Aug. 12, 1958 J. S. FREISMUTH 2,847,165

THERMOSTATS

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FIG. 1

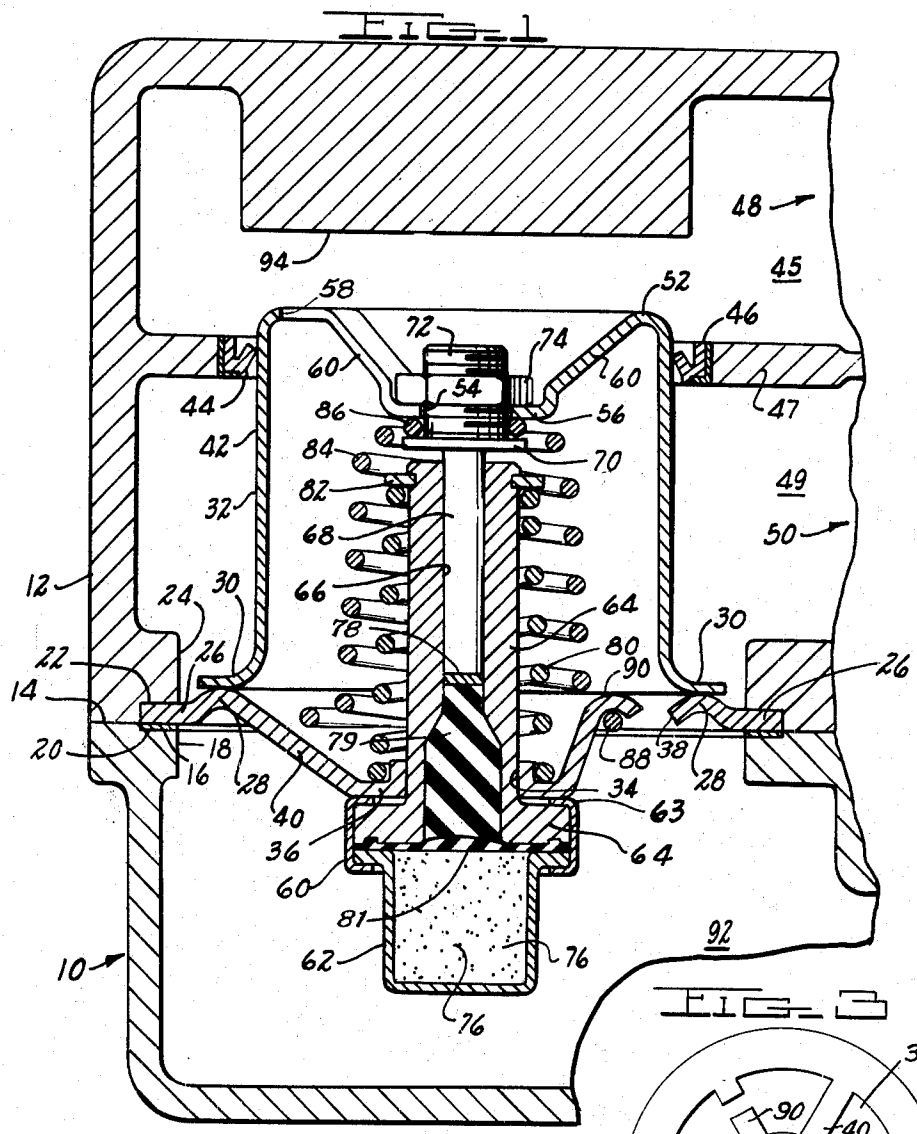


FIG. 2

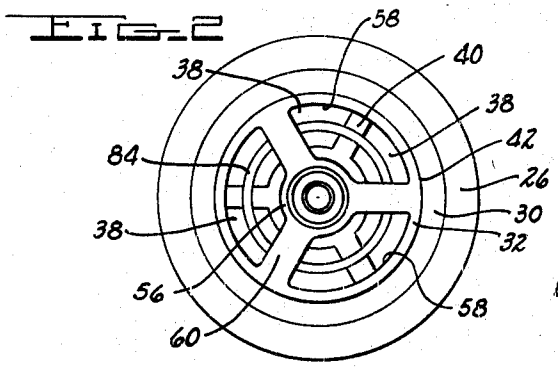
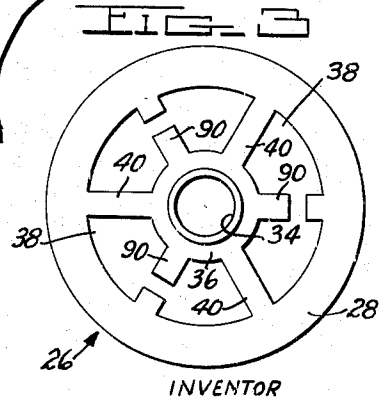


FIG. 3



INVENTOR

JOHN S. FREISMUTH

BY

SMITH, OLSEN, LEWIS & McRAE

ATTORNEYS

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John S. Freismuth, St. Clair Shores, Mich., assignor, by mesne assignments, to American Radiator & Standard Sanitary Corporation, New York, N. Y., a corporation of Delaware

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2 Claims. (Cl. 236—34.5)

This invention relates to thermostatic valve devices, as for example valve devices useful in the cooling system of internal combustion engines.

It is an object of this invention to provide an improved thermostatic valve device which is relatively simple to manufacture and assemble.

It is a further object of this invention to provide an improved thermosensitive valve device which is particularly adapted for use in the water cooling systems of automobile internal combustion engines and which may be easily and economically installed therein.

It is still another object of this invention to provide a valve of the foregoing character which is smaller in size than previous corresponding thermostatic valve devices.

Another object of this invention is to provide an improved thermostatic by-pass type valve wherein the thermostatic device which opens the valve in response to temperature increases is resiliently mounted in the valve seat, whereby to prevent damage to the valve in the event of excessively high fluid temperatures.

A further object is to provide a thermostatic valve of the foregoing character which is not affected by changes in the pressure of the coolant flowing therethrough.

A still further object is to provide in combination with a thermostatic by-pass valve of the foregoing character, a coolant by-pass outlet system for the valve in which the space for free flow of coolant into the outlet passage will be reduced as the valve opens and thereby tend to force a larger flow of coolant through the valve opening.

Other objects of this invention will appear in the following description and appended claims, reference being had to the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

In the drawings:

Fig. 1 shows a cross sectional view of one embodiment of this invention positioned in a cooling system for an internal combustion engine.

Fig. 2 shows a top view of the assembled valve of this invention.

Fig. 3 is a top plan view of a valve seat member **26** employed in the Fig. 1 embodiment.

Before explaining the present invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also, it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

In Fig. 1 there is shown a portion of the main line in a cooling water jacket **10** for an internal combustion engine such as an automobile engine. A fitting **12** is suitably bolted to the discharge face **14** of the jacket **10**. Face **14** is annularly recessed at **16** about the periphery of the discharge opening **18** for the reception of sealing means shown as gasket **20**. Discharge opening **18** also acts

as inlet wall means for fitting **12**. Likewise the adjacent face of the fitting **12** is annularly recessed at **22** about the periphery of the inlet opening **24** to accommodate the seating edge of the valve seat member **26**.

Valve seat member **26** includes an annular portion **28** which serves to seat the free edge **30** of inverted cup member **32**. The central portion of valve seat member **26** is indented in an upstream direction and has a central opening **34** therethrough to form an annulus **36**. Between annulus **36** and annular seating rim **28** there are ports **38** for the passage of coolant therethrough. Ports **38** are formed by spider leg means **40** connecting annulus **36** to the annular rim **28**.

Cup member **32** has its side wall or shell **42** in slidable union with a bushing member **44** seated in opening **46** in wall **47** of fitting **12**. Wall **47** forms a by-pass passageway **45** to the engine and a take-off passageway **49** to the radiator cooling means. Flow of coolant in passages **45** and **49** is in the direction of arrows **48** and **50**.

In Fig. 1, the wall opening **46** in the circulating system is downstream of the take-off line **49** and upstream of the by-pass line **45**. End **52** of cup **32** is centrally indented in an upstream direction and has a central opening **54** formed therethrough in annulus **56**. Interconnecting annulus **56** and wall **42** are spider legs **60** which serve to define ports or annular openings **58** for the passage of coolant therethrough to the by-pass passageway **48**, shown in Fig. 2.

In order to move cup **32** there is provided a temperature responsive means shown as a thermostatic piston power element **60** which may be constructed as shown in U. S. Patent No. 2,636,776. The illustrated power element is particularly adapted to fit in small diameter flow passages so as to permit utilization of smaller thermostatic valves than the conventional bellows-type thermostatic element. Further the illustrated power element is less subject to loss of calibration due to coolant pressure variation.

Power element **60** preferably includes a container **62** adapted to be seated by means of a shoulder **63** on the upstream side of annulus **36** in the valve seat member **26**. Attached at one end of container **62** is a sleeve **64** which is adapted to slidably extend through central opening **34** in valve seat member **36**. Slidably positioned in and extending out of a central bore **66** in sleeve **64** is a piston element **68** which has a flange **70** extending radially therefrom. The outer end of piston **68** has a threaded portion **72** which extends through opening **54** in cup **32** and is operably attached to annulus **56** thereof by means of a nut **74**. The inner end of piston **68** is in pressure communication with an anti-extrusion disk **78** and elastomeric plug **79**. An elastic diaphragm **81** is positioned between plug **79** and thermally expansible material **76**. The temperature responsive means **60** has its thermosensitive end resiliently mounted on annulus **36** by means of a coil spring **80** maintained under compression by being seated between the downstream side of annulus **36** and a detachably affixed C-shaped retainer **82** extending radially from sleeve **64**.

Cup member **32** is operably attached to the valve seat member **26** by means of a coil spring **84** axially aligned with and coiled around the compression spring **80** and maintained under tension by having its downstream endmost convolution **86** fixedly retained or anchored between the piston flange **70** and the annulus **56** by nut **74**, and by having its other endmost convolution **88** fixedly retained or anchored by three spider legs **90**. Spider legs **90** are cut and hooked adjacent the rim edge **28** to flexibly retain the coil spring **84**. Legs **90** are located at intermediate points between legs **40**. In the embodiment of Figs. 1 and 2 member **26** is provided with six spider legs. The alternate three of these legs act as reinforcing means **40** for the annular shoulder **36** and the remaining alter-

nate three act as anchoring means **90** for the tension coil spring means **84**. Legs **90** are positioned in alignment with legs **60** and are thus not visible in Fig. 2. Tension spring **84** tends to close the cup **32** against seat member **26**.

During operation of the thermostatic by-pass type valve of this invention and when the temperature of the coolant is below the thermosensitive range of the temperature deformable medium **76**, cup **32** will be closed against the rim **28** of its valve seat member **26** and coolant will then only flow from the inlet passageway **92** through the annular openings **38** in the valve seat member **26** and out of the cup member **32** through its annular openings **58** and into the by-pass passageway **45** back to the engine. No coolant is permittent to flow through the by-pass valve opening into the take-off passageway **49** to the radiator.

However when the coolant is at a temperature which is within or above the thermosensitive range of the deformable medium **76**, it will cause the medium **76** to expand and work against the deformable diaphragm **78**, which in turn will push piston **68** out of the central opening **66**. In this manner the power element **60** will raise cup member **32** off the rim **28** of its valve seat **26** and permit coolant to flow through the opening formed thereby into the take-off passageway **49** to the cooling means.

It is a preferred modification of this invention to have the ported end of the cup **32** in spaced distance relationship with the by-pass wall protrusion **94**, so that when the piston **68** raises the cup **32** off the valve seat, the space for free flow of coolant into passage **45** will be reduced and thereby tend to force a larger flow of coolant through the valve opening between the valve seat member **26** and the free edge end **30** of the cup **32** into passage **49**. It is also a preferred feature of this invention to have the thermoresponsive means **60** resiliently mounted in the valve seat member **26**. With such a mounting, if the coolant temperature should become so high that cup **32** exerts a high pressure on wall portion **94**, sleeve **64** will slide downwardly in annulus **36** so as to prevent damage to any of the working mechanisms.

The invention claimed is:

1. In an engine cooling system; wall means forming an inlet passage; a first opening in said wall means; a second wall cooperating with the first wall means to define a first discharge passage; a second opening in said second wall in axial alignment with the first opening; a third wall cooperating with the second wall to define a second discharge passage and an abutment surface in registry with the second opening; a plate mounted in said first opening; said plate having a central opening and at least one fluid flow opening therethrough; a cylindrical valve element slidably extending through said second opening for reciprocable movement between the plate and the abutment surface so as to inversely vary the fluid flow into the discharge passages; a thermostatic power element including a cup positioned in the inlet passage and a sleeve freely extending from said cup through the central opening in the plate; thermally expansible material within the cup; a piston slidably positioned in the sleeve for outward axial movement in response to expansion of the expansible material; means connecting the piston with the cylindrical valve element; tension spring means between the piston-cylindrical valve element assembly and plate for urging the piston into the sleeve on fluid temperature decrease; means forming a shoulder on the sleeve; and compression spring means between said shoulder and the plate for mounting the power element while permitting the power element sleeve to slide in the plate central opening if the fluid temperatures should become sufficiently high to cause the cylindrical valve element to exert more than a predetermined pressure on the abutment surface.

2. In an engine cooling system; wall means forming an inlet passage; a first opening in said wall means; a second wall cooperating with the first wall means to define a first discharge passage; a second opening in said second wall in axial alignment with the first opening; a third wall cooperating with the second wall to define a second discharge passage and an abutment surface in registry with the second opening; a plate mounted in said first opening; said plate including an outer annular portion defining a valve surface, an inner annular portion defining a central opening, and a series of legs interconnecting the annular portions to define fluid flow openings; a cylindrical valve element slidably extending through said second opening for reciprocable movement between the plate and the abutment surface so as to inversely vary the fluid flow into the discharge pasasges; a thermostatic power element including a cup positioned in the inlet passage and a sleeve freely extending from said cup through the central opening in the plate; thermally expansible material within the cup; a piston slidably positioned in the sleeve for outward axial movement in response to expansion of the expansible material; means connecting the piston with the cylindrical valve element; some of the aforementioned legs being cut through and deformed to provide hooks; a tension spring extending from the piston-cylindrical valve element assembly into connection with the hooks so as to urge the piston into the sleeve on fluid temperature decrease; means forming a shoulder on the sleeve; and compression spring means between said shoulder and the plate for mounting the power element while permitting the power element sleeve to slide in the plate central opening if the fluid temperatures should become sufficiently high to cause the cylindrical valve element to exert more than a predetermined pressure on the abutment surface.

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