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THERMOSTATICALLY OPERABLE VALVE STRUCTURES

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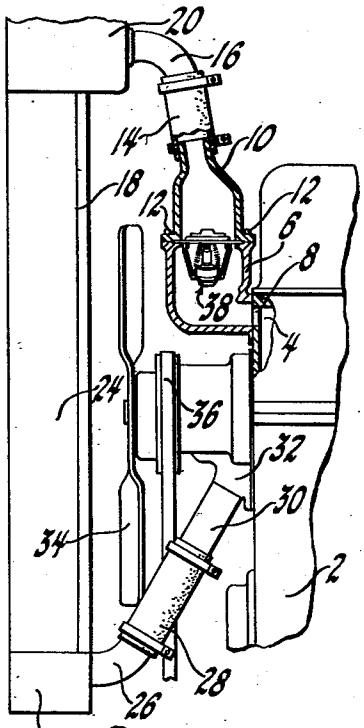


Fig. 1

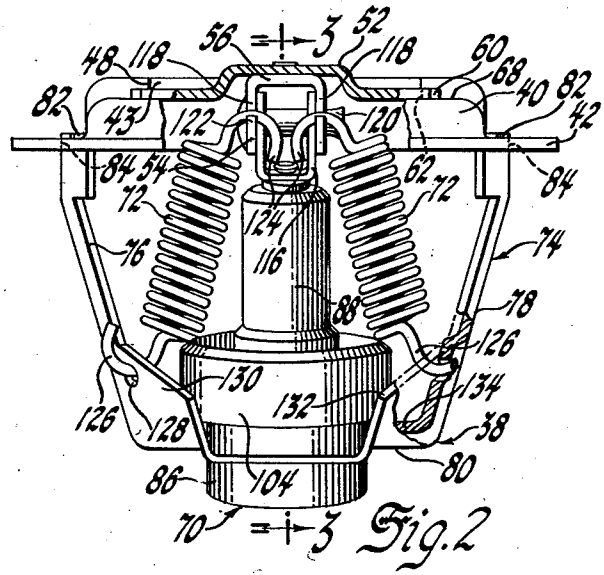


Fig. 2

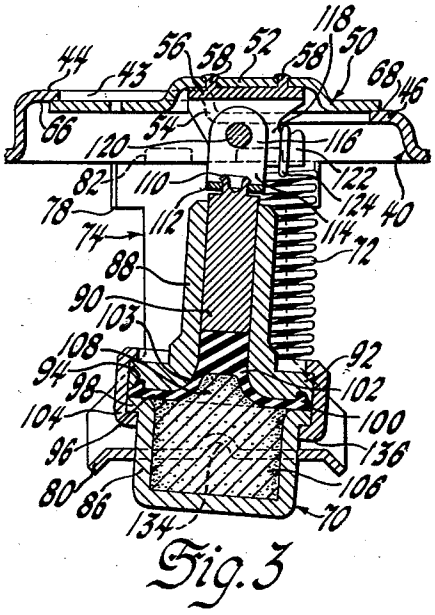


Fig. 3

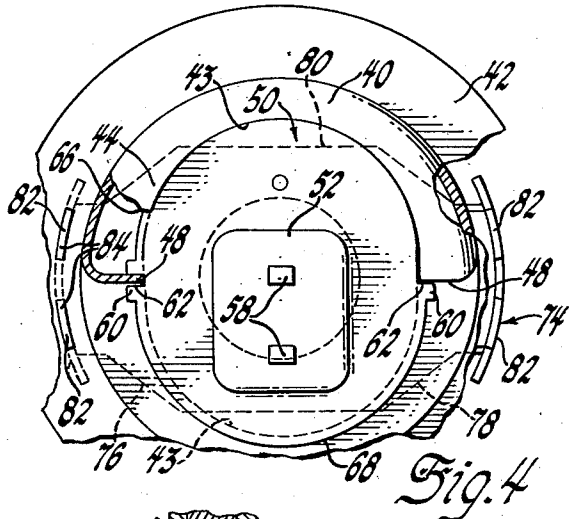


Fig. 4

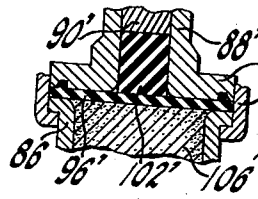


Fig. 5

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THERMOSTATICALLY OPERABLE VALVE STRUCTURES

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2 Claims. (Cl. 236—34)

This invention relates to thermostatically controlled devices and more particularly to thermostatically operable valve mechanisms.

Thermostatically operable valve mechanisms, particularly those employed in fluid pressure systems are subject to severe conditions and consequently must be so constructed as to not only withstand such use but to operate efficiently as well. Many of the prior thermostatically operable valve mechanisms which were generally satisfactory in lower pressure systems are not adapted for satisfactory use in systems operating under higher pressures. Many of the prior structures also lack the structural and operating characteristics necessary to meet the requirements of efficiency and reliability of certain installations.

One object of the present invention is to provide a generally improved thermostatically operable valve mechanism which is adapted for reliable and efficient use in both high and lower pressure fluid system.

Another object is to provide thermostatically operable valve structures of the stated character having novel and improved features of construction which insure efficient performance of the device over extended periods of operation.

Other and further objects will become apparent as the description of the invention progresses.

Of the drawings:

Fig. 1 is a fragmentary side elevational view of the front end of an internal combustion engine showing the fluid cooling system associated therewith, including the thermostatically operable valve structure comprising the present invention, certain parts being broken away and shown in section to more clearly illustrate certain features thereof.

Fig. 2 is an enlarged side elevational view of the thermostatically operable valve structure shown in Fig. 1, certain parts being broken away and shown in section to more clearly illustrate the structure of certain features thereof.

Fig. 3 is a sectional elevational view taken substantially along line 3—3 of Fig. 2.

Fig. 4 is a plan view of the thermostatically operable valve structure shown in Figs. 2 and 3, certain parts thereof being shown in section and parts being broken away to illustrate certain features thereof, and

Fig. 5 is a fragmentary sectional elevational view of a modified construction.

Referring to the drawings, the numeral 2 indicates generally an internal combustion engine such as that employed on motor vehicles having a fluid cooled jacket 4 provided thereon for receiving a liquid cooling medium. A fitting 6 is secured to the front end of engine 2 and communicates with jacket 4 through an opening 8 provided in the wall of the engine. A second fitting 10 is secured by stud bolts 12 to fitting 6 and the upper end thereof is connected by the usual flexible connection 14 to the inlet connection 16 of a radiator 18. Radiator 18 may be of any suitable construction having an upper liquid receiving tank 20, a lower tank 22, connected by a series of tubes indicated generally at 24. The outlet fitting 26 secured to tank 22 is connected by a flexible

connection 28 to an inlet connection 30 to a pump 32 mounted at the front end of the engine in the usual manner. The usual fan 34 connected to the crank shaft of the engine, not shown, by a belt and pulley mechanism 36 draws air between the tubes of radiator 18. The pump 32 is also driven by the belt and pulley mechanism 26. Accordingly, upon operation of the engine 2 liquid from jacket 4 when heated may circulate to radiator 18 and be returned to the jacket by pump 32.

In order to prevent circulation of the liquid coolant from the engine to the radiator, until the engine has warmed up sufficiently, a thermostatically operable valve structure 38 is provided. Valve structure 38 consists of a valve seat 40 having an offset substantially circular flange 42 provided thereon which is adapted to seat on the upper end of fitting 6 and is rigidly held in position between fittings 6 and 10 by the bolts 12. Valve seat 40 is of substantially circular construction having a substantially oval-shaped opening 43 provided therein. Valve seat 40 is provided with stepped or offset relatively flat portions 44 and 46 which are connected by spaced upwardly extending portions 48. A substantially oval-shaped butterfly valve 50 somewhat larger than opening 43 is mounted for pivotal movement on seat 40. Valve 50 is relatively flat and has an upwardly depressed portion 52 provided thereon for receiving a bracket 54. Bracket 54, as shown more particularly in Fig. 3, is provided with a relatively flat upper portion 56 which engages the under side of depressed portion 52 and has rivets 58 secured thereto which extend through apertures provided in said depressed portion. When the bracket 54 has been assembled, as shown in Fig. 3, the upper ends of the rivets are peened over to secure the said bracket in position. Valve 50 is provided with diametrically opposed, laterally extending projections 60, each having an inwardly extending slot 62 provided therein which receives the adjacent upwardly extending portion 48 of seat 40 when the valve is assembled in position as shown in Fig. 4. When valve 50 is in closed position, as shown in Figs. 3 and 4, the left-hand end thereof (Fig. 3) engages the under surface 66 of valve seat 40 while the right-hand end engages the upper surface 68 of said seat. By this construction valve 50 is pivotally supported on valve seat 40 and is retained thereon by the overlapping arrangement of the valve and valve seat just described. The valve pivots about the inclined portion 48 when operated by mechanism which will presently be described. A valve structure of this general type is shown in the copending application of Lewis D. Burch, Serial No. 314,635, filed October 14, 1952, and to which reference may be had for a more complete disclosure thereof.

Valve 50 is actuated to open position by a thermostatically operable unit indicated generally by the numeral 70 and to closed position by a pair of coil springs 72. Unit 70 is pivotally supported in a frame 74 which consists of spaced upwardly and slightly outwardly inclined arms 76 and 78 which are connected at their lower ends by a web 80. The upper ends of the arms 76 and 78 are provided with tabs 82 which extend into slots 84 provided in the flange 42 of seat 40 and are secured in position in any suitable way such as by peening over the upper ends thereof or by soldering or welding. The web portion 80 of frame 74 is provided with an opening centrally thereof through which the cup-shaped pellet receiving container 86 of unit 70 extends. Extending upwardly from container 86 is a cylinder 88 having an elongated plunger or piston 90 reciprocably mounted therein. The lower end of cylinder 88 is provided with an outwardly extending annular flange 92 having an annular recess 94 provided in its lower surface near the outer periphery thereof. A diaphragm 96 is secured between the upper annular flange 98 of container 86 and the lower surface of flange 92 of

cylinder 88. Diaphragm 96 has an annular rib 100 provided thereon which extends into the recess 94 in flange 92. Diaphragm 96 has integral therewith a plunger portion 102 which extends into the lowere end of cylinder 88 and abuts the lower end of piston 90. The lower end of cylinder 88 is provided with an enlarged curved portion 103 which presents a smooth surface to the diaphragm. This not only reduces wear but enables the diaphragm to properly expand and contract during operation of the device. When the parts have been assembled, as shown in Fig. 3, a securing band 104 is provided around the unit and the upper and lower ends thereof are then crimped over so as to tightly engage the upper and lower surfaces of annular flanges 92 and 98, respectively, thereby compressing the diaphragm into sealing tight relation with said flanges.

A pellet 106 is placed in chamber 86 before assembly and completely occupied the said chamber as well as the area 108 disposed immediatelly beneath plunger 102 and diaphragm 96. Pellet 106 may be of any suitable composition and preferably contains a crystalline wax, a plasticizer such as tricresylphosphate or mineral oil, and powdered heat conducting metal such as aluminum or copper.

The upper end of piston 90 is provided with a reduced hollow rivet portion 110 which is adapted to extend through an opening provided in the web 112 of a hook-like link member 114. The upwardly extending arms 116 of link 114 lie in close juxtaposition with the inner surface of the downwardly extending arms 118 of bracket 54. The arms 116 and 118 of link 114 and bracket 54, respectively, are provided with aligned apertures for receiving a pivot pin 120. Valve 50 is thus pivotally connected to the upper end of piston 90.

Each arm 118 of bracket 54 is provided with a hook portion 122 for receiving the upper hooked end 124 of a spring 72. The lower hooked ends 126 of springs 72 are hooked into apertures 128 provided in the lower enlarged portions 130 and 132 of arms 76 and 78, respectively. Springs 72 diverge toward their lower points of attachment with frame 74 and are so tensioned as to exert equal pressure on opposite side of the major axis of valve 50. Undesirable turning or twisting of the valve assembly likely to cause binding between parts is thus prevented. The forces operating on the valve structure during movement of the valve 50 to open and closed positions, accordingly, are effectively balanced and proper operation as well as proper seating of said valve is thus assured. The web portion 80 of frame 74 at either side of the opening provided centrally thereof is formed with a semicircular projection 134 which engage the end securing band 104 and form therewith a pivotal support for unit 70. The opening in web 80 is slightly larger than the outer diameter of container 86 and consequently the required amount of rocking movement is permitted during the operation of the device.

Fig. 5 shows a modified construction wherein a different type of plunger and diaphragm is employed. In this construction the diaphragm 96' and the plunger 102' are separate rather than integral. As in the structure just described, the plunger 102' tightly fits in the lower end of cylinder 88' and also engages the lower end of a piston 90'. Otherwise the structures are substantially the same.

From the foregoing description it is believed that the operation of the thermostatically operable valve structure is apparent. However, in order to correlate the various elements thereof, a brief resume of the operation of the device as a whole will now be given. Upon operation of the engine 2, valve 50 will remain in seated position to prevent the circulation of liquid between the said engine and radiator until the temperature of the coolant reaches a predetermined value. The start-to-open temperature may vary with different types of constructions, some requiring a start-to-open temperature of approximately 160° F. while others may require a start-to-open temperature in excess of this value. The pellet 106, accordingly is selected for the desired start-to-open temperature and contains such properties that it will remain in the solid state until the start-to-open temperature is reached, at which time it changes from the solid to the liquid state causing substantial expansion to take place. Upon expansion of the pellet, plunger 102 actuates piston 90 upwardly which in turn causes valve 50 to pivot in a counterclockwise direction (Fig. 3) about the upwardly extending portions 48 of valve seat 40. Upon opening of valve 50 in this manner, liquid from the jacket 4 of the engine may circulate through the radiator and the desired engine temperature is thus maintained. When the temperature of the liquid falls below the start-to-open temperature, the pellet 106 changes from the liquid to the solid state thereby contracting and relieving the pressure on valve 50. When this occurs, springs 72 function to actuate the valve 50 to seated position and to restore the parts to the normal position shown in Fig. 3. Upon increase in the temperature to the start-to-open value, the pellet again expands and the cycle of operation just described is repeated.

From the foregoing description it is seen that an efficient and highly novel and useful thermostatically operable valve structure has been provided. While but two embodiments of the invention have been shown and described herein, it is apparent that it may be embodied in other forms without departing from the invention. It therefore is to be understood that it is not intended to limit the invention to the embodiments disclosed herein but only by the scope of the claims which follow.

What is claimed is:

1. In a device of the class described, a shaftless valve structure comprising a circular valve seat with an upstanding cylindrical portion having an end wall, an opening of oval configuration in said end wall of said portion, a butterfly valve larger than said opening and having aligned notches receiving opposed parts of said end wall at the minimum width of said opening for pivotally supporting said valve with respect to said opening to control the latter, marginal portions of said valve being located at opposite sides of said end wall, a support fixed to said valve seat, thermostatically operated means interposed between said support and said valve to open the latter when subjected to an increase in temperature, multiple coiled springs connecting said valve and said support and urging the said valve into its closed position, and said springs diverging from said valve towards said support.

2. A shaftless valve structure comprising a valve seat with a wall having an opening of oval configuration in said wall and defined by a continuous curved edge, a butterfly valve larger than said opening and having aligned notches retaining said edge pivotally and at opposite sides across the minimum width of said opening to support said valve with relation to said valve seat opening, marginal portions of said valve being located at opposite sides of said valve seat wall, a support fixed to said valve seat, thermostatically operated means and spring means interposed between and connecting said support and valve to control the latter, and ends of said thermostatically operated means and spring means being connected to a central portion of said valve, and said spring means diverging outwardly from said valve to impart stability of valve action.

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