April 8, 1941. J. V. GIESLER 2,237,732

TEMPERATURE REGULATOR

Filed Aug. 4, 1938

Fig. 1.

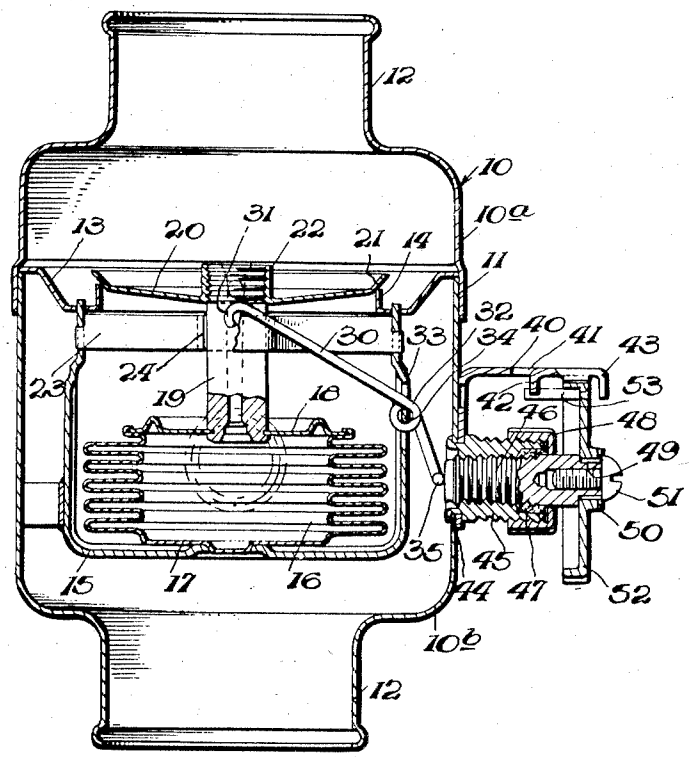
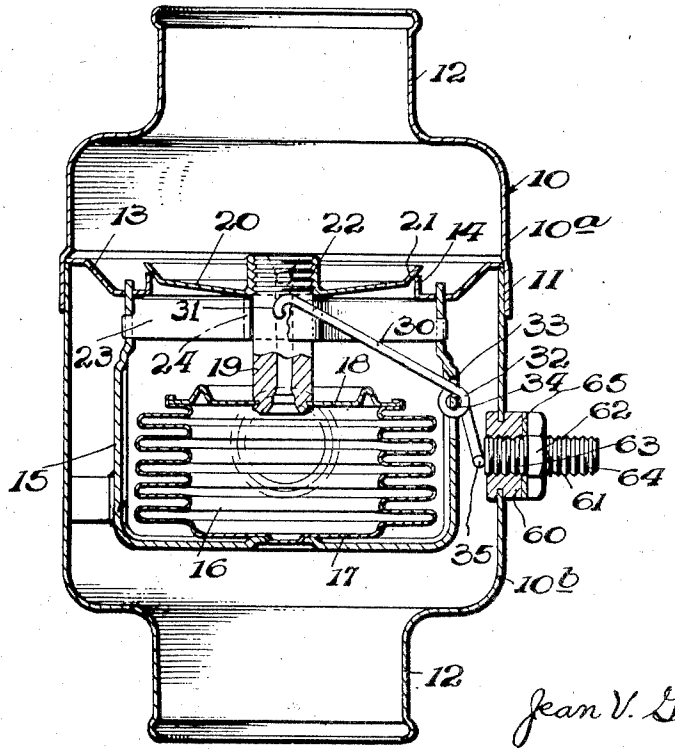


Fig. 2.



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TEMPERATURE REGULATOR

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1 Claim. (Cl. 236—34)

This invention relates to temperature regulators, and more particularly to temperature regulators adapted to be applied to the control of the circulation of cooling water in the cooling systems of internal combustion engines.

It is an object of this invention to provide a device of the type characterized with improved means for adjusting the operation thereof.

Another object of this invention is to provide adjusting means for a temperature regulator of the type characterized which may be applied to a wide variety of structures of this character.

Another object of this invention is to provide adjusting means for a temperature regulator of the type characterized which is simple in construction and easy to manipulate.

Another object of this invention is to provide a temperature regulator of the type characterized having a predetermined minimum temperature of operation as charged and means for adjusting said temperature regulator so as to predeterminately lower the initial temperature of operation.

Another object of this invention is to provide a device of the type last characterized with adjusting means which prolongs the temperature range during which the regulator is opening the valve, the temperature at which the valve reaches wide open position being preferably substantially the same irrespective of the initial temperature of operation to which the device is adjusted.

Another object of this invention is to provide a temperature regulator with adjusting means which will assist the valve to its position of safety in the event that the thermostatic means thereof leaks or is punctured.

Another object of this invention is to provide a temperature regulator of the type characterized with adjusting means which, while adjustable to lower the initial temperature of operation, cannot be operated to increase the initial temperature of operation above that for which the device is originally designed.

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 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 in both figures,

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

Fig. 2 is an axial section of another embodiment of the present invention.

As illustrated, the temperature regulator is mounted in a housing 10 of any suitable size, construction and material, and here shown as composed of two parts 10*a* and 10*b* secured together in any suitable way at 11 and respectively providing portions 12 of reduced diameter so as to receive sections of the hose line conventionally employed in automobile cooling systems. It is to be expressly understood, however, that the housing 10 may take any other suitable form, as one adapted to be mounted on the engine block or the radiator, or to be projected through an aperture in the wall of any suitable part of the cooling system, etc.

Mounted within the housing 10 is a temperature regulator of any suitable construction, here shown as including a valve seat element 13, illustrated as a sheet metal annulus having its outer periphery clamped in position between the two sections 10*a* and 10*b* of the housing 10, and having centrally thereof an axially directed flange 14 adapted to serve as a valve seat; a thermostat support 15, illustrated as a U-shaped strap having its ends secured in any suitable way in apertures in the valve seat element 13; a thermostat 16 of any suitable size, form and construction, illustrated as in the form of metallic bellows having one end 17 stationarily secured in any suitable way to the strap 15 and its opposite movable end attached in any suitable way to a valve stem 19; a valve member 20 of any suitable form, construction and material, illustrated as a disk having an inclined periphery 21 for cooperation with the valve seat 14 and having a centrally disposed and internally threaded sleeve-like hub 22 adapted to be secured on the outer end of the valve stem 19; and a valve stem guide 23, illustrated as composed of a pair of strips formed of sheet metal and provided with semicircular bends intermediate their lengths, said strips adapted to be secured in any suitable way in apertures in the strap 15 with the semicircular bends forming a guide portion 24 embracing the valve stem. While a preferred construction for the thermostatically operated valve member, with its support, valve seat and valve stem guide, has been illustrated and described for purposes of exemplifying the invention, it is to be expressly understood that the present in-

vention is not restricted to such a construction of the thermostatically operated valve unit, as the invention may be applied to a wide variety of other constructions of thermostatically operated valve units as will be apparent from the following description.

In accordance with the present invention the thermostat 16 is initially charged so as to provide a predetermined initial temperature of operation at which the valve member 20 starts to open and which is the highest initial operating temperature that is desirable in practice, and cooperating with said thermostatically operated valve is adjustable means for adding a resilient force that tends to move the valve member 20 toward open position, to thereby lower the initial operating temperature in accordance with the condition of adjustment of said resilient means. As shown said adjusting means takes the form of a generally U-shaped spring 30 bent at its ends as shown at 31 to provide curved surfaces for engagement with the valve member 20 and adapted to be disposed so that the two legs of the spring engage the valve member 20 at either side of the valve stem 19 and symmetrically with respect to the axis of the thermostatically operated valve. Intermediate their length each leg of the U is provided with a loop 32 whereby the U-shaped spring may be mounted in an aperture 33 provided in the strap 15, as by a pivot pin 34 secured in position in any suitable way or by means of cylindrical projections extending inwardly into the slot 33 from the lateral walls of the slot. The bottom or connecting portion 35 of said U-shaped spring is associated with means for adjusting the same to vary the tension of said spring on said valve member. So far the description applies equally to the embodiments of Fig. 1 and Fig. 2.

The embodiment of Fig. 1 illustrates manually adjustable means for incrementally varying the tension on the spring 30. As here shown a sheet metal bracket 40 is secured to the wall of the housing 10 in any suitable way and slotted at 41 to provide for an inwardly bent tab 42 to constitute a stop member. An additional tab 43 may be provided to constitute a pointer for cooperation with the disk to be described. The wall of the housing 10 is apertured as shown at 44 and suitably secured in said aperture is a nipple 45 which is interiorly threaded to receive a threaded plug 46. To prevent leakage of the cooling water between the threads of the nipple 45 and plug 46 packing may be provided at 47 and retained in position by a suitable gland nut 48 secured to an exteriorly threaded portion of said nipple 45. Threaded plug 46, at its outer end, has secured thereon at 49, in any suitable way as by washer 50 and screw 51, a disk 52 for rotating the same and which may be provided with suitable indicia for cooperation with the pointer 43 to show the initial operating temperature at which the device is set. Said disk is preferably provided with a pin 53 which projects inwardly with respect thereto for cooperation with the tab 42 to limit the extent to which the plug 46 may be threaded into the nipple 45, and thereby predetermine the lowest initial operating temperature at which the device may be set.

It will be perceived that by rotating the disk 52 the plug 46 may be projected to varying amounts into the interior of the housing 10, within the limits defined by the cooperation of the pin 53 with the tab 42. Preferably, when the plug 46 is at one limit of its possible movement the U-shaped spring 30 is merely in contact with or applying only light tension to the valve disk 20, so that the initial operating temperature of the thermostatic valve unit is substantially that for which the device is set when it is originally charged. Progressive projection of the plug 46 through the nipple 45 from the aforementioned limit will increasingly impose tension on the spring 30, thereby providing an increasing force at the valve disk 20 tending to move the latter toward open position.

When the temperature of the cooling medium is below the initial operating temperature thus predetermined, the valve 20 is held in closed position by the thermostat 16 which is now in collapsed condition. As the temperature of the cooling medium rises, however, that temperature will be reached at which the capacity of the thermostat 16 to hold the valve member in closed position, because of internal pressure, will be balanced by the tension on the spring 30, and upon any further increase in temperature, the valve member 20 will begin to open, and continue to open as long as the temperature tends to increase, until as a limit condition said valve member is in wide open position. Although the spring 30 may be so designed that even in the wide open position of the valve member it still exerts a tension on the valve member in the opening direction, the wide open position of the valve member will under the conditions hereinbefore assumed be a position in which the spring 30 ceases to exert any substantial tension in the opening direction of the valve member. Hence it will be noted that the wide open position of the valve member will be substantially the same and correspond to substantially the same maximum temperature whether the spring 30 be adjusted to its inactive position, so that the initial operating temperature is that for which the thermostat was originally designed, or whether spring 30 has any of its other positions of adjustment, the adjustment of the spring 30 lowering the initial operating temperature but not substantially changing the ultimate or maximum temperature at which the valve member acquires its wide open position.

Furthermore it will be observed that inasmuch as the spring 30 in all of its active positions of adjustment exerts a force on the valve member 20 in the direction of opening movement, said spring 30 supplements the inherent resiliency of the bellows 16 to tend to move the valve member toward its open position or position of safety in the event that internal and external pressures become balanced when the thermostat leaks or becomes punctured, to permit maximum flow of the cooling medium through the valve port at 14.

Whereas in the embodiment of Fig. 1 the adjusting means enables the tension of the spring 30 to be varied by small increments between the limits fixed, the embodiment of Fig. 2 provides for only two conditions of adjustment. As here shown a nut 60 is secured in any suitable way in an aperture in the housing 10, and a plug 61 provided with a hex 62 so that it may be readily manipulated, as by a wrench, has threaded end portions 63 and 64 which project to different lengths from the hex 62. Leakage may be prevented by a washer 65 or any other suitable means. The shorter projection 63 may be such that when inwardly directed the U-shaped spring 30 is under no substantial tension, or the extent of its projection

may be such as to impose a small or intermediate tension on the spring **30**. The longer end **64** of the plug, however, when inwardly projected, will impose a tension on the spring **30** which may be of any desired amount, say the maximum that would be imposed by the plug **46** in the embodiment of Fig. 1. In this embodiment only two conditions of adjustment of the U-shaped spring **30** is therefore provided, whereas in the embodiment of Fig. 1 a progressive adjustment is provided within the limits fixed by stop **42**. Otherwise the embodiment of Fig. 2 operates upon the same principle as the embodiment of Fig. 1.

It will therefore be perceived that by the present invention a very simple means of adjustment has been provided for temperature regulators, and inasmuch as temperature regulators of this character are ordinarily mounted within a housing, and commonly have a supporting strap of the type illustrated, the adjusting means herein disclosed may be readily applied to a wide variety of constructions of such temperature regulators. The present invention provides that the maximum initial operating temperature shall be determined by the manufacturer of the thermostat, i. e., by the charge with which the thermostat is originally supplied, while lower initial operating temperatures, within predetermined limits, may be obtained as desired. While lower initial operating temperatures may thus be provided the temperature at which the valve member is in wide open position may be kept the same irrespective of the condition of adjustment of the spring. Furthermore, as the spring tends to move the valve toward opening position in all active conditions of adjustment, it cooperates with the thermostat to move the latter towards its position of safety in the event of the thermostat becoming leaky or punctured.

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 restricted thereto, as the same may receive a variety of mechanical expressions, as will readily suggest themselves to those skilled in the art, and changes may be made in the details of construction, arrangement and proportion of parts, and certain features used without other features, without departing from the spirit of this invention. Reference is therefore to be had to the appended claim for a definition of this invention.

What is claimed is:

In a temperature regulator for the cooling system of an internal combustion engine, in combination with a housing, means in said housing providing a valve seat, a thermostat support in said housing, a disk-type valve member movable rectilinearly toward and away from said seat, a thermostat mounted on said support, means operatively connecting said thermostat with said valve member, said thermostat operative to move said valve member away from its seat upon expansion of said thermostat, resilient means tending to urge said valve member in the same direction that it is moved by the expansion of said thermostat and including a spring pivoted intermediate of its length on said thermostat support, said spring being bifurcated at one end and having its bifurcated ends engaged with and adapted to apply pressure to said valve member symmetrically with respect to the axis of said thermostat and said valve member, the opposite end of said spring extending beyond said pivot on the opposite side of said pivot from said bifurcated end and into adjacency with the wall of said housing, and means extending through the wall of said housing into cooperative relationship with said last named end of said spring and adjustable to press on and flex said spring to apply different degrees of resilient tension to said valve member tending to urge the valve member toward its open position and thereby vary the initial temperature at which said valve member starts to move from closed toward open position.

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