a main valve port at its end opposite from said thermostat, the cylindrical peripheral portion of said casing nearer said main port being apertured to have communication with a by-pass, a valve stem extending from said thermostat, a main valve member mounted on said stem for cooperation with said main port, a by-pass valve member mounted on said stem intermediate said main valve member and said thermostat and constructed to engage said shoulder on the casing for discontinuing by-pass flow, said by-pass valve member being slidingly mounted on said stem, resilient means coacting with said by-pass valve member, and a shoulder on said stem with which said by-pass valve member is normally engaged by said resilient means but with respect to which said by-pass valve member may move after said member has engaged said shoulder on the casing.

4. In a temperature regulator of the character described, the combination of a casing provided with at least two substantially cylindrical peripheral portions connected by a shoulder, a thermostat suspended from said casing, said casing being formed to provide a main valve port at its end opposite from said thermostat, the cylindrical peripheral portion of said casing nearer said main port being apertured to have communication with a by-pass, a valve stem extending from said thermostat, a main valve member mounted on said stem for cooperation with said main port, a by-pass valve member mounted on said stem intermediate said main valve member and said thermostat, said by-pass valve member including a substantially cylindrical portion having a flared extremity adapted to cooperate with said shoulder on the casing to discontinue by-pass flow, said by-pass valve member being slidingly mounted on said stem, resilient means coacting with said by-pass valve member, and a shoulder on said stem with which said by-pass valve member is normally engaged by said resilient means but with respect to which said by-pass valve member may move after said member has engaged said shoulder on the casing.

5. In a temperature regulator of the character described, the combination of a casing provided with at least two substantially cylindrical peripheral portions connected by a shoulder, a thermostat suspended from said casing, said casing being formed to provide a main valve port at its end opposite from said thermostat, the cylindrical peripheral portion of said casing nearer said main port being apertured to have communication with a by-pass, a valve stem extending from said thermostat, a main valve member mounted on said stem for cooperation with said main port, a by-pass valve member mounted on said stem intermediate said main valve member and said thermostat and constructed to cooperate with said shoulder on the casing for discontinuing by-pass flow, said by-pass valve member including spaced axially extending surfaces adapted to cooperate with the cylindrical portion of said casing nearer said main port for guiding said valve member, said by-pass valve member being slidingly mounted on said stem, resilient means coacting with said by-pass valve member, and a shoulder on said stem with which said by-pass valve member is normally engaged by said resilient means but with respect to which said by-pass valve member may move after said member has engaged said shoulder on the casing.

6. In a temperature regulator of the character described, the combination of a casing provided with at least two substantially cylindrical peripheral portions connected by a shoulder, a thermostat suspended from said casing, said casing being formed to provide a main valve port at its end opposite from said thermostat, the cylindrical peripheral portion of said casing nearer said main port being apertured to have communication with a by-pass, a valve stem extending from said thermostat, a main valve member mounted on said stem for cooperation with said main port, a

by-pass valve member mounted on said stem intermediate said main valve member and said thermostat, said by-pass valve member including a substantially cylindrical portion having clearance with respect to the apertured cylindrical portion of said casing and having axially extending beads in engagement with and guided by the cylindrical portion of said casing nearer said main port and a flared portion adapted to cooperate with said shoulder on the casing to discontinue by-pass flow, said by-pass valve member being slidingly mounted on said stem, resilient means coacting with said by-pass valve member, and a shoulder on said stem with which said by-pass valve member is normally engaged by said resilient means but with respect to which said by-pass valve member may move after said member has engaged said shoulder on the casing.

7. In a temperature regulator of the character described, the combination of a casing provided with at least two substantially cylindrical peripheral portions of different diameter connected interiorly of the casing and intermediate the length thereof by an outwardly directed shoulder integral therewith, a thermostat suspended from said casing, said casing having a portion apertured to provide a main valve port at its end opposite from said thermostat, the cylindrical peripheral portion of said casing nearer said main

port being joined to said portion providing said main port by a second shoulder integral with said peripheral portions and being apertured to have communication with a by-pass, a valve stem extending from said thermostat, a main valve member mounted on said stem for cooperation with said main port and a by-pass valve member mounted on said stem intermediate said main valve member and said thermostat, said by-pass valve member including a substantially cylindrical portion having a flared skirt and an end surface adapted to engage substantially simultaneously the respective shoulders.

WILLIAM MADISON WATKINS, JR.

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The following references are of record in the file of this patent:

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