Aug. 10, 1937. A. MOORHOUSE 2,089,288

INTERNAL COMBUSTION ENGINE

Filed Dec. 4, 1930 3 Sheets-Sheet 1

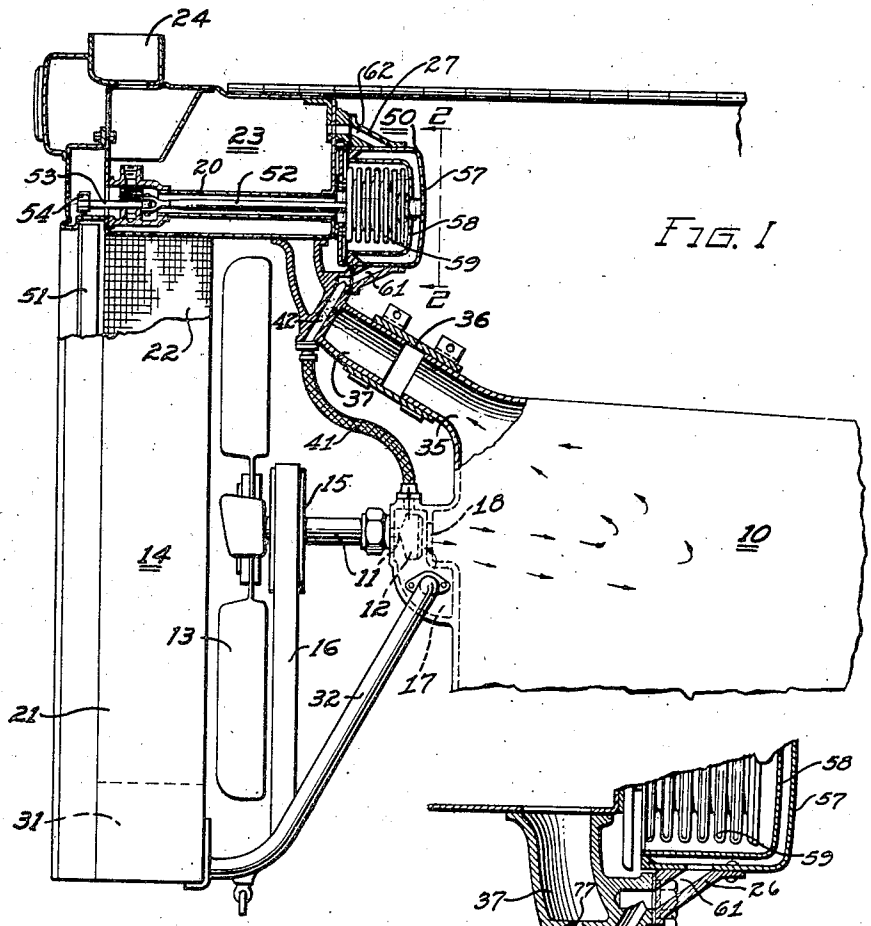


FIG. 1

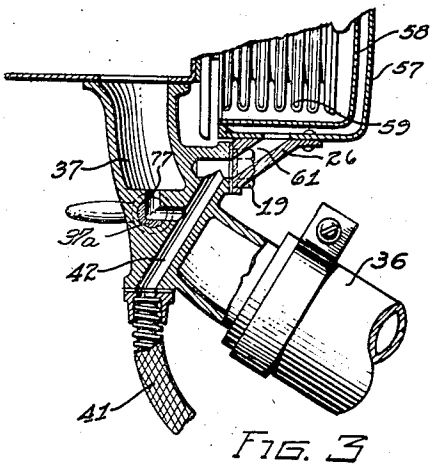


FIG. 3

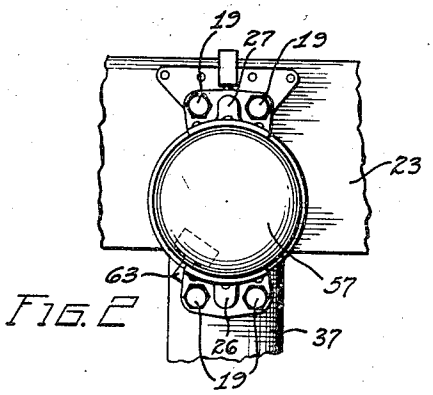


FIG. 2

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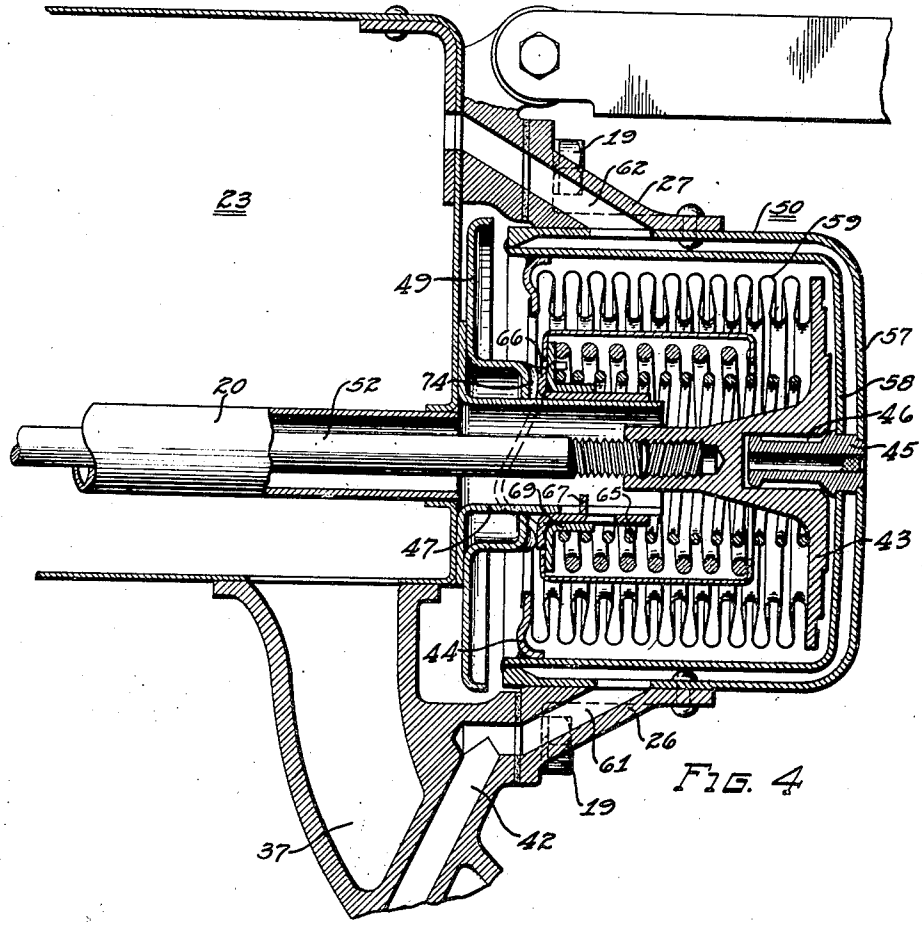


FIG. 4

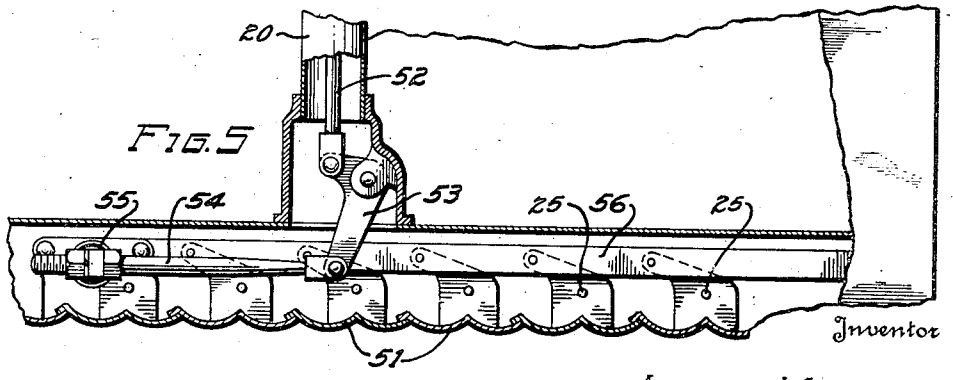


FIG. 5

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INTERNAL COMBUSTION ENGINE

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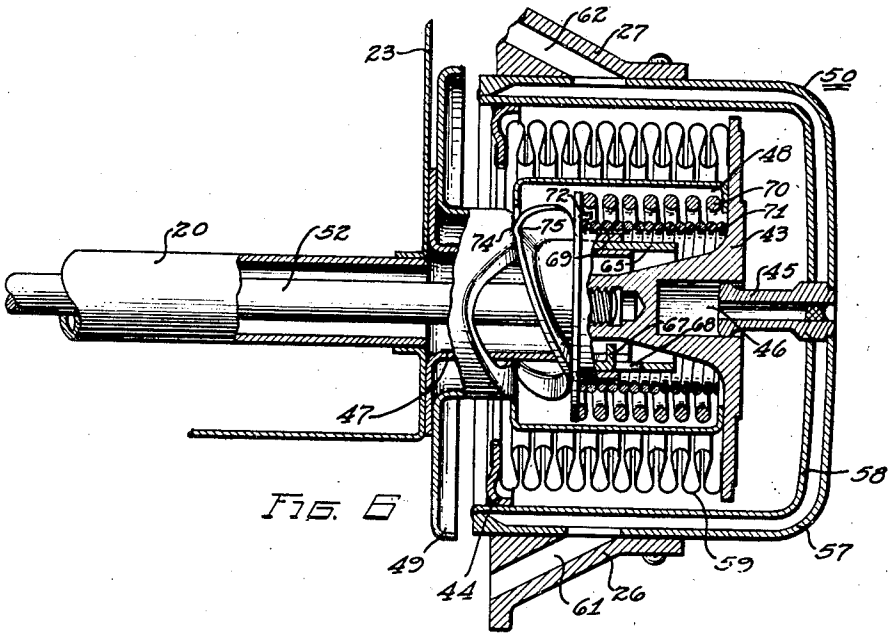


FIG. 6

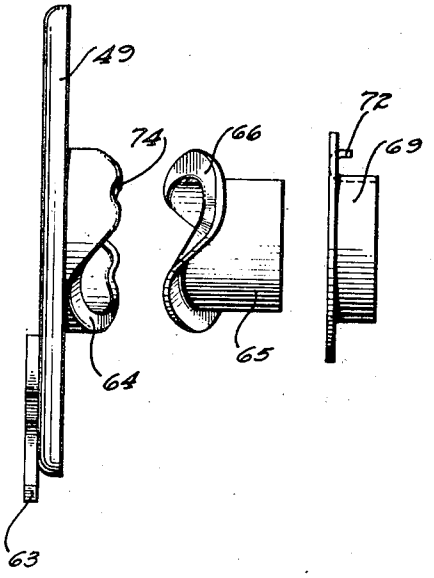


FIG. 7

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Patented Aug. 10, 1937 2,089,288

UNITED STATES PATENT OFFICE

2,089,288

INTERNAL COMBUSTION ENGINE

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Application December 4, 1930, Serial No. 500,013

12 Claims. (Cl. 123—174)

This invention relates to internal combustion engines and more particularly to automatic controls for radiator shutters in an engine cooling system.

Thermostats for actuating motor vehicle radiator shutters are usually mounted in the radiator head or in a position where they are responsive to the temperature of the cooling water leaving the engine head. As such temperature is the hottest in a cycle of the water circulation, the shutters are not operated in response to an average temperature, and as a result they are opened too soon which subjects the water in the radiator to a cooling blast before the desired average high temperature has been reached. In cold weather, and more in particular during the higher vehicle speeds, this form of control of the shutters will cause a temperature fluctuation which is undesirable for the best engine running conditions.

An object of the invention is to provide a control for the shutters associated with an engine radiator which is arranged to be responsive to the most nearly constant water temperature in the cooling system.

Another object of the invention is to provide a thermostat control for the shutters associated with an engine radiator which is responsive to the cooling water temperature at the outlet of the radiator.

A further object of the invention is to provide a controlling means for the mechanism operating radiator shutters in an engine cooling system which is of a unitary nature and readily detachable or assembled as such.

Still another object of the invention is to provide a shutter control thermostat mechanism for an engine radiator which is responsive to the temperature of a selective mixture of water flowing from the outlet of the radiator and to the head of the radiator from the engine.

Still a further object of the invention is to provide a thermostat mechanism for operating engine radiator shutters which can be readily adjusted to vary the effect of temperatures thereon.

These and other objects of the invention will appear from the following description taken in connection with the drawings, which form a part of this specification, and in which:

Fig. 1 is a view, partially in elevation and partially in section, of a part of an internal combustion engine and a radiator for motor vehicles in which the invention has been incorporated;

Fig. 2 is a view in elevation of the thermostatic control unit, taken on line 2—2 in Fig. 1;

Fig. 3 is an enlarged view of the radiator inlet pipe and a portion of the thermostatic unit shown in Fig. 1 but in a slightly modified form;

Fig. 4 is an enlarged sectional view of the thermostatic unit, upper tank and inlet pipe shown in Fig. 1;

Fig. 5 is a top plan view, partly in section, of the mechanism utilized in operating the radiator shutters;

Fig. 6 is a view, partly in section and partly in elevation, of the thermostatic unit shown in Fig. 4 in a different position of adjustment;

Fig. 7 is an exploded view of the cam and follower utilized in adjusting the tension of the springs of the thermostatic control unit.

The present invention deals particularly with means for controlling the rate of heat transfer from the cooling system of an internal combustion engine wherein a thermostatic element is surrounded by the cooling fluid and is moved in accordance with the temperature thereof to control shutters or the like associated to regulate the passage of air through the radiator of the cooling system.

Referring now to the drawings by characters of reference, 10 represents generally a water-cooled type of internal combustion engine having a shaft 11 at the front end thereof. This shaft extends into a compartment 17 and has fixed thereto a pump 12 within the compartment and a fan 13 fixed to the end adjacent the rear of the radiator 14. A pulley 15 is fixed to the shaft and is driven by a belt 16 from a moving part of the engine in the usual manner.

The radiator 14 is of the conventional type and includes a shell 21, a core 22, an upper header 23 and a lower header 31. The upper header is provided with an inlet or filler neck 24, while an outlet conduit 32 extends from the lower header to the compartment 17 formed in the front end of the engine casting. Water flows through the engine casting in the usual manner under pressure, being driven from the compartment 17 through an outlet 18 and moves through the engine outlet neck 35 and an inlet neck 37 associated with the upper radiator header and a hose connection 36 which joins the engine outlet neck 35 and the radiator inlet neck 37.

A thermostatic unit, indicated generally at 50, is detachably secured to the rear end of the upper radiator header and the depending neck 37 by means of bolts 19, and an axially movable rod 52 extends from the thermostat unit through

a sleeve 20 projecting forwardly of the radiator. This rod 52 is pivotally connected with a bell crank 53 which is pivoted to the housing 20 and to the rod 54 which is fastened to a bracket 55 secured to a control bar 56 to which the shutters 51 are pivotally connected. Reciprocation of the rod 52 by the thermostat unit will reciprocate the bar 56 in a direction perpendicular thereto through means of the bell crank lever 53 and the rod 54 and will control the angular position of the shutters 51 upon their pivots 25 so that the volume of air which passes through the radiator core is in this manner automatically controlled.

The thermostatic unit includes a pair of telescoped spaced cup-shaped members 57 and 58 which are joined together at their open ends in any suitable manner to provide a cylindrical chamber through which a part of the fluid in the cooling system is shunted. A neck 26 is secured to the lower portion of the casing 57 and provides a passage 61 which connects the space between the members 57 and 58 with a passage 42 which extends transversely through the header neck 37, and to this passage 42 there is connected a conduit 41 leading from the compartment 17 in which the pump 12 is housed and in which water or a fluid is conducted through the conduit 32 from the lower header of the radiator. The pump 12, as before explained, moves the cooling fluid through an outlet 18 to the engine casting, and it also moves some of the fluid in the compartment 17 through an outlet which leads to the conduit 41 wherefrom it goes through the passages 42 and 61 into the space between the casings 57 and 58 of the thermostatic unit and such fluid moves back into the radiator header from the chamber between the members 57 and 58 through a passage 62 formed in a neck 27 which is secured to the member 57. The bolts 19 extend through the necks 26 and 27 and detachably secure the thermostat unit to the neck 37 and the rear end of the radiator header.

Within the outer end of the inner shell 58 is arranged a plate 43 into which the end of the rod 52 is screwed. A disk 44 is arranged transversely at the open front end of the shell 58 and is soldered or otherwise secured in leak-proof relation thereto. A thermostatic bellows 59 is sealed at one end to the disk 44 and at the other end to the plate 43 and is expansible or contractible axially to reciprocate the plate 43 in response to the expansion or contraction of a fluid contained in the space between the bellows and the shell 58, and the disk 44 and the plate 43, which is influenced by the temperature of the cooling system fluid which is moved through the space between the members 57 and 58. There is a pilot member 45 secured in leak-proof relation with the casing elements 57 and 58 which is adapted to enter a recess 46 in the plate 43.

A sleeve member 47 is fixed to the rear end of the header telescoping the rod 52 and projecting axially into the bellows 59 through the disk 44, and a cage 48 having inturned end flanges telescopes the sleeve 47 and is arranged in spaced relation therewith within the bellows. A disk 49 is rotatably mounted upon the sleeve 47 adjacent the rear end of the header and has a finger 63 fixed thereto for manual engagement. The disk is formed with a rearwardly extending sleeve which terminates in an inturned flange 64 which is of an irregular or cam form. Cooperating with the cam face of the disk sleeve is another cam member which consists of a sleeve portion 65 terminating at its forward end in an out-turned flange 66 formed substantially complementary to the cam face 64. This sleeve 65 closely telescopes the sleeve 47 and is provided with a tongue 67 which projects into an axially extending slot 68 formed in the sleeve 47. The projection of the tongue into the slot 68 of the stationary sleeve member 47 will permit axial movement of the cam member 65 but will prevent its rotation. A spring retainer 69 is carried by the sleeve cam member 65 and a pair of telescoping coil springs 70 and 71 bear at one end against the retainer while the inner spring bears at its other end against the plate 43 and the outer spring bears against the inturned end of the cage 48. The retainer is formed with a tongue 72 for separating the two sets of springs.

The cam member 49 when adjusted into complementary position with the cam 66 will permit the inner spring to move the plate 43 adjacent the end wall of the casing element 58, but when the cam member 49 is rotated 180° it will move the cam member 65 axially and therefore place the spring 71 under greater tension than it is when the cam faces are complementary. In order to retain the cams in this adjustment, the cam face 64 is provided with a depression 74 and the cam face 66 is formed with a boss 75 which is arranged to seat within the recess 74 and maintain the cam members in their adjusted position when turned 180° from their complementary relation. It is obvious that with the cam members in the position shown in Fig. 6 the tension of the inner spring will be greater than when the cam faces are complementary, and consequently with the greater spring tension there will have to be a greater pressure against the plate 43 in order to move the rod forwardly to open the shutters than would be necessary when the cam faces are complementary and the tension of the inner spring is less, such as shown in Fig. 4. The outer spring serves to limit the compression of the bellows and it will be seen that the cage 48 can be moved forwardly with respect to the spring retainer but not rearwardly therefrom, and in this manner the plate 43 will be stopped in its forward movement through engagement with the spring-pressed rear end of the cage 48. Such a relation is shown in Fig. 6 wherein the bellows is compressed to its maximum and the rod 52 is moved to a position placing the shutters in wide open position, whereas in Fig. 4 the rod 52 is in position closing the shutters.

It will be seen that with the arrangement for shunting the cooling fluid from the lower header of the radiator substantially directly to the thermostat the temperature of the water in the lower header of the radiator will control the thermostat and, consequently, the position of the shutters; however, if it is desired to raise the average temperature of the cooling fluid which is shunted around the thermostat so that it will be of a higher temperature than the temperature of the cooling fluid in the bottom radiator header, I provide an angular passage 77 which establishes communication between the neck 37 and the passage 42. This passage is controlled by a valve 37a which can be adjusted to close the passage or to admit a variable volume of water leaving the engine to enter the passage 42 and mingle with the cooling water which is flowing from the conduit 41. The fluid passing upwardly through the passage 42 will have an ejector action on the fluid in the passage 77 and, when the valve is open, fluid will be drawn from the passage 37

through the passage 77 into the passage 42. Through means of this valve I can vary the temperature conditions under which the shutters will be actuated and this can likewise be done through the adjustment of the cam member. It will be seen that the valve is a temperature regulator while the cam is a pressure regulator, however they both effect the same result upon the shaft 52.

With the mechanism above described, I am able to utilize the temperature of the water in the lower radiator header without any substantial influence from the heat of the engine to regulate the thermostat for controlling the shutter position, and as the temperature of the water at this point of the circulating system is the most constant I thereby eliminate unnecessary opening and closing of the shutters which results when the thermostat is responsive to the temperature of the cooling fluid leaving the engine. In addition, I provide simple mechanisms for regulating the response of the thermostat to the water temperature conditions and also provide a thermostat unit which can be readily assembled or disengaged from the radiator.

Although the invention has been described in connection with a specific embodiment, the principles involved are susceptible of numerous other applications which will readily occur to persons skilled in the art. The invention is therefore to be limited only as indicated by the scope of the appended claims.

What I claim is:

1. In a circulating fluid cooling system for an internal combustion engine, a radiator connected in circuit with the engine, shutters for the radiator, control means for the shutters including a thermostat, and means for moving cooling fluid from the system around the thermostat at a temperature determined entirely by the mean temperature of the fluid entering and leaving the engine.

2. In a circulating fluid cooling system for an internal combustion engine, a radiator connected in circuit with the engine to provide a fluid circulating system, shutters for the radiator, a unitary thermostat structure, means for moving a stream of cooling fluid flowing from the outlet of the engine and from the outlet of the radiator around the thermostat under all engine operating conditions, linkage connecting the thermostat with the shutters and operable by the thermostat to control the position of the shutters, and means detachably securing the thermostat unit to the rear end of the radiator.

3. In a circulating fluid cooling system for an internal combustion engine, a radiator connected in circuit with the engine, a fluid inlet compartment associated with the engine, a thermostat having a surrounding chamber in communication with the engine inlet compartment and the radiator, shutter operating mechanism associated to be actuated by the thermostat, an engine driven pump for causing the circulation of fluid through the engine, a conduit for conducting the fluid from the engine to the radiator, and a conduit through which a part of the cooling fluid from the radiator passes to said chamber, the latter conduit being located so as to be heated by said fluid after its passage through the engine.

4. In a circulating fluid cooling system for an internal combustion engine, a radiator connected in circuit with the engine, shutters for the radiator, control means for the shutters including a thermostat, a chamber surrounding the thermostat and connected with the radiator and the fluid inlet portion of the engine, means for moving incoming fluid in the engine through the engine and through the chamber to the radiator in separate streams, and a valve means adjustable to establish a connection of the streams to admit warmer fluid from the engine into the cooler stream flowing to the chamber.

5. In combination with a cooling system for an internal combustion engine including a radiator, a thermostat for regulating the rate of heat transfer of the system operative by heat transfer from the cooling fluid, a conduit leading from the radiator outlet through the engine outlet to the thermostat, and means comprising a valve for compensating for seasonal changes in the ambient temperature adapted to admit selectively to the thermostat only cooling fluid from the radiator outlet or a mixture of fluid from said outlet and fluid from the engine outlet.

6. In a circulating fluid cooling system for an internal combustion engine, a radiator connected in circuit with the engine cooling system, shutters for the radiator, control means for the shutters including a thermostat, means connecting the space around the thermostat in circuit with the radiator, means for varying the temperature of the fluid flowing around the thermostat, and means including a cam for adjusting the thermostat to vary the temperature at which it will be actuated by the fluid.

7. In a circulating fluid cooling system for an internal combustion engine, a radiator connected in circuit with the engine, shutters for the radiator, control means for the shutters including a thermostat, means connecting the thermostat in circuit with the radiator whereby a portion of the cooling fluid leaving the radiator will be shunted from circulation through the engine fluid passages to the thermostat, and means connected to the engine outlet and associated with the connection between the thermostat and the radiator whereby fluid flowing from the engine will warm the cooler fluid flowing from the radiator to the thermostat.

8. In a circulating fluid cooling system for an internal combustion engine, a radiator connected in circuit with the engine, shutters for the radiator, control means for the shutters including a thermostat, means for connecting the thermostat in circuit with and open to the radiator during all engine operating conditions, means adjustable to regulate the temperature of the fluid flowing to the thermostat, and means for adjusting the thermostat to establish the temperature at which it will be actuated by the fluid temperature.

9. In a circulating fluid cooling system for an internal combustion engine, a radiator connected in circuit with the engine, shutters for the radiator, control means for the shutters including a thermostat, and means connecting the themostat openly to the radiator outlet and to the engine outlet during all engine operating conditions whereby the thermostat will be actuated entirely in response to the temperature of the combined fluids.

10. In a cooling system for an internal combustion engine, a radiator connected in circuit with the engine, shutters for the radiator, control means for the shutter including a thermostat, open means for conducting the cooling fluid from the radiator to the thermostat under all engine operating conditions, means for conducting the fluid from the engine to the radiator and means for causing a portion of the heat in the fluid

from the engine to be transmitted to the fluid passing from the radiator to the thermostat.

11. In a cooling system for an internal combustion engine, a radiator connected in circuit with the engine, shutters for the radiator, control means for the shutter including a thermostat, means for conducting the fluid from the engine to the radiator and a conduit for conducting the fluid from the radiator to the thermostat, said conduit being located to be heated by the fluid in the circuit flowing from the engine to the radiator.

12. In a cooling system for an internal combustion engine, a radiator connected in circuit with the engine, shutters for the radiator, control means for the shutters including a thermostat, means for conducting fluid flowing from the radiator to the thermostat, and means for varying the temperature of the fluid flowing to the thermostat in accordance with the temperature of the cooling fluid leaving the engine.

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