Aug. 25, 1936. L. M. PAYNE 2,052,313

INTERNAL COMBUSTION ENGINE

Filed April 3, 1933 2 Sheets-Sheet 1

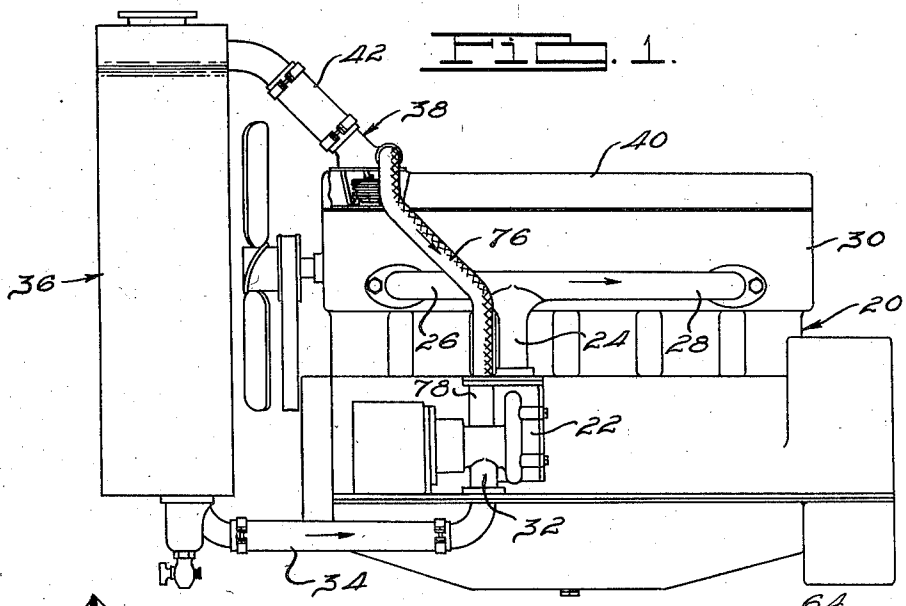


Fig. 1.

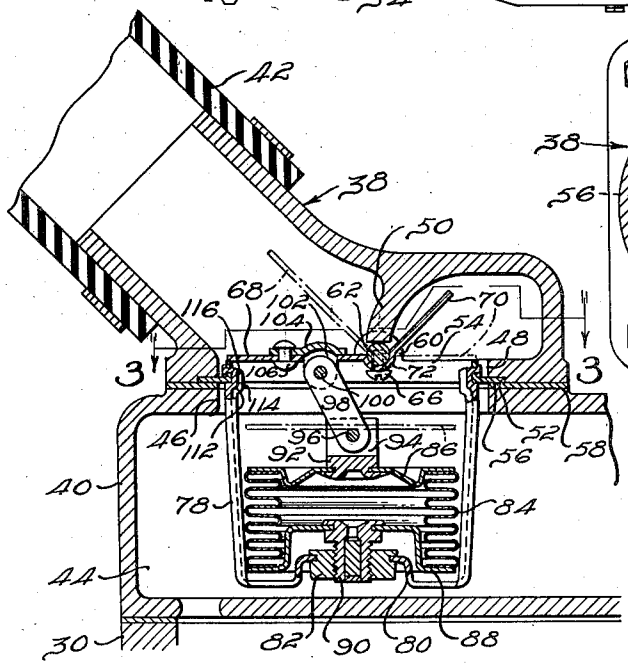


Fig. 2.

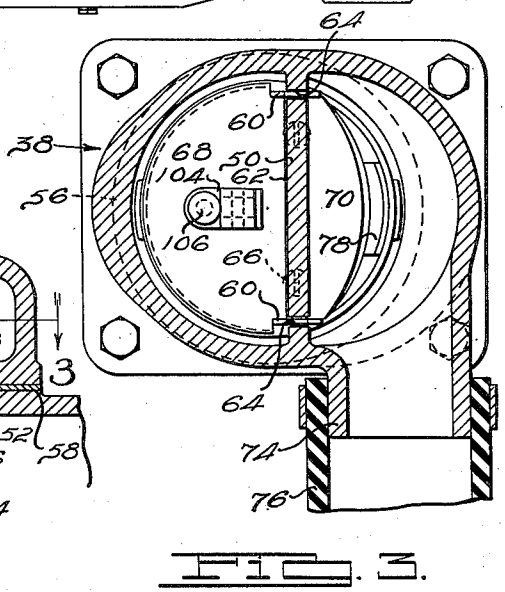


Fig. 3.

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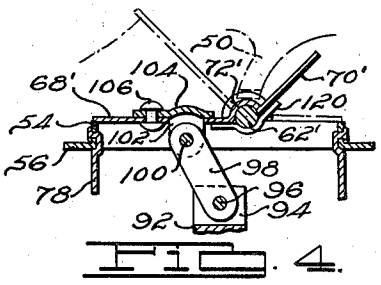


FIG. 4.

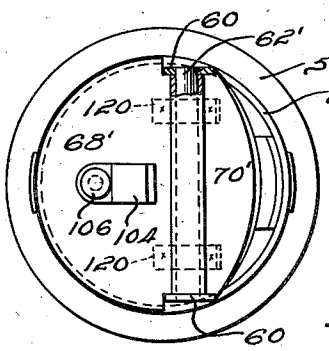


FIG. 5.

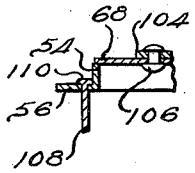


FIG. 6.

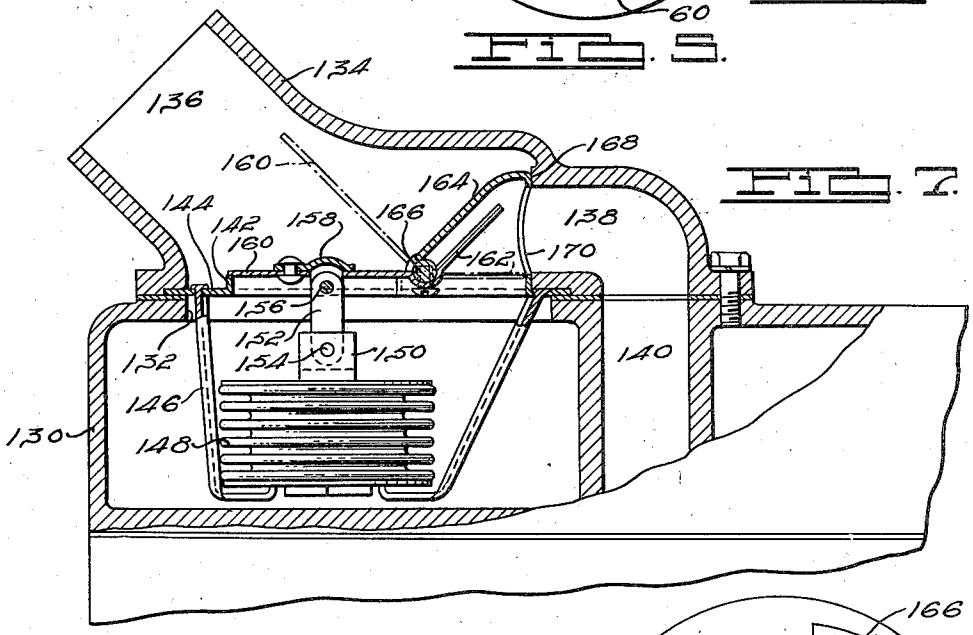


FIG. 7.

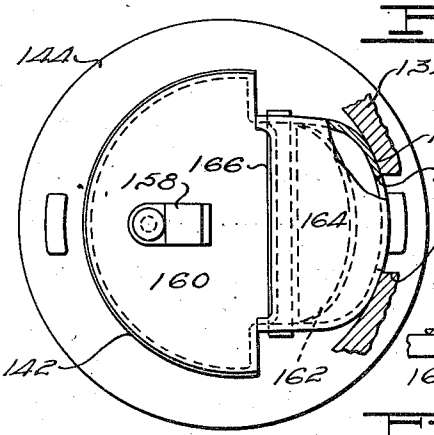


FIG. 8.

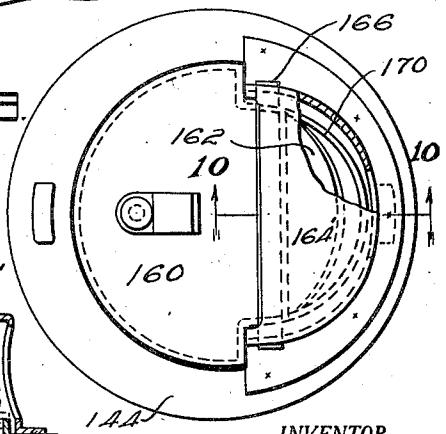


FIG. 9.

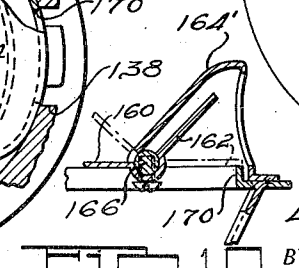


FIG. 10.

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2,052,313

INTERNAL COMBUSTION ENGINE

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Application April 3, 1933, Serial No. 664,047

16 Claims. (Cl. 236—34)

This invention relates to internal combustion engines and particularly to means for thermostatically controlling circulation of the liquid cooling medium tnerefor, the principal object being the provision of a new and novel device for this purpose that is simple in design, efficient in operation and economical to produce.

Other objects include the provision of a simple and efficient means for by-passing the liquid cooling medium of an internal combustion engine around the radiator thereof while the temperature of such medium is below a predetermined value, and to close such by-pass and open the flow of such medium to the radiator when the temperature of such medium attains a predetermined value; to provide such a structure in which the number of operating parts is reduced to a minimum; to provide such a structure in which possibility of lag on the part of one of the valves with respect to the other is positively obviated; and to provide such a structure that is simple, efficient and positive in operation.

Other objects include the provision of a thermostatic valve structure for simultaneously controlling the flow of fluid through two passages; the provision of a thermostatic valve structure including a pair of thermostatic valve elements operable on a common pivotal axis; the provision of a thermostatic valve structure including a pair of valve elements pivotally fixed with respect to each other; the provision of a thermostatic valve structure including a pair of valve elements integrally associated with each other; the provision of a thermostatic valve structure including a main body portion having an opening therein and a pair of cooperating valve elements cooperating with the opening; the provision of a thermostatic valve structure including a pair of valve elements angularly disposed with respect to each other; and the provision of a thermostatic valve structure including a body member having an opening therein and a valve mechanism cooperating with the opening to close one portion of the opening to the flow of fluid therethrough while opening another portion of the opening to the flow of fluid therethrough.

Other objects include the provision of an internal combustion engine having a single discharge opening in the cylinder head thereof for the discharge of cooling medium and having an outlet connection cooperating with the opening and having a pair of passages therein, and a thermostatic valve structure associated therewith and adapted when in one extremity of its movable position to direct substantially all of the cooling medium flowing through the opening into one of the passages, and when in the other extremity of its movable position to direct substantially all the cooling medium flowing through the opening into the other of said passages; the provision of a cylinder head including a discharge connection having a pair of passages formed therein and a single valve member pivotally mounted intermediate the passages and movable to close either one or the other thereof; the provision of a cylinder head having a single outlet opening and a dischrage connection provided with a pair of discharge passages, and a thermostatic valve structure clamped between the connection and the cylinder head and operable to control the flow of fluid through said passages.

Further objects include the provision of a cylinder head having a single outlet opening therein and an outlet connection member associated therewith and provided with a main discharge passage and a by-pass passage, and a thermostatic valve structure including a main body portion having a main discharge opening, a wall member cooperating with the said body member and said by-pass passage, and a valve structure pivotally associated with said body portion and movable under the influence of temperature changes in the cooling medium in said cylinder head to direct the flow of water therefrom either through said main discharge passage or through said by-pass passage; the provision of a valve structure of the type described in which the wall portion cooperating with the by-pass passage is in the form of a projection on the main body portion; the provision of a structure as above described in which said wall portion is in the form of a hood or pocket cooperating between the axis of the valve element and a wall of the outlet connection member; and the provision of a thermostatic valve structure including a body member having an opening therein and a projecting pocket portion opening laterally of the opening, and a pivoted valve element cooperating with the opening and having one portion thereof adapted to control the flow of fluid through said opening into said pocket and another portion thereof adapted to control the flow of fluid through that portion of the opening outside of said pocket.

The above being among the objects of the present invention, the same consists in certain novel features of construction and combinations of parts to be hereinafter described with reference to the accompanying drawings, and then

claimed, having the above and other objects in view.

In the accompanying drawings which illustrate suitable embodiments of the present invention and in which like numerals refer to like parts throughout the several different views.

Fig. 1 is a more or less diagrammatic partially broken side elevational view of an internal combustion engine of the general type employed in connection with motor vehicles, together with a radiator as conventionally employed in connection therewith for cooling the engine cooling medium.

Fig. 2 is an enlarged vertical sectional view taken longitudinally of and centrally through a fragment of the cylinder head and water discharge connection of the engine shown in Fig. 1.

Fig. 3 is a horizontal sectional view taken on the line 3—3 of Fig. 2.

Fig. 4 is a fragmentary sectional view showing a slight modification of the construction illustrated in Fig. 2.

Fig. 5 is a plan view of the modified structure shown in Fig. 4.

Fig. 6 is a fragmentary vertical sectional view illustrating a slightly different method of securing the bellows supporting member or strap to the main body portion of the thermostatic valve.

Fig. 7 is a view similar to Fig. 2 but showing a modified form of construction.

Fig. 8 is a plan view of the valve structure shown in Fig. 7.

Fig. 9 is a view similar to Fig. 8 but showing a modification thereof.

Fig. 10 is a fragmentary vertical sectional view taken on the line 10—10 of Fig. 9.

As is well understood in the art, it is conventional practice in connection with substantially all motor vehicles except those of the cheapest type, to provide automatically actuated means for rendering the radiator of the vehicle inoperative for cooling purposes until the temperature of the cooling fluid in the water jacket of the engine has attained a predetermined value. The reason for the use of such means is that the engine of a motor vehicle operates most efficiently at a predetermined temperature, and the quicker the temperature of the engine can be brought to this value the quicker it will operate under normal conditions, and the closer this temperature is maintained during operation the more efficient will be the operation of the vehicle as a whole.

There are in general two main types of devices employed for this purpose. One of these types includes the provision of a shutter mechanism in front of the radiator, and operating the shutters by means of a thermal responsive device positioned in the flow of cooling medium for the engine. The use of such devices is more or less limited primarily because of the greater cost involved in applying them to motor vehicles, and also due to the fact that the entire body of liquid cooling fluid in the water jacket of the engine must be brought to the desired maximum value before the engine begins to operate at normal temperature. The other main type of devices includes a valvular means interposed in the engine cooling medium discharge connection bebetween the engine and the radiator, and is operated by thermally responsive means located in the engine cooling system to prevent the flow of cooling fluid through the radiator until the temperature of the cooling fluid in the engine itself has attained the desired high value. This latter class may also be divided into two main subclasses, one of which substantially prevents any flow of fluid through the engine cooling system until the temperature of the cooling fluid in the engine water jacket has reached the desired high value, and the other of which includes means for by-passing the cooling fluid from the engine outlet to the engine inlet, around the radiator, so that the water in the engine may be circulated while its temperature is being raised and thereby effectively prevents the formation of localized steam pockets or other areas of excessive temperature. This latter class of device is coming into greater favor, but its use has been restricted to some extent both because of its relatively greater cost than the simple flow stopping type of device, and also because of the relatively complicated mechanism of relatively large size that has heretofore been provided in the use of the same.

The present invention relates to the latter class of devices and by its use the disadvantages of this type of devices inherent in the constructions heretofore proposed have ben largely eliminated, and a simple, economical and efficient mechanism has been provided in its place.

Referring to the drawings, in Fig. 1 is illustrated generally at 20 an internal combustion engine of a type conventionally employed in connection with motor vehicles. This engine is provided with a water pump 22 having an outlet 24 which branches as at 26 and 28 to opposite ends of the water jacket 30 of the engine into which it discharges. The pump 22 is provided with an inlet 32 which is connected by means of a suitable connection such as 34 with the outlet side of a radiator of conventional construction indicated generally as at 36. An outlet connection indicated generally as at 38 secured to the upper face of the cylinder head 40 of the engine 20 is connected as by means of suitable tubing 42 with the inlet side of the radiator 36. Under normal conditions of operation water or other cooling fluid is withdrawn from the radiator 36 through the connection 34 to the inlet connection 32 of the pump 22, and is discharged by the pump 22 through the outlet connection 24 and branches 26 and 28 to the water jacket 30 where it is circulated around the cylinders of the engine and discharged through the cylinder head 40 and outlet connection 38 to the tubing 42 and returned to the inlet side of the radiator 36 to be passed through it for the purpose of reducing its temperature.

It will, of course, be understood that the cylinder head 40 is provided with suitable spaces 44 for the reception and circulation of the cooling fluid circulated by the pump 22, and the head 40 is further provided with a discharge opening 46, best shown in Fig. 2, through which the cooling fluid is adapted to pass to the outlet connection 38. The outlet connection 38 is provided with an opening 48 matching the opening 46. The openings 46 and 48 are both shown circular in shape, which is preferable in that it facilitates the machining of the walls thereof where necessary in production.

It will be noted that the space provided in the outlet connection 38 above the opening 48 is divided by a downwardly projecting transversely disposed wall portion 50 formed integrally with the outlet member 38. The lower face of the outlet connection 38 is annularly recessed as at 52 in concentric relation with respect to the opening 48. The thermostatic valve structure includes a body member having an upstanding annular collar portion 54 and a radially outwardly extending

flange 56, the latter of which is received in the recess 52 and is clamped between the corresponding face of the outlet member 38 and a gasket 58 interposed between the outlet member 38 and the cylinder head 40. The peripheral diameter of the flange 56 is preferably such as to be relatively closely received by the outer edge wall of the recess 52, that is to say, the fit is sufficiently close so as to maintain the collar 54 in substantial concentricity with the opening 48.

At laterally opposite sides of the collar portion 54, but rearwardly spaced from the center thereof, are a pair of upstanding ears 60, and pivotally mounted between the ears 60 is a shaft 62. It will be noted from an inspection of Figs. 2 and 3 that the dividing wall 50 extends downwardly into substantially contacting relation with respect to the upper surface of the shaft 52, and as particularly well shown in Fig. 3, the dividing wall 50 at its extreme opposite side substantially contacts with the outer faces of the ears 60 and extends down into contacting relation with respect to the upper surface of the flange 56, it being cut out or slotted as at 64 for relatively close reception of the ears 60 therein.

Rigidly secured to the shaft 62 as by means of screws 66 are a pair of valves 68 and 70, shown as formed integrally with each other. In the particular valve unit shown, the central portion thereof is depressed as at 72 to form a groove complementary to the exterior surface of the shaft 62 to which it is secured, thus aiding in locating the valve unit with respect to the shaft. As indicated in Fig. 2, the valve 68 is disposed at an angle of approximately 45 degrees with respect to the valve 70 about the axis of the shaft 72, although it is to be understood that the particular angular relation between these valves is more or less unimportant as long as it is sufficient to accomplish the desired purposes of the valve structure as will hereinafter be brought out.

In Fig. 2 the valve 68 is shown in closed position and in such position its outer marginal portion seats against the corresponding outer marginal portion of the collar 54 forwardly of the shaft 62 and dividing wall 50, and in such case the valve 70 is in open position as indicated. When the parts are in this position it will be apparent that the opening in the collar member 54 forwardly of the shaft 62 and dividing wall 50 is substantially completely closed to the flow of cooling medium therethrough, and that that portion of the central opening in the collar 54 rearwardly of the shaft 62 and dividing wall 50 is substantially fully open. That portion of the space within the outlet connection 38 rearwardly of the dividing wall 50 is provided with an outlet connection 74, best shown in Fig. 3, which, as shown in Figs. 1 and 3, is connected by suitable means such as the tube 76 with a second inlet connection 78 for the circulating pump 22. Accordingly, when the parts are in the position indicated in Fig. 2 and the engine 20 is operating, the cooling fluid is circulated by the pump 22 through the pump outlet connection 24 and branches 26 and 28 to the water jacket 30, from whence it passes through the cylinder head 40 and out through the outlet connection 38 rearwardly of the dividing wall 50 and thence back to the pump through the tube 76. In such case it will be apparent that substantially no cooling effect is applied to the fluid being circulated through the engine and, accordingly, it will be apparent that such fluid will be relatively quickly raised in temperature due to this fact.

When the valve 68 is in open position and the valve 70 is in closed position, as indicated in dotted line in Fig. 2, then the above described circulation of the cooling medium from the outlet connection back to the pump through the tube 76 will be prevented, and substantially all of the water flowing into the outlet connection 38 will then pass through the tubing 42 to the radiator, and the pump 22 will draw cooled fluid from the lower part of the radiator 36 and circulate it through the engine.

The valves 68 and 70 are controlled in accordance with the temperature of the cooling medium being circulated through the engine in the following manner. A U-shaped support 78 of strap-like formation is secured at its upper end to the body member including the collar 54 and flange 56 and projects downwardly therefrom. The bottom of the member 78 is upwardly bent or recessed as at 80 and rotatably receives therein a nut member 82. Between the inwardly spaced sides of the member 78 is received a metal bellows 84 having a head 86 and a bottom 88. The bottom 88 is upwardly recessed so as to provide clearance for the reception of the upwardly bent portion 80 of the support 78 and the nut 82 therein, this permitting a greater length of wall of the bellows 84 without a corresponding increase in the overall height of the structure. Centrally secured to the bottom 88 of the bellows is a downwardly extending stud member 90 threadably received in the nut 82 and serving to fix the bottom 88 with respect to the bottom wall of the support 78.

The upper wall 86 of the bellows 84 is provided with a fixed upstanding boss or lug 92 which is centrally slotted as at 94, and pivotally secured within the slot 94 as by means of a pin 96 is the lower end of a link 98. The upper end of the link 98 is pivotally secured by means of a pin 100 to the downwardly extending ear 102 of a bracket 104 secured to the valve 68 by means of a rivet 106.

As in conventional constructions, the bellows 84 is filled with a volatile liquid which volatilizes at the temperature at which it is desired to maintain the cooling fluid which is circulated through the engine 20. Consequently, when the liquid within the bellows is all in liquid form, below the desired high temperature of the cooling system, a partial vacuum will be created within the bellows which will tend to contract it and will cause the mechanism to assume the position indicated in full lines in Fig. 2. As soon as the desired temperature is reached, sufficient liquid in the bellows 84 will vaporize to expand the bellows 84 and in expanding it will move the valve members 68 and 70 to the position indicated in dotted lines in Fig. 2. The exact temperature at which the valve 68 will begin to open may be adjusted in production by rotating the nut 82 to vary the position of the bottom of the bellows in respect to the shaft 62 and, when the desired adjustment is reached, staking the nut 82 to the stud 90 to thereby lock it in such position.

The conventional method of securing supports of the general character illustrated at 78 in Figs. 2 and 3 to the main body portion of the valve structure is illustrated in fragmentary form in Fig. 6, in which a strap member 108 is substituted for the strap 78 in Fig. 2. As illustrated, the conventional practice is to extend a portion of the upper end of the strap 108 through the flange 56 and to peen over the projecting end of the strap 108 as at 110 to lock the parts together. In such a construction it is necessary that the

flange 56 be made sufficiently wide to effect the desired clamping between the outlet connection and the cylinder head radially outwardly of the peened over end portion 110 of the strap 108. This, of course, means that the opening in the cylinder head and the outlet connection, corresponding to the openings 46 and 48 in Fig. 2, must be made sufficiently large to take care of this feature. Inasmuch as it is important in connection with internal combustion engines that the size of such openings be kept at a minimum dimension and yet be large enough to permit a substantially unrestricted flow of cooling medium through them, I have devised a novel method of securing the strap member 84 to the main body member as best illustrated in Fig. 2. In this figure it will be noted that the upper ends of the strap member 78 are inwardly bent as at 112 so as to provide a shoulder which seats against the lower inner margin of the flange 56. The ends are then bent upwardly as at 114 and then radially outwardly as at 116, and these portions 116 project through the side walls of the collar 54 and their outer ends are peened over to secure them against displacement. By this means the effective outer diameter of the strap member 78 is substantially no greater than the outer diameter of the collar 54 and consequently the flange 56 may be made relatively narrower than the construction illustrated in Fig. 6, and still provide an equivalent amount of effective clamping surface.

With the above construction it will be noted that the valve structure as a whole is of minimum diameter and of minimum height, that it consists of no more parts than are found in those types of thermostatic valve structures designed to simply stop the flow of cooling water through the engine instead of by-passing the same, that accordingly it contains a minimum number of parts all of which are of simplest construction and consequently it may be produced at a minimum amount of expense. It will be noted that because the valves 68 and 70 are fixed relative to one another, no lag of one valve with respect to the other is possible, and they are forced to move together. It will also be apparent that when the valve 68 is in open position the greater portion of the central opening in the collar 54 is opened to the flow of circulating water through it, and it offers a substantially unrestricted flow of cooling water directly into the main discharge passage of the outlet connection 38, and that when the valve 70 is open it provides an amply clear passage for the recirculation of the volume of cooling fluid generally circulated through an engine when cold.

It will also be observed that inasmuch as the area of the valve 68 is substantially greater than the area of the valve 70, should the bellows 84 spring a leak so that the normal increase in temperature of the circulating fluid about it fails to cause it to expand and thereby open the valve 68, and which failure to open would cause the temperature of the cooling fluid to be built up to a point which would be dangerous to the operation of the engine, the pressure of the circulating fluid on the valve 68 would overcome any pressure which might be exerted on the valve 70, and cause the valve 68 to open and thus permit circulation of the cooling fluid through the radiator. This feature eliminates the possibility of burning up the engine because of a leaky bellows.

In Figs. 4 and 5 a slight modification of the foregoing valve structure is illustrated, the change being mainly concerned with the formation and support of the valves 68 and 70. In Figs. 4 and 5 these valves are replaced by valves 68' and 70' respectively and the shaft 62' corresponding to the shaft 62 in the previously described construction is non-rotatably secured between the ears 60. The valves 68' and 70' in this construction are connected by a curved portion 72' fitting the surface of the shaft 62' but in this case the portion 72' extends over the upper surface of the shaft 62' and is circumferentially slidable thereon. Strap members 120 are secured to the lower faces of the valves 68' and 70' and extend under and slidably fit the lower surface of the shaft 62'. The lower edge of the dividing wall 50 in this case extends into substantially contacting relation with the outer surface of the curved portion 72' to effect a substantial seal between them. As will be noted, the effect of this construction is to make the shaft 62' stationary and the valves 68' and 70' rotatable thereon.

In Figs. 7 and 8 a modification of the foregoing construction is illustrated. In this case a cylinder head 130 is provided with a discharge opening 132 which cooperates with an outlet member 134 having a main discharge passage 136 adapted to be connected to the radiator of the vehicle and a by-pass discharge passage 138 which is shown as connecting to a passage 140 formed integrally in the cylinder head 130, it being understood that this latter feature is optional in any of the constructions herein described. The valve structure in this case includes a main body member comprising a collar 142 and flange 144, strap-like supporting member 146 for the bellows 148 and boss 150 on the head of the bellows 148 connected by the link 152, pivot pins 154 and 156 and bracket 158 to the main discharge valve 160. It may be noted that in this case the bellows 148 is axially offset from the axis of the opening 132 to provide a straighter connection with the valve 160. The main discharge valve 160 in this case is of substantially the same size, and cooperates with the collar 142 in substantially the same manner, as the valve 68 and collar 54 in the previously described figures. In this case the by-pass valve 162 is slightly smaller than the by-pass valve 70 in Fig. 2 and is enclosed within a hood 164 formed integrally with the main body member and which serves the same purpose as the dividing wall 50 in Fig. 2, but in this case is integral with the valve structure instead of the outlet connection 134. The radially inner wall of the hood 164 extends into substantially contacting relation with the shaft 166 for the valves 160 and 162 to form a seal at this point, and its radially outer face is formed to provide a partially cylindrical surface 168, best shown in Fig. 8, which is adapted to engage a correspondingly shaped face on the inner wall of the outlet connection 134 around the by-pass discharge opening 138 so as to effect a substantial seal therebetween. The hood 164 is provided with an opening 170 therein aligned with the passage 138 so as to permit the flow of cooling fluid through the hood 164 into the passage 138. The valve 162 in this case is adapted to substantially slidably engage the substantially vertical side walls of the hood 164 when in closed position in order to prevent a substantial flow of cooling fluid through the by-pass passage. The effect of the construction is identical to that previously disclosed.

In Figs. 9 and 10 a modification of the con-

struction shown in Figs. 7 and 8 is disclosed. In these figures the hood 164' which corresponds to the hood 164 in Figs. 7 and 8 is not formed integrally with the valve structure but is formed separately therefrom and then fixed thereto. In this case the main body portion is provided with an upstanding flange or collar portion 170 against the upper edge of which the by-pass valve 162 is adapted to contact and rest when in closed position. The hood 164' extends outwardly beyond the collar portion 170 so as to provide ample clearance for movement of the valve 164 therein. It will be noted that in both of these constructions the shaft 166 which pivotally supports the valves is mounted in the side walls of the hood 164 or 164', as the case may be.

Various modifications and changes in the specific construction of the devices above shown and described will be apparent to those skilled in the art once the teachings of the present invention are made available to them and, accordingly, it is to be understood that formal changes may be made in the specific embodiments of the invention described without departing from the spirit or substance of the broad invention, the scope of which is commensurate with the appended claims.

What I claim is:

1. In combination with an internal combustion engine, a cooling system therefor having a pair of outlet passages, a pivotal axis between said passages, a valve unit pivotally supported on said axis and movable to close either one or the other of said passages to the flow of fluid therethrough, said valve unit including a pair of valve portions disposed in planes angularly offset from one another and thermal responsive means for moving said valve unit about said axis, one of said portions presenting a greater effective area to fluid pressure than the other said portion, whereby fluid flow will be continuously effected through the passage controlled by said first valve portion upon the thermal responsive means becoming inoperable.

2. In combination with an internal combustion engine having a cylinder head, a cooling system for said engine having a discharge opening in said head, an outlet connection for said system secured to said head over said opening, a pair of passages in said connection, and a unitary thermostatically operated valvular device for controlling the relative flow of fluid through said passages comprising a frame having an outwardly radially extending flange adapted to be clamped in position between said head and connection, a thermostat supported wholly on the frame and valve means supported wholly on the frame and operable by the thermostat.

3. In combination with an internal combustion engine having a cylinder head, a cooling system for said engine having a discharge opening in said head, an outlet connection secured to said head over said opening, a wall in said connection separating the interior thereof into a plurality of chambers, an outlet passage for each of said chambers, a plurality of rigidly connected valves movable to substantially completely close one of said passages at a time to the flow of fluid therethrough, and means for moving said valves.

4. In combination with an internal combustion engine having a cylinder head, a cooling system for said engine having a discharge opening in said head, an outlet connection secured to said head over said opening, a pair of outlet passages for said connection, and thermostatically operated means for controlling the flow of fluid through said passages including a body member forming a dividing wall for said connection and a pair of valves pivotally supported by said body member.

5. In combination with an internal combustion engine provided with a water jacket having a discharge opening therein, an outlet connection disposed over said opening and having a pair of discharge passages opening into said jacket in a substantially common plane, a valve for controlling each of said passages, and a thermostat within said jacket connected to said valves for causing movement thereof to substantially prevent the flow of fluid through either one or the other of said passages.

6. In a thermostatic valve structure, a body member having an opening therein, a plurality of angularly offset valve members fixed with respect to each other and co-operable to close different portions of said opening, and thermostatic means controlling said valve members.

7. A thermostatic valve structure as described in claim 6 and in which the valve members cooperate to concurrently open one portion of the opening and close another.

8. A thermostatic valve structure as described in claim 6 and in which the valve members are pivoted on the body member and pivotally moved by the thermostatic means.

9. In a thermostatic valve structure, a body member having a flow opening therein, a plurality of angularly offset valve members fixed with respect to each other and cooperable to close different portions of said opening, thermostatic means controlling said valve members, the valve members cooperating to concurrently open one portion of the opening and close another portion and both valve members opening in the direction of flow through the opening.

10. In a thermostatic valve structure, a body member having a flow opening therethrough, a plurality of angularly offset valve members fixed with respect to each other and cooperable to close different portions of said opening, thermostatic means for moving the valve members, both valve members, when opening, opening in the direction of flow through the body member, and one valve member having a greater area than the other exposed to flow approach pressure.

11. In a thermostatic valve structure, in combination a body member having a fluid opening therethrough, a butterfly valve unit pivotally mounted thereon providing an axis of rotation to control flow through the opening, a portion of said valve unit on one side of the pivotal axis being disposed at an angle relative to that portion thereof on the other side of the said axis and both said portions being constrained toward angular movement in unison in the same direction with respect to said axis, thermal responsive means for moving said unit, each valve portion having a closed position in which it closes a portion of the opening and adapted to move to open position in the direction of flow through the opening.

12. In a thermostatic valve structure, in combination, a body member having a flow passageway therethrough, a butterfly valve unit pivotally mounted thereon, a portion of said valve unit on one side of the pivotal axis being disposed at an angle relative to that portion thereof on the other side of side axis, and one portion being of greater area than the other and both said portions being constrained to move in unison with respect to said axis, the valve portions jointly controlling

flows through the passageway thermal responsive means for moving said unit, each valve portion opening in the direction of flow through the passageway.

13. In a thermostatic valve structure adapted for bodily insertion within the cooling ducts of an internal combustion engine, in combination, a body member having an opening therethrough and a peripheral clamping flange, valvular means comprising two butterfly valve portions fixed at an angle to each other and pivotally supported on the body member and jointly controlling the flow of fluid through said opening, a support projecting from said body member, a thermal responsive means carried by said support and having an end portion thereof fixed relative to said support, and an operative connection between said thermal responsive means and said valvular means, said support including a pair of side members the upper ends of which extend into the interior of said body member and are secured thereto.

14. In a thermostatic valve structure, in combination, a body member having an opening therethrough, valvular means comprising two butterfly valve portions fixed at an angle to each other and pivotally supported on the body member and jointly controlling the flow of fluid through said opening, a support projecting from said body member, a thermal responsive means carried by said support, and an operative connection between said thermal responsive means and said valvular means, said support including a pair of side members the upper ends of which are secured to said body member.

15. In a thermostatic valve structure, a body member having a flow opening therethrough, a plurality of angularly offset valve members fixed with respect to each other and cooperable to close different portions of said opening, thermostatic means for moving the valve members, both valve members, when opening, opening in the direction of flow through the body member, and one valve member having a greater area than the other exposed to flow approach pressure and adapted to move to open position upon failure of the thermostat.

16. In a thermostatic valve structure, a body member having an opening therethrough, a plurality of butterfly type valves fixed at an angle to each other and cooperable to close different portions of said opening, and thermostatic means for moving the valve members concurrently to open one opening portion and close the other and vice versa.

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