March 16, 1965 F. E. OBERMAIER 3,173,609

WATERLINE THERMOSTAT

Filed April 3, 1961 2 Sheets-Sheet 1

FIG. 1

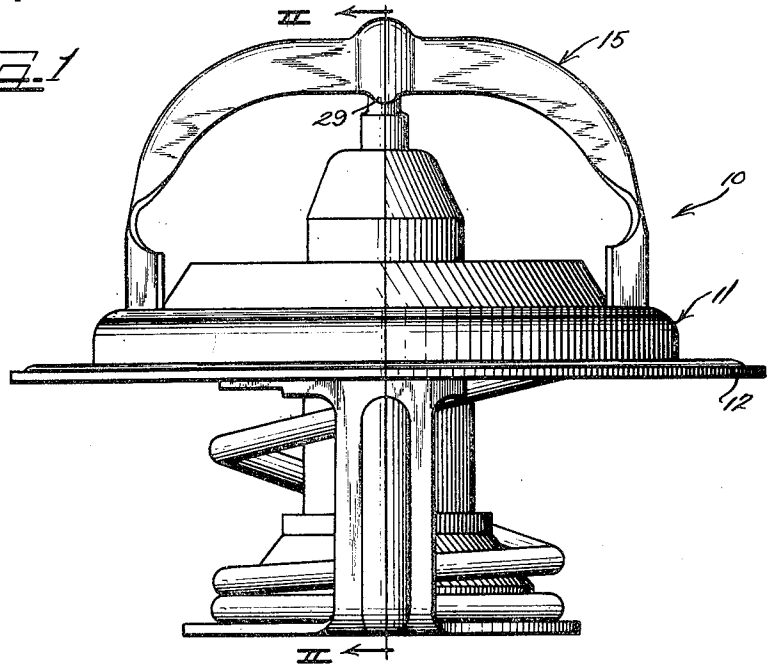
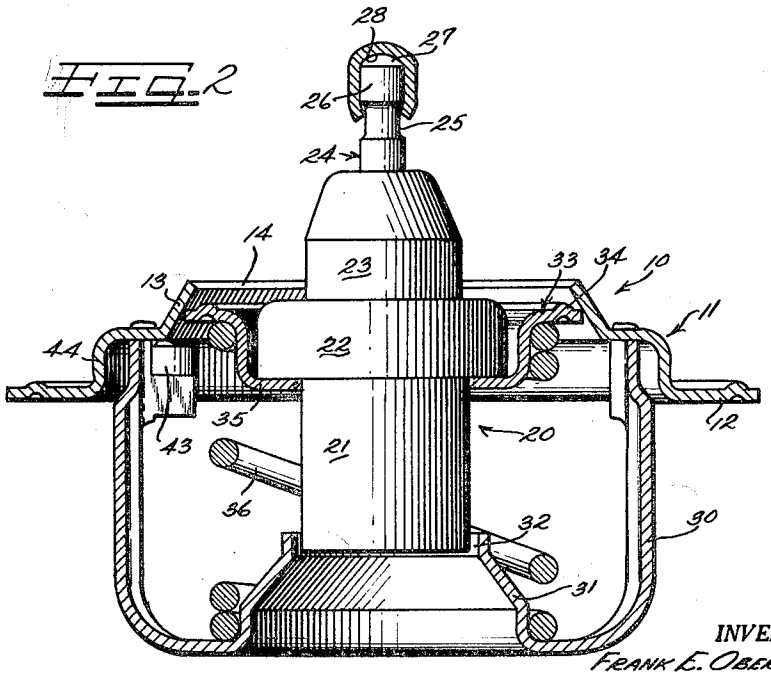


FIG. 2



INVENTOR.
FRANK E. OBERMAIER

BY

Hill, Sherman, Meroni, Gross & Simpson

ATTORNEYS

March 16, 1965 F. E. OBERMAIER 3,173,609

WATERLINE THERMOSTAT

Filed April 3, 1961 2 Sheets-Sheet 2

FIG. 3

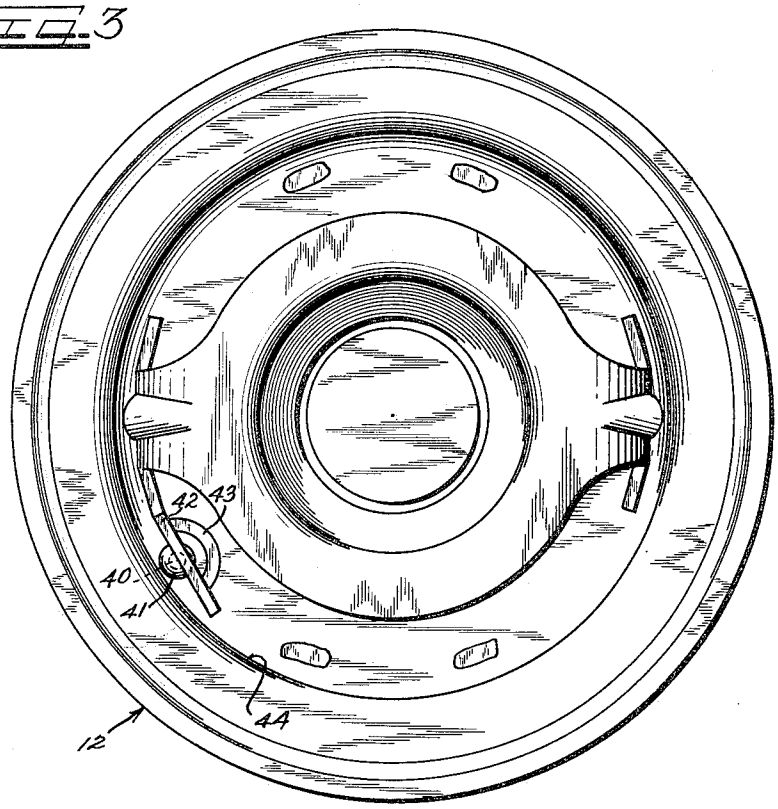
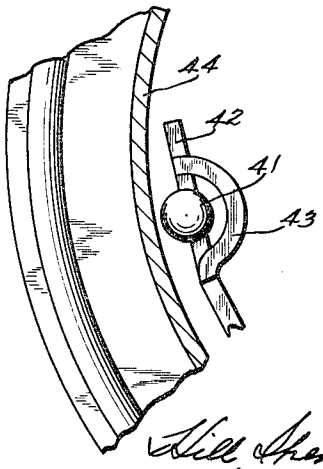


FIG. 4



INVENTOR.
FRANK E. OBERMAIER
BY
Hill, Sherman, Meroni, Gross & Simpson
ATTORNEYS

United States Patent Office 3,173,609 Patented Mar. 16, 1965

3,173,609

WATERLINE THERMOSTAT

Frank E. Obermaier, Park Ridge, Ill., assignor to The Dole Valve Company, Morton Grove, Ill., a corporation of Illinois

Filed Apr. 3, 1961, Ser. No. 100,336
1 Claim. (Cl. 236—34)

This invention relates to waterline thermostats and more particularly relates to waterline thermostat having improved structural characteristics tending to increase the life and efficiency thereof.

A number of waterline thermostats have been devised which employ a ported valve seat, a stirrup connected to the seat, a temperature sensitive power unit extending through the port and having a piston or power member abutting and connecting to the stirrup and a relatively movable portion or casing connected to a valve which is cooperable with the port. A guide of some sort is provided for the casing of the power unit. Springs serve to bias the casing and the valve in one direction and thermal energization of the power unit caused by predetermined ambient temperature conditions effects movement thereof in an opposite direction. Bleed ports are generally provided either in the transverse wall or in the valve member itself to permit a small amount of air and/or liquid flow past the valve when the valve member is in a seated position. In some cases the valve member is not made to seat very snugly on its seating surface so that there is an inherent "fluid bleed" in the valve itself.

Poppet type valve members, however, of whatever size are subject to high frequency vibrations when exposed to pressurized fluid and the magnitude of these vibrations is of course dependent on the pressure of that fluid on one side of the valve member, or more accurately, the pressure drop across the valve member.

It was thought that by designing such valve structures so that the power member would be movably rather than rigidly affixed to the stirrup, undesirable stirrup distortion and breakage could be largely eliminated. In designing such valves, the stirrup was apertured to receive the outer free end of the power member and the power member carried a collar thereon which was generally seated on the inner surface of the stirrup. The aperture was of greater diameter than the free end of the power member so that the power member could tilt with respect to the stirrup with the collar lifting off the stirrup so that only an edge thereof rode on the stirrup. Valves constructed in accordance with this concept however did not satisfactorily withstand life tests. Indeed, it was found that the stirrups of valves constructed in this manner were literally cut in two.

I have discovered that one of the reasons for such stirrup breakage lies in the fact that the power unit to which the valve member is connected tends to oscillate under ambient high pressure fluid conditions and such oscillation causes the collar on the power member to actually cut into or saw through the stirrup.

To obviate the disadvantages of movably mounting the power member on the stirrup while still obviating the disadvantages encountered in providing a rigid connection between the stirrup and power, I have devised a structure wherein the power member may be mounted for tiltable or rockable movement on the stirrup and yet in which it is prevented from moving axially and in which sawing of the stirrup may be prevented.

In accordance with my invention, the power member has a circumferential recess formed therearound which defines a head at the outer end of the power member. The head has a rounded end surface which fits within a complimentary socket formed in the stirrup. A portion of the stirrup fits about the head and is turned inwardly

within the circumferential recess in the power member to prevent axial movement of that power member. I have found that a device constructed in accordance with these principles will satisfactorily withstand life tests under the most adverse conditions.

I have devised a means whereby coolant flow past the valve member of the thermostat can be positively prevented until the coolant has reached the desired temperature and yet in which trapped air may be permitted to escape from the block and travel past the valve member. Such air will then travel to the radiator and may there be vented to the atmosphere.

The particular means that I have devised for accomplishing this object comprises basically a ball valve which is confined for limited freedom of movement on the "block-side" of the transverse wall extending across the thermostat and which is cooperable with a bleed port formed within that transverse wall. The ball valve, if initially not seated on the bleed port, will be sucked into the bleed port to close all fluid communication therethrough as a result of a predetermined pressure differential thereacross caused by fluid impinging on the ball valve from the engine block and seeking an exit through the bleed port. Since exansion of the coolant within the engine block caused by heating thereof is relatively slow and since the pressure head of coolant and air seeking exit through the bleed port is quite different for each of the two fluids, I have been able to design a ball valve with sufficient mass to permit the gradual seepage of air through the bleed port but to seat on that port when the coolant seeks an exit therethrough. Air trapped within the engine block can therefore be permitted to escape past the valve member while the thermostat will act to positively prevent any flow of liquid to the radiator until the coolant within the block has reached the desired temperature.

In view of the foregoing it is a principal object of this invention to provide an improved fluid control valve of the type generally referred to above wherein the power member of the temperature sensitive power unit is rockably mounted on the valve stirrup.

Another object of the invention is directed to the provision of a waterline thermostate with a main valve member and separate means for permitting the flow of air past the thermostat but which will be effective to prevent the flow of liquid therepast.

A still further and important object of the invention as will hereafter be pointed out resides in the provision of a waterline thermostat of the type above described in which the means for confining the ball valve on the -"block-side" of the transverse wall of the thermostat comprises an extension from and an integral part of the power unit guide.

These and other objects of the invention will appear from time to time as the following specification proceeds and with reference to the accompanying drawings, wherein:

FIGURE 1 is a side elevational view of a waterline thermostat constructed in accordance with the principles of the present invention;

FIGURE 2 is a vertical sectional view of the thermostat illustrated in FIGURE 1 and taken along lines II—II of FIGURE 1;

FIGURE 3 is a bottom plan view of the thermostat illustrated in FIGURES 1 and 2; and

FIGURE 4 is a fragmental horizontal sectional view looking downwardly from a line passing just below the transverse wall adjacent the ball valve.

The waterline thermostat **10** illustrated in the drawings comprises generally a transverse wall piece **11** which has an annular flange **12** extending therefrom which provides a means for mounting the thermostat **10** in a desired loca-

tion in the cooling system of a road vehicle or the like. The transverse wall piece **11** also has an inwardly and upwardly extending portion **13** which is apertured as at **14** to define a main port for the flow of coolant through the thermostat.

A stirrup **15** extends upwardly from the transverse wall piece **11** and is rigidly connected thereto by welding or the like, as desired. The stirrup **15** is preferably formed from an elongated narrow piece of stock which is bent along its longitudinal axis to provide a strong and rigid support.

A temperature sensitive power unit **20** is of the well known "solid-fill" type and comprises a temperature sensitive portion **21**, a collar **22**, a power member guide portion **23**, and a power member **24**. The thermostat contains a fusible thermally expansible material within the temperature sensitive portion **21** which expands when the ambient temperatures rises to or above the critical temperature of the expansible material. The expansible material acts against a diaphragm within the power unit which, in turn, abuts or is connected to the power member **24** so that heating of the temperature sensitive portion **21** above the critical temperature of the expansible material contained therein will effect relative extensible movement of the power member **24** from the casing of the power unit. For the purposes of simplicity, that portion of the power unit **20** which includes a temperature sensitive portion **21**, the collar **22**, and the guide portion **23** is referred to as the casing.

It will be noted that the free end of the power member **24** has a circumferential recess **25** which is formed thereabout and which defines a head **26** at the outer end of the power member. The head **26** has a rounded end surface **27** which fits within a complimentary socket **28** formed in the stirrup **15**. The socket **28** can be formed in any desired manner and simply constitutes a rounded out portion of the stirrup **15**. It is important to note however that curvilinear fingers **29** are formed integrally with the stirrup **15** and extend around the head **27** and are bent inwardly within the circumferential recess **25** on opposite sides of the power member to positively prevent the power member **24** from having any axial movement with respect to the stirrup **15**. It will be noted however that the curvilinear fingers **29** are inturned only a sufficient distance to prevent the head **26** from moving out of the socket **28** and that they do not prevent the power member **24** from having rockable movement with respect to the socket **28**. The rounded end **27** of the head **26** will therefore be free to rock slightly within the socket **28**; a very small amount of rockable movement being all that is necessary to obviate the disadvantages of prior types of devices which have already been characterized above.

A base wall piece **30** is affixed to the transverse wall **11** in preferably the same manner as the stirrup is affixed to that wall and extends from the wall in an opposite direction from the stirrup **15**. The base wall piece **30** has an upturned spring guide portion **31** extending centrally thereof in the direction of the port **14** and this spring guide portion is apertured as at **32** to provide a guide for the temperature sensitive portion **21** of the power unit **20**.

A valve member **33** is effective to control the flow of fluid through the port **14** and includes an outturned flange portion **34** which is engageable with the inwardly and upwardly extending wall **13** to shut off the flow of fluid through the port **14**. The valve member **33** also has an inwardly extending flange **35** formed integrally therewith which is centrally apertured to receive the temperature sensitive portion **21** of the power **20**. The inturned flange **35** seats upon the collar **22** and is preferably maintained in engagement therewith by means of a power unit return spring **36** which is interposed between the outturned flange **34** of the valve member **33** and the base wall piece **30**. The spring **36** thus serves the dual purpose of positively mounting the valve member **33** on the collar **22**

and of acting as a means for returning the power unit to the position illustrated in FIGURE 2 upon cooling of the temperature sensitive substance within the temperature sensitive portion **21**. The spring **36** extends around the spring guide portion **31** of the base wall piece **30** and is thereby maintained in its proper position on the base wall piece.

Turning now more particularly to FIGURES 3 and 4, the transverse wall piece with **12** has a small diameter bleed port **40** formed therein. A ball valve **41** is cooperable with this bleed port to control the flow of fluid therethrough and will act to completely shut off any flow of fluid through the bleed port when it is seated on that port.

Means are provided for confining the ball valve **41** for limited freedom of movement in an area adjacent to the bleed port **40**. This means comprises generally a leg **42** which extends outwardly from the base wall piece **30** and a curvilinear finger **43** which partially surrounds the ball valve **41** and which is formed integrally with the leg **42**. In the illustrated embodiment of my invention, the port **40** is formed through the transverse wall **11** at a point adjacent to a depending wall portion **44** of the transverse wall so that the ball valve **41** is caged between the wall portion **44**, the leg **42**, and the curved finger **43**. It will be understood that the port **40** need not be formed adjacent to the wall portion **44** and in such instances the curved finger **43** could be made circular or nearly circular so that the finger and the leg would themselves act to cage the ball valve in a position directly beneath the port **40**.

In operation, and assuming that the thermostat is mounted in its usual position in the cooling system of a road vehicle, the thermostat will function substantially as follows: If the temperature of the coolant within the engine block is initially quite cold and is thereafter gradually raised, the coolant will tend to expand and to force any trapped air within the block to seek an exit. The ball valve **41** will normally be resting on the leg **42** so that the air within the engine block will be free to seep past the valve and through the bleed port **40** and may then travel to the radiator from which it can be vented to the atmosphere.

If however the temperature of the coolant within the engine block raises to a degree such that the heated coolant seeks a higher level and begins to flow through the bleed port **40** the pressure head of the liquid and the pressure differential created across the ball valve **41** by liquid flowing around the valve and beginning to flow through the bleed port **40** will act to seat the ball valve **41** on the port and completely shut off liquid flow therethrough.

When the ambient temperature around the temperature sensitive portion **21** raises above the critical temperature of the temperature sensitive substance contained therein, that substance will expand and cause the casing and the power member **24** to move axially relative to one another. The power member **24** is prevented from moving axially by the manner in which the head **26** is mounted within the socket **28** and the casing will accordingly back off from the stirrup **15**. As the casing backs away from the stirrup the valve member **33** will be unseated from the upwardly and inwardly extending wall portion **13** to permit the liquid within the engine block to travel to the radiator. When the ambient temperature about the temperature sensitive portion **21** decreases so that it is lower than the critical temperature of the temperature sensitive substance contained therein, the compression spring **36** will act against the valve member **33** which, in turn, will act against the casing of the power unit to return the power unit to the position illustrated in FIGURE 2.

It will be understood that these embodiments of the invention have been used for illustrative purposes only and that various modifications and variations in the present invention may be effected without departing from the spirit and scope of the novel concepts thereof.

I claim as my invention:

A waterline thermostat for controlling the unidirectional flow of liquid through a conduit which comprises, a transverse wall piece positioned within the conduit and having a stirrup and a base connected thereto and extending from opposite sides thereof, a port formed within said transverse wall, a temperature operable power unit having a casing and a power member relatively extensible therefrom, a circumferential recess formed within said power member adjacent the free end thereof, said recess defining a rounded head at the outer free end of said power member, a pair of ears formed integrally with and depending from said stirrup centrally thereof, a socket formed within said stirrup by said ears and rockably receiving said rounded head, said ears having ends crimped inwardly within said recess to prevent axial movement of said power member relative to said bracket while still permitting rockable movement therebetween, means guiding

said casing for movement axially of said port, and valve means extending from said casing and cooperable with said port to control fluid flow therethrough.

References Cited by the Examiner

UNITED STATES PATENTS

313,081	3/85	Kelly.	
1,607,745	11/26	Palm	236—34
2,147,513	2/39	Baker	236—12
2,174,042	9/39	Rose	236—34.5
2,829,835	4/58	Branson	236—34.5
2,842,317	7/58	Wood	236—34
2,857,105	10/58	Drapeau	236—34
2,872,118	2/59	Puster	236—34

EDWARD J. MICHAEL, *Primary Examiner.*

JAMES W. WESTHAVER, FREDERICK L. MATTESON, JR., PERCY L. PATRICK, *Examiners.*