July 6, 1943. J. V. GIESLER 2,323,533

TEMPERATURE REGULATOR

Filed Feb. 24, 1941 3 Sheets-Sheet 1

Fig. 1.

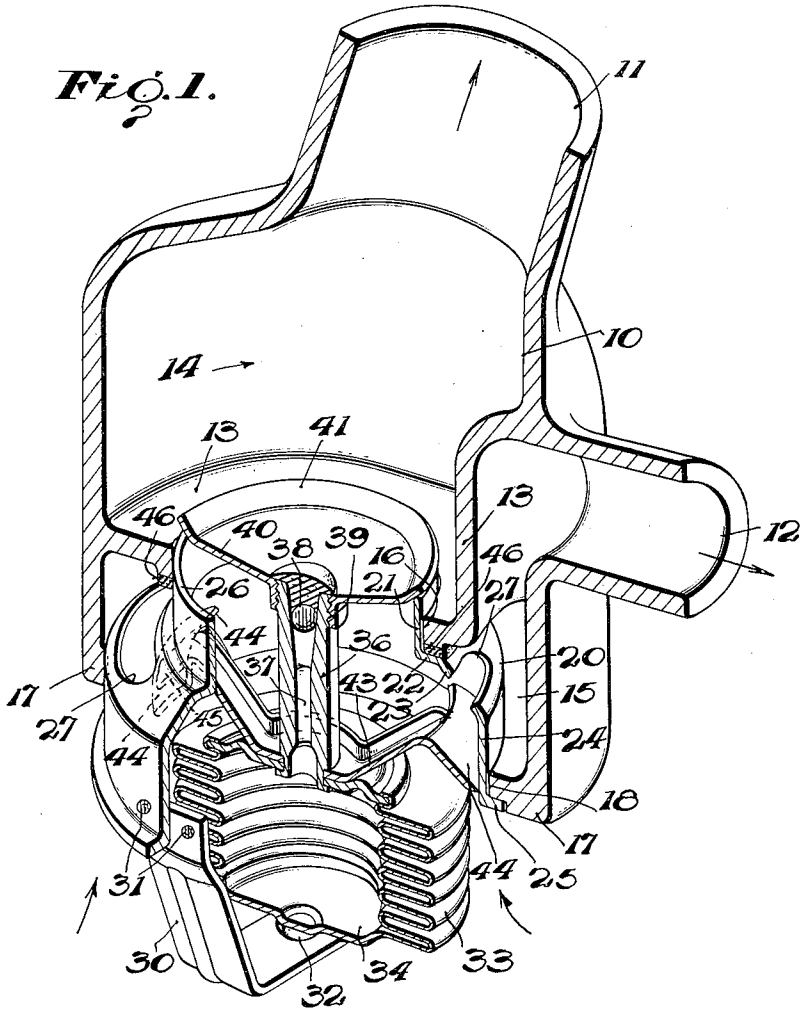

Fig. 3.

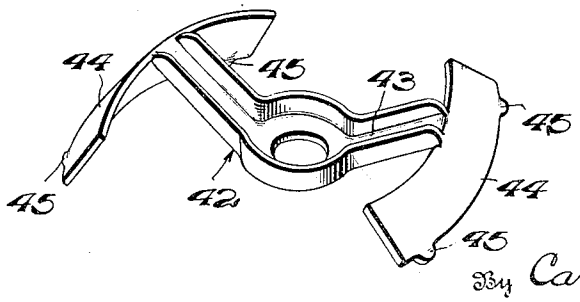

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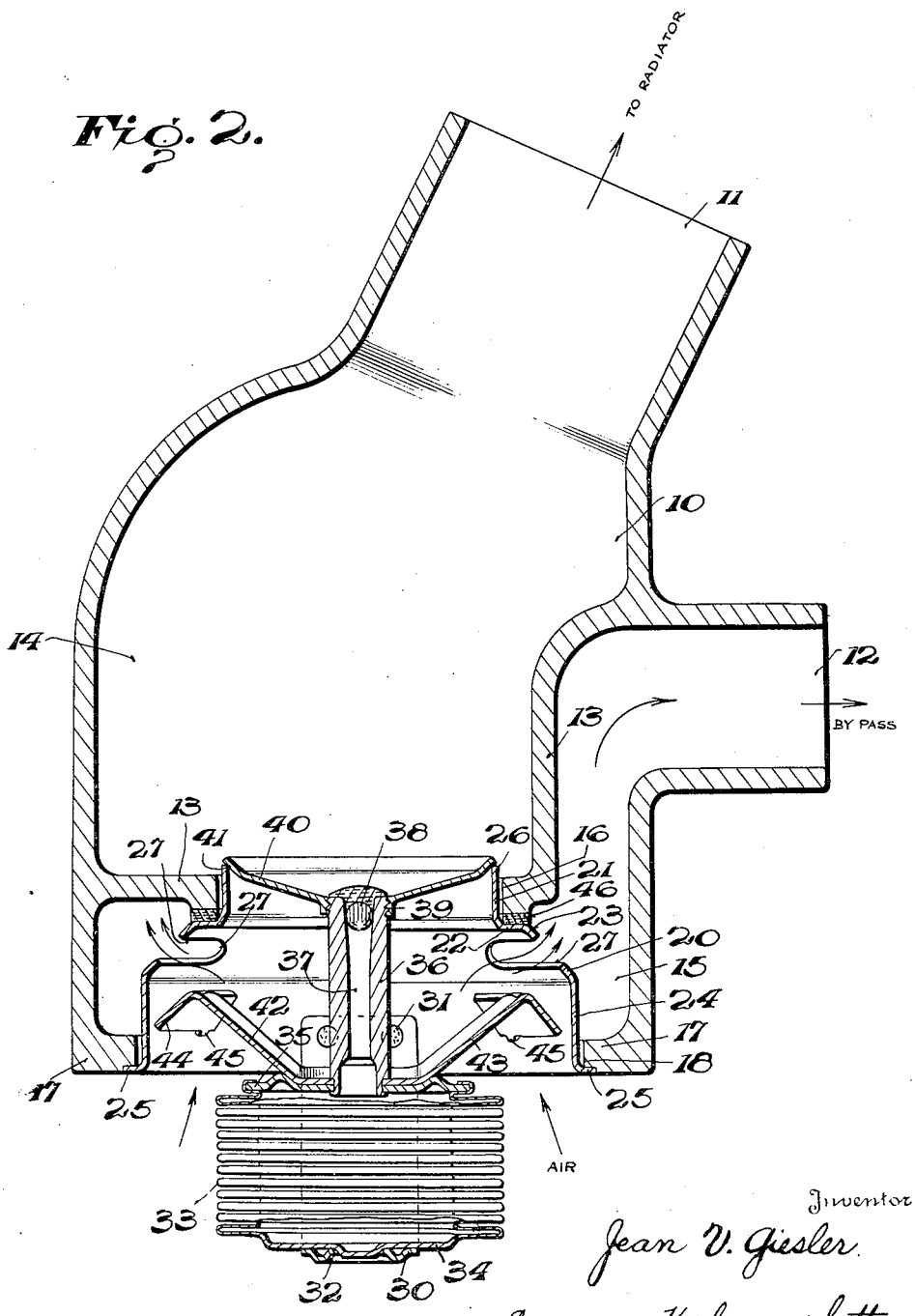
Fig. 2.



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TEMPERATURE REGULATOR

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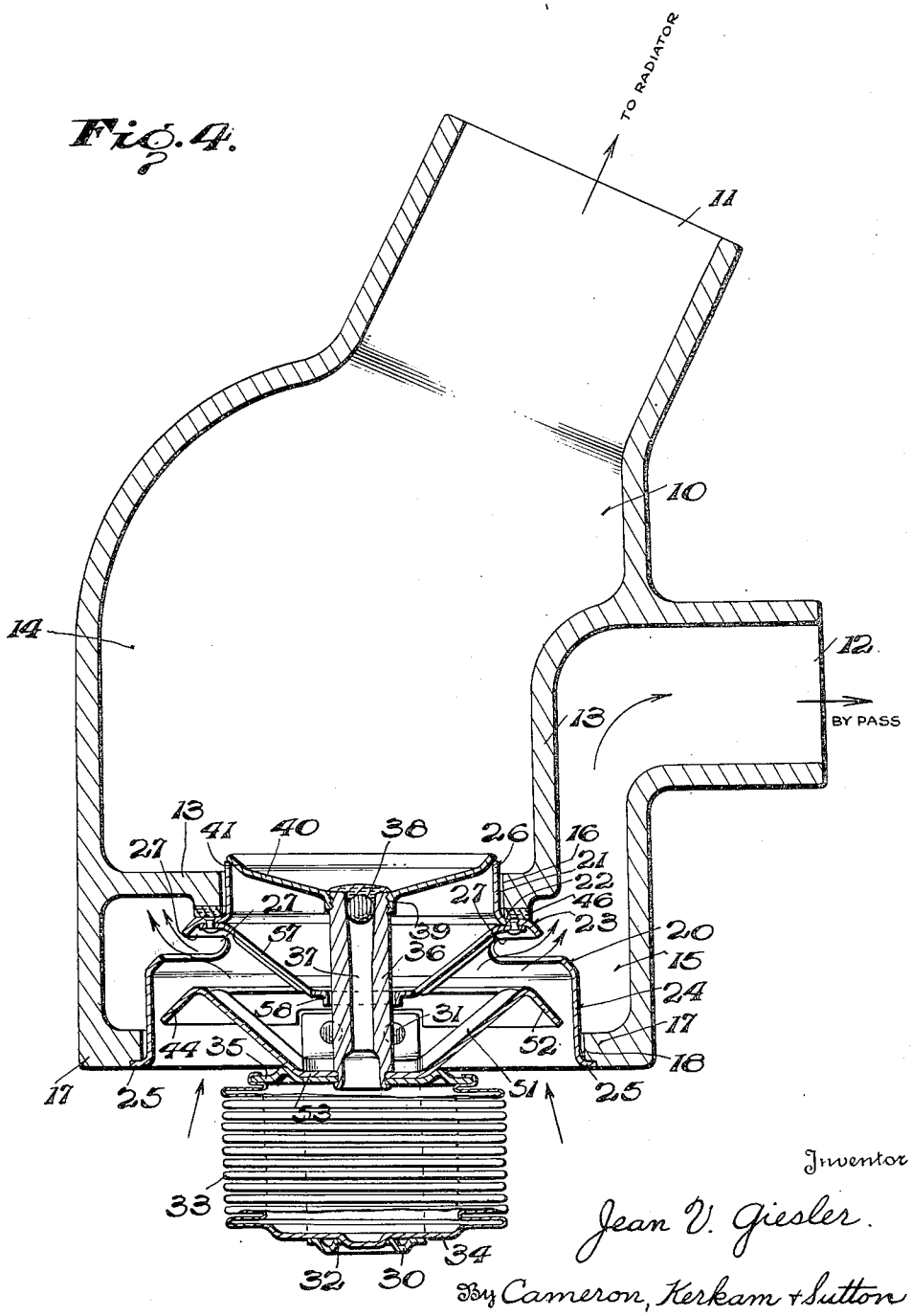
Fig. 4.



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UNITED STATES PATENT OFFICE

2,323,533

TEMPERATURE REGULATOR

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Application February 24, 1941, Serial No. 380,354

5 Claims. (Cl. 236—34)

This invention relates to temperature regulators, and more particularly to a temperature regulator of the by-pass type adapted for controlling the flow of cooling medium through the cooling system of an internal combustion engine.

It is an object of this invention to provide a device of the type characterized which is simple in construction, composed of a minimum number of parts, and so formed as to facilitate fabrication from sheet metal in quantity production.

Another object of this invention is to provide a device of the type characterized which employs an improved construction embodying a tubular housing element different portions of which are constructed to constitute the valve seats for the main valve and the by-pass valve, the portion constituting one of said valve seats taking the form of a tapered shoulder intermediate the length of the housing element for coaction with a correspondingly tapered valve member.

Another object of this invention is to provide a device of the type characterized which employs an improved construction embodying a single tubular housing element different portions of which are constructed to constitute the valve seats for the main valve and the by-pass valve, and coaxially arranged valve members actuated by a thermostat supported from said housing element, at least one of said valve members cooperating with said housing element to provide a guide for the movements of both of said valve members without separate provision therefor.

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

The invention is capable of receiving a variety of mechanical expressions, two of which are 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 said drawings, wherein the same reference characters are employed to designate corresponding parts in the several figures,

Fig. 1 is a perspective view, partly cut away, of an embodiment of the present invention;

Fig. 2 is an axial section of the embodiment of Fig. 1, but to a larger scale;

Fig. 3 is a detailed perspective view of the by-pass valve member; and

Fig. 4 is an axial section of another embodiment of the present invention.

In the form shown the temperature regulator of the present invention is formed as a self-contained unit which may be supplied by the regulator manufacturer for installation in an engine cooling system at any suitable location therein. Hence the portion of the cooling system of the engine to be associated with said regulator unit may take various forms as preferred by the engine or car manufacturer. As illustrated the regulator unit is designed to be assembled with a casting associated with a suitable aperture in the wall of the water jacket, with its thermostat depending into the water of said jacket, said casting being of suitable form to provide separated passages for the flow of cooling medium therethrough, to the radiator on the one hand and to the by-pass on the other hand.

As illustrated casting 10 has an outlet 11 which may be connected in any suitable way to the water line leading to the radiator and an outlet 12 which may be connected in any suitable way to the by-pass. Interiorly said casting 10 has a wall 13 which subdivides the interior into a chamber 14 leading to the outlet 11 and a chamber 15 in communication with the outlet 12. Partition 13 contains an aperture 16 to receive one end of the regulator unit, as hereinafter explained, and the end wall 17 of the casting 10 is provided with an aperture 18 intended, in the embodiment illustrated, to fit over a suitable opening in the wall of the cooling jacket.

The regulator unit of the present invention as illustrated includes a housing element generally designated 20 which includes a tubular end portion 21, intermediate shoulder 22, axially inclined portion 23, and a second tubular portion 24 of materially larger cross section than the tubular portion 21.

As shown the end of the tubular portion 24 is outwardly flanged at 25 so that it may be clamped under the end wall 17, or be retained in position within a groove in the latter, when the casting 10 is secured to the cooling water jacket. This housing element 20 is preferably formed in one piece as shown, and can be conveniently drawn from sheet metal. However, if preferred, said housing member may be formed of separate pieces secured together in any suitable way, as will be apparent to those skilled in the art.

The end 26 of tubular portion 21 is designed to function as the valve seat for the main valve member, as hereinafter explained, and the inclined portion 23 is provided with one or more apertures 27, of suitable area and peripheral extent, to provide the by-pass port. As here illus-

trated, two such ports 27 are disposed at diametrically opposite sides of the unit, as is evident from Fig. 1, but a different number of ports may be used if preferred.

Suitably attached to the housing element at any suitable location thereon is a U-shaped strap 30, here shown as having its extremities riveted at 31 to the tubular portion 24 of the housing element. Mounted on the base portion of said strap and secured thereto in any suitable way, as by soldering a projection on its end wall into an aperture 32 in the strap, is a thermostat 33 of any suitable size and construction. Said thermostat preferably takes the form of an expansible and collapsible corrugated tubular metal wall, or bellows, having a stationary end wall 34 integrally united therewith or suitably attached thereto and here shown as secured in the aperture 32 of the strap 30, and a movable end wall 35, here shown as a relatively rigid disk-like element suitably attached, as by soldering or brazing, to the end of said bellows. Secured in movable end wall 35 in any suitable way, as by staking, is a valve stem 36, here shown as having a filling aperture 37 extending therethrough to the end that any suitable charge, preferably a volatile liquid, may be introduced into the bellows 33 through said passage 37, after which said passage may be suitably sealed as by a ball and solder plug as indicated at 38.

Attached to the end of the valve stem 36 in any suitably way, as by the threads indicated at 39, is a main valve member 40 here shown as of cupped formation and having its peripheral portion 41 inclined with respect to the body portion thereof, and of suitable diameter so that said portion 41 will make contact with the valve seat 26. By inclining the portion 41 of the valve member, a line contact may be made with the valve seat 26. Also attached to said valve stem 36 at any suitable portion thereof, but preferably near the bellows end thereof, is a by-pass valve member 42. As shown in Figs. 1, 2 and 3 said by-pass valve member is secured in contact with the movable end wall 35 by the attachment of the stem 36 to said movable end wall, but said valve member may be attached to the stem 36 in other ways and at other locations out of contact with the end wall 35. Said valve member 42 takes the form of a spider, as shown more clearly in Fig. 3, said spider having as many arms 43 as there are valve ports 27, and each of said arms 43 terminating in a plate-like but arcuate portion 44 having an area somewhat larger than the area of the corresponding port 27, each of said arcuate portions 44 making the same inclination with the axis of the unit as the inclined portion 23 of the housing element 20. If preferred, however, the by-pass valve member 42 may be made as a complete annulus connected to the central portion thereof by a suitable number of arms 43, as shown in Fig. 4, or it may be otherwise formed provided suitable apertures of sufficient size are controlled thereby so as to permit the flow of the cooling medium as hereinafter explained.

By-pass valve member 42 is also so formed according to one embodiment of the invention as to constitute a guide for the main and by-pass valve members, to the end that no additional guiding element need be supplied for the valve stem 36, and therefore the additional labor and material costs incident to the fabrication and attachment of such guide means may be avoided. While the by-pass valve member 42 may be made of such diameter that its periphery, or the periphery of the arcuate portions thereof, contacts the inner wall of the tubular portion 24 and slides thereon as a guide, it is preferred, in order to reduce friction, that the periphery of the by-pass valve member be provided with suitable projections for contact with the inner periphery of the wall 24. While any suitable number of projections may be employed, a pair of such projections 45 are shown on each of the arcuate valve portions 44 as clearly appears from Fig. 3.

The portion 22 of the housing element 20 is designed to cooperate with the partition 13 to prevent undue leakage between the chambers 14 and 15. As here shown, a gasket 46 is interposed between the end of partition 13 and shoulder 22. However it is to be expressly understood that other suitable provisions may be made for cooperation with said partition 13 to prevent undue leakage; for example a bead may be formed on the tubular portion 21 for cooperation with the end of partition 13, with or without the interposition of a gasket.

Fig. 4 illustrates another embodiment of the present invention wherein the by-pass valve member is in the form of a continuous annulus as above referred to and wherein the projections 45 have been omitted from the by-pass valve member, a separate valve stem guide mounted on the housing element being used to maintain the desired rectilinear movement of the valve stem 36. As here shown, the by-pass valve member takes the form of a spider having a plurality of arms 51 which are integral with or suitably attached to an annulus 52 that is frusto-conical in form and constitutes the valve member proper, said arms extending from a central hub 53 that is suitably attached to the valve stem 36. Annulus 52 may be of uniform width throughout and of such width as to close properly the apertures 27, or it may be reduced in width opposite those portions of the shoulder 23 which are intermediate the apertures 27. As in the embodiment of Figs. 1 to 3 the valve member 52 is tapered or inclined in the direction of the axis of the unit so as to have the same angularity or taper as the shoulder 23, to the end that member 52 will engage the shoulder 23 and close the apertures 27 as explained in conjunction with the embodiment of Figs. 1 to 3. As in this embodiment the periphery of member 52 does not slidably engage the interior of the housing element, the valve stem may be provided with a guide in any suitable way. As here shown said guide takes the form of a spider 57 having the extremity of its arms suitably attached, as by riveting, to a portion of the housing element 20, as the shoulder 22, and having at its central portion a hub 58 which is adapted to slidably receive the valve stem 36. As shown said spider 57 may depend into the housing element 20 to such a position that its hub 58 also cooperates with the hub of the by-pass valve member so as to constitute a stop limiting the extent of expansion of the thermostat 33. Any other suitable form of valve stem guide may be used and it may be mounted on any other suitable part of housing element 20. While in this embodiment, as will be apparent from Fig. 4, the periphery of the by-pass valve member 52 is out of contact with the interior of the wall portion 24, so that the latter does not cooperate with the by-pass valve member to guide the valve members during their opening and closing movements, member

52, if desired for any reason, may be suitably formed so as to cooperate with the inner periphery of the wall 24 and assist in guiding the movements of the valve members. Otherwise the structure of Fig. 4 is or may be the same as that of Figs. 1 to 3, and corresponding reference numerals have accordingly been used to designate corresponding parts.

In operation the unit is installed in the relationship shown in Figs. 2 and 4. The housing element 20 by cooperation with the partition 13 and the end wall 17 separates the chamber 15 from the chamber 14. The thermostat 33 is suspended in the cooling water, and when the latter is cool said thermostat is contracted so as to hold the valve member 41 against its seat 26, preventing flow to the outlet 11 and causing the flow to pass through the apertures 27 into the chamber 15, and thence to the outlet 12. As the temperature of the cooling water rises the thermostat 33 expands, moving valve member 41 from its seat 26 and causing the valve member 42 to advance its arcuate portions 44 toward the apertures 27 in Figs. 1 to 3 or valve member 52 in Fig. 4 to approach said apertures. While the thermostat is so expanding both valve members are out of contact with their seats and the flow is proportioned between the main and by-pass circuits in accordance with the relative degrees of opening of the main and by-pass valve members. As the thermostat continues to expand the valve member 42 or 52 finally contacts the inclined portion 23 of the housing element 20, which provides a stop for said valve member, and closes the apertures 27, thereby discontinuing flow of the cooling medium through chamber 15 and forcing all of the flow through chamber 14. As the thermostat contracts with a lowering of the water temperature the reverse operation occurs as apparent. Throughout the expansion and contraction of the thermostat both valve members are guided by reason of the coaction of the valve member 42 with the inner periphery of the wall of the housing portion 24 in Figs. 1 to 3 or by the valve stem guide 58 of Fig. 4.

It will therefore be perceived that a temperature regulator has been provided which may be readily manufactured and assembled as a unit for delivery to the engine or car manufacturer, and that this unit is composed of a relatively small number of parts which are simple in form and easily assembled. Both the housing member and the valve members may be readily fabricated from sheet metal, and by reason of the coaction of the by-pass valve member with the housing element according to the embodiment of Figs. 1 to 3 no separate guide means need be supplied although one may be used if preferred as in the embodiment of Fig. 4. The structure readily lends itself to production by unskilled labor and in relatively large quantities and thereby material and labor costs are substantially reduced.

While the embodiments of the invention illustrated on the drawings have been described with considerable particularity, it is to be expressly understood that the invention is capable of receiving a variety of expressions, as will now be apparent to those skilled in the art, while changes may be made in details of construction, material, arrangement and proportion of parts, other forms and constructions of thermostat may be employed, the unit of the present invention may be associated with cooling system elements of other form and construction, the function of valve members as main and by-pass valves may be exchanged, etc., without departing from the spirit of the present invention. Reference is therefore to be had to the appended claims for a definition of said invention. This application is a continuation in part of my application Serial No. 253,674 filed January 30, 1939 for Temperature regulators.

What is claimed is:

1. In a temperature regulator for controlling the flow of cooling medium through main and by-pass passages of the cooling system of an internal combustion engine, a tubular housing element having end portions of different diameter, a thermostat mounted on said tubular housing element, an intermediate portion of said housing element being inclined to the axis thereof and apertured to provide a valve seat, a pair of valve members connected to said thermostat, one of said valve members cooperating with a valve seat provided on the end portion of said tubular housing element and the other of said valve members having a seating portion arranged to close the apertures in said inclined portion when said first named valve member is open, and said second named valve member cooperating only at the periphery of said seating portion with the portion of said housing element of larger diameter to constitute a guide for both of said valve members during the expansion and contraction of said thermostat.

2. In a temperature regulator for controlling the flow of cooling medium through main and by-pass passages of the cooling system of an internal combustion engine, a tubular housing element including end portions of different diameter connected by an inclined portion provided with one or more apertures, a thermostat supported from said housing element, a pair of valve members attached to said thermostat, one of said valve members adapted to contact said end portion of smaller diameter and close the passage axially through said housing element, the other of said valve members including one or more plate-like portions parallel to said inclined portion and corresponding in number with and adapted to close the aperture or apertures therein, said second named valve member at the edge of said plate-like portion cooperating with the inner periphery of said housing element portion of larger diameter to constitute therewith a guide for both of said valve members during the expansion and contraction of said thermostat.

3. In a temperature regulator for controlling the flow of cooling medium through main and by-pass passages of the cooling system of an internal combustion engine, a tubular housing element having end portions of different diameter united by an inclined portion apertured to constitute a valve seat, a thermostat support attached to said housing element, a thermostat mounted on said support and having a valve stem extending from the movable end wall thereof, a valve member attached to said valve stem and cooperating with the free end of the housing element which is of smaller diameter to control the flow of cooling medium axially through said housing element, and a second valve member mounted on said valve stem adjacent said thermostat and having an inclined plate-like seating portion adapted to cooperate with the apertured portion of said housing element to provide a valve therewith, said second named valve member cooperating with the housing element portion which is of larger diameter to constitute therewith a guide for both of said valve members dur-

ing the expansion and contraction of said thermostat and contacting said housing portion only at the periphery of said seating portion.

4. In a temperature regulator for controlling the flow of cooling medium through main and by-pass passages of the cooling system of an internal combustion engine, a tubular housing element having end portions of different diameter united by an inclined portion apertured to constitute a valve seat, a thermostat support attached to said housing element, a thermostat mounted on said support and having a valve stem extending from the movable end wall thereof, a valve member attached to said valve stem and cooperating with a valve seat provided at said housing element portion which is of smaller diameter to control the flow of cooling medium axially through said housing element, and a second valve member mounted on said valve stem and adapted to cooperate with the apertured portion of said housing element to provide a valve therewith, said last named valve member being provided with circumferentially narrow, radially extending peripheral projections adapted to engage and slide on the inner periphery of said housing element portion which is of larger diameter to constitute therewith a guide for both of said valve members during the expansion and contraction of said thermostat.

5. In a temperature regulator for controlling the flow of cooling medium through main and by-pass passages of the cooling system of an internal combustion engine, a tubular housing element provided with end portions of different diameter and having an intermediate portion inclined with respect to the axis of said housing element, said last named portion being apertured and constituting a valve seat, and the free end of said housing element which is of smaller diameter constituting a second valve seat, a U-shaped thermostat support attached to and suspended from said housing element portion which is of larger diameter, a thermostat mounted on said support, a valve stem projecting from the movable wall of said thermostat, a valve member attached to the free end of said valve stem and cooperating with said second named valve seat to control the flow of cooling medium axially through said housing element, and a second valve member attached to said valve stem, said second valve member including a spider having arms provided with arcuate valve portions adapted to seat on and close the apertured portion of said first named valve seat when said first named valve member is open, said second named valve member cooperating with the inner periphery of said housing element portion which is of larger diameter to constitute therewith a guide for both of said valve members during the expansion and contraction of said thermostat.

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