Aug. 16, 1938. J. V. GIESLER ET AL 2,127,059

TEMPERATURE REGULATOR

Filed Oct. 28, 1935

Fig. 1.

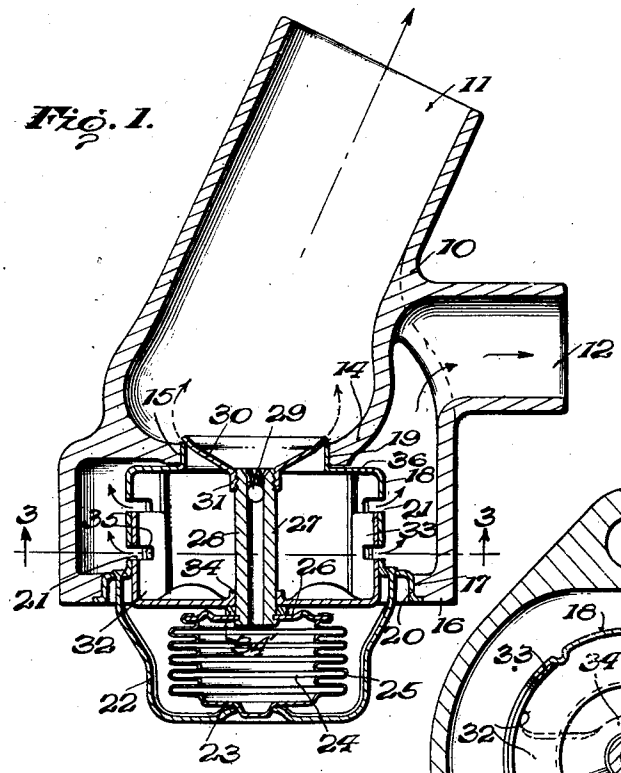


Fig. 3.

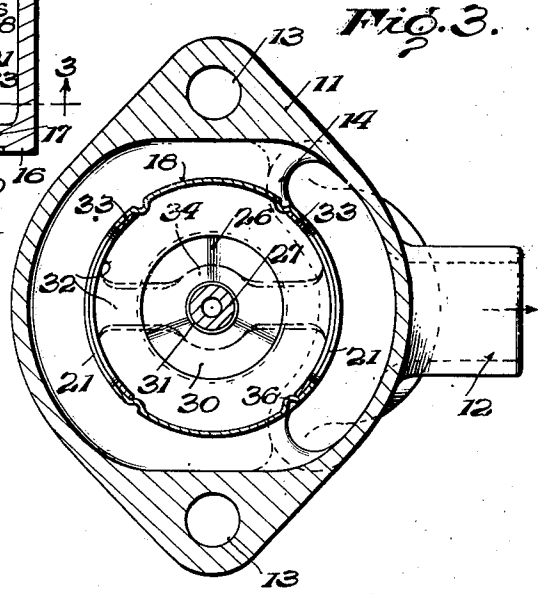
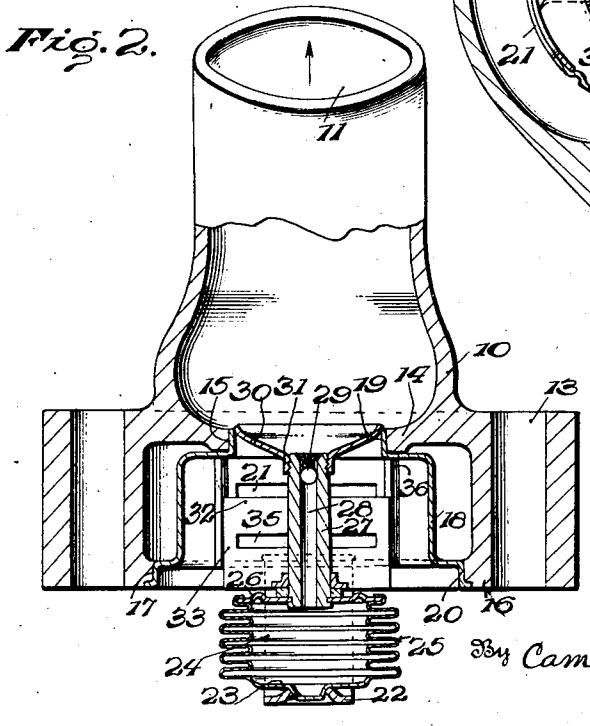


Fig. 2.



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TEMPERATURE REGULATOR

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1 Claim. (Cl. 236—34)

This invention relates to temperature regulators for internal combustion engines, and more particularly to regulators of this character which are designed to control the circulation of the cooling medium through main and by-pass conduits under different temperature conditions.

Temperature regulators for internal combustion engines which predetermine the circulation of cooling medium between main and by-pass conduits are well known, and it has heretofore been the practice to provide such a regulator in the form of a pair of valves each of which is closed only when the other is wide open. In the customary construction of regulators of the type under consideration this relationship between the valves is made necessary by the fact that seating valves are employed so that the engagement of either valve with its seat constitutes a stop preventing further movement of the other valve. Thus engagement of the by-pass valve with its seat prevents further opening of the valve in the main line, and this requires that the by-pass valve not engage its seat until the valve in the main line has reached its wide open position. Conversely, the by-pass valve is opened as soon as the main valve starts to move toward its closed position. Thus the by-pass valve is open to varying degrees throughout the stroke of the main valve.

A by-pass is desirable because of the continuous circulation of water provided thereby, avoiding tendencies for overheating at any portion of the system, but as soon as the temperature of the cooling medium has risen to that degree at which it is desirable that some of the circulation take place through the radiator need for continuous circulation through the by-pass no longer exists. Moreover, if the circulation is established solely through the radiator soon after the main valve starts to open, a closer temperature control can be maintained because of the fact that all of the circulation is thereafter maintained through one conduit and at a rate determined by the degree of opening of one valve.

It is an object of this invention to provide a regulator of the type characterized wherein the by-pass valve is closed promptly after the main valve starts to open, and remains closed throughout the remainder of the opening stroke of the main valve.

Another object of this invention is to provide a regulator of the type characterized whereby a closer regulation of the temperature of the cooling medium may be obtained by compelling all of the circulation to flow through the main passage except when the main valve is at or closely adjacent to its seat.

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 shown on the accompanying drawing, but it is to be expressly understood that the drawing is for purposes of illustration only, and is not to be construed as a definition of the limits of the invention, reference being had to the appended claim for that purpose.

Referring in detail to the drawing, wherein the same reference characters are employed to designate corresponding parts of the several figures—

Fig. 1 is an axial section of an embodiment of the present invention;

Fig. 2 is an axial section of the embodiment of Fig. 1 taken on a plane at right angles thereto; and

Fig. 3 is a cross section on the line 3—3 of Fig. 1.

In the form shown, a casing 10 of any suitable size, construction and material, is provided with a passage 11, adapted to communicate with the main circuit for the cooling medium, preferably that including a radiator, and with a passage 12, adapted to communicate with a by-pass in a manner well understood in the art. As shown, said casing 10 is of a form suitable for mounting the regulator so that the thermostat thereof may depend into the water jacket of the engine, said casing being shown as provided with apertures 13 by which it may be bolted or otherwise suitably secured to the engine head or to a suitable extension of the engine jacket, but it is to be expressly understood that the present invention may be incorporated in a structure suitable for installation at any other appropriate place in the cooling system. Casing 10 is provided with an interior wall 14 having an aperture 15 and its end 16 is provided with an aperture 17 to receive the regulator to be described.

The temperature regulator per se is preferably formed as a readily attachable and detachable unit which may be secured in the casing 10 in any suitable way, but it is to be expressly understood that the invention is not restricted to the use of a regulator that is mountable as a self-contained unit, as one or more of the relatively stationary elements, as the outer member of the by-pass valve, the support for the thermostat, etc., may if preferred be made integral with or separately attached to the casing 10.

In the form shown, a generally tubular member 18 has a cylindrical extension 19 of reduced

diameter and of a size adapted to fit snugly in the aperture 15. At its opposite end said tubular member 18 is flanged or otherwise suitably formed so as to fit snugly in the aperture 17, as shown at 20, and the same is secured fixedly therein in any suitable way. The wall of said member 18 is provided with a suitable number of apertures 21 which may be variously disposed around the circumference of said wall and in one or more circumferential planes as preferred. The number and size of said apertures 21 are so selected that when said apertures are uncovered the predetermined circulation of cooling medium through the by-pass passage 12 is obtained.

Suitably formed on or attached to said member 18 is a spider or other suitable support for a thermostat. As here shown, said support takes the form of a generally U-shaped strap 22 that has its extremities suitably secured in apertures in the member 18 and which at its intermediate portion is suitably shaped or formed so as to have fixedly attached thereto the stationary end wall 23 of a thermostat 24 of any suitable character and construction. As illustrated, said thermostat 24 is formed by an expansible and collapsible deeply corrugated tubular metal wall or bellows 25 having one end integral with or suitaby attached to said stationary end wall 23 and having its opposite end suitably secured to a movable end wall 26. Attached to said movable end wall 26 in any suitable way is a valve stem 27, here shown as provided with a central aperture 28 so as to afford a filling opening for the thermostat. When the thermostat has been suitably charged passage 28 may be sealed in any suitable way, as by a ball and a block of solder indicated at 29. Attached to the opposite extremity of the valve stem 27 in any suitable way is a valve member 30 of the poppet type here shown as provided with an integrally threaded hub 31 for attachment by threads to the end of the valve stem. As illustrated, said valve member is made of dished formation so that it may have a line contact with the valve seat provided by the tubular extremity 19 of the member 18, but any other suitable form of valve may be employed.

Also attached to the valve stem 27 in any suitable way is a valve member 32 so constructed that it will open and close the apertures 21 in the member 18 as hereinafter explained. As shown, the apertures 21 are provided in diametrically opposite portions of the member 18 and the valve member 32 is therefore formed as a diametrically extending strip having at its opposite extremities valve portions 33 which extend axially of the regulator and are curved circumferentially so as to contact with the opposite arcuate portions of the member 18 containing the apertures 21. The axially extending portions 33 are preferably of somewhat greater width than the apertures 21 so that said apertures may be completely closed as hereinafter explained. The central portion of said member 32 has an apertured hub 34 by which it is mounted and retained on the valve stem 27, a washer 34' being illustrated as spacing said member from the movable end wall 26 of the thermostat. The axially extending portions 33 of member 32 are provided with apertures 35 designed to register with the apertures 21, and said portions are preferably of such length that when the valve member 30 is in engagement with its seat the circumferential row of apertures nearer the valve member 30 is cleared thereby, this construction reducing the number of apertures that need be formed in the member 32 to control the apertures 21 and also shortening the axial length of the regulator as will now appear.

Not only does the co-action of the member 32 with the member 18 provide a guide for the rectilinear movements of the valve member 30 and its stem 28 as the thermostat 24 expands and contracts, but the engagement of the extremities of the axially extending portions 33 with the inwardly extending shoulder 36 of the member 18 constitutes a stop which predetermines the extent of expansion of the thermostat 24 and of the opening movement of the valve 30.

The novel principle of operation involved in a device embodying the present invention will appear from a description of the operation thereof. In the relationship of the parts shown in Fig. 1 the valve member 30 is in engagement with its seat and the circulation of water through the passage 11 is completely or substantially prevented. The cooling water flows over the thermostat 24, however, and through the apertures 21 to the passage 12 because of the registering apertures 35 in the member 32 and the uncovered apertures 21 at the free ends of the axially extending portions 33. When the temperature of the cooling water has attained that degree at which it is desired that the main valve 30 begins to open, expansion of the thermostat 24 not only moves valve member 30 away from its seat but at the same time moves member 32 to restrict the openings 21. Continued expansion of the thermostat continues the opening movement of the valve member 30 and, depending upon the axial dimension of the apertures 21, said apertures are promptly closed after a portion only of the movement of the valve member 30 away from its seat. Continued expansion of the thermostat 24 continues the movement of the valve member 30 away from its seat until the ends of the portions 33 engage the shoulder 36, but throughout the latter and major portion of the stroke of the valve member 30 the apertures 21 are maintained closed and substantially no circulation of the cooling medium through the by-pass can occur. Conversely, when the thermostat begins to contract the valve member 30 is caused to approach its seat, but not until the later and minor portion of the stroke of the valve member 30 are the apertures 21 uncovered, and therefore resumption of circulation through the by-pass occurs only just before valve member 30 engages its seat.

By varying the axial dimension of the apertures 21 the proportionate part of the stroke of valve member 30 during which circulation through the by-pass is maintained can be nicely determined, and throughout the remainder of the stroke of the valve member 30 the circulation is maintained only through the passage 11. As this passage usually communicates with the radiator, the cooling effect of the latter is obtained as to all of the circulating water throughout the major portion of the stroke of the valve member 30, and the rate of circulation thereof is nicely regulated by reason of the one valve controlling the same from the thermostat subjected to the temperature of the circulating water.

It will therefore be perceived that by the present invention a by-pass regulator has been provided whereby the by-pass is active only for that part of the stroke of the main valve wherein the main valve is at or adjacent to its seat, and throughout the remainder of the stroke of said main valve the entire circulation is maintained

through the radiator and under the control of the one valve.

While the embodiment of the invention illustrated on the drawing has been described with considerable particularity, it is to be expressly understood that the invention is not to be restricted thereto, as the same is capable of receiving a variety of mechanical expressions. The construction illustrated and described possesses the advantage that the member **18**, the thermostat support **22**, the sleeve valve member **32** and the main valve member **30** or one or more of them, may be formed of sheet metal, and therefore the structure is simple and inexpensive to produce. It is to be understood, however, that the parts of the structure may be made in any other suitable way if preferred. It will also be apparent that the shape, size and construction of the parts may be widely varied, other forms of thermostat, valve members, housings, etc., may be employed, and numerous 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 claim for a definition of the invention.

What is claimed is:

In a temperature regulator for the cooling system of an internal combustion engine, a casing adapted to be secured to the water jacket of the engine, a passage in said casing adapted to communicate with the main circuit for the cooling medium, a second passage in said casing adapted to communicate with a by-pass, an apertured tubular member carried within said casing separating said first named passage and said second named passage, a spider secured to said tubular member and extending below said casing, a thermostat carried within said spider and designed to extend into the water jacket of the engine, a valve stem carried by said thermostat extending centrally through said tubular member, a valve member of the poppet type carried on said valve stem designed to normally close said first named passage, and an apertured valve member curved circumferentially and slidably contacting opposite arcuate internal portions of said tubular member carried by said valve stem, the apertures in said second valve member being designed to register with the apertures in said tubular member only when said first named valve member is substantially closed and thereby open communication with said second named passage whereby the apertures in said second named valve member cease to register with the apertures in said tubular member as soon as said first named valve member starts substantially on its opening stroke.

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