March 31, 1942. E. C. BOOTH 2,277,814

AUTOMOBILE HEATING SYSTEM

Filed April 8, 1940 3 Sheets-Sheet 1

Fig. 1.

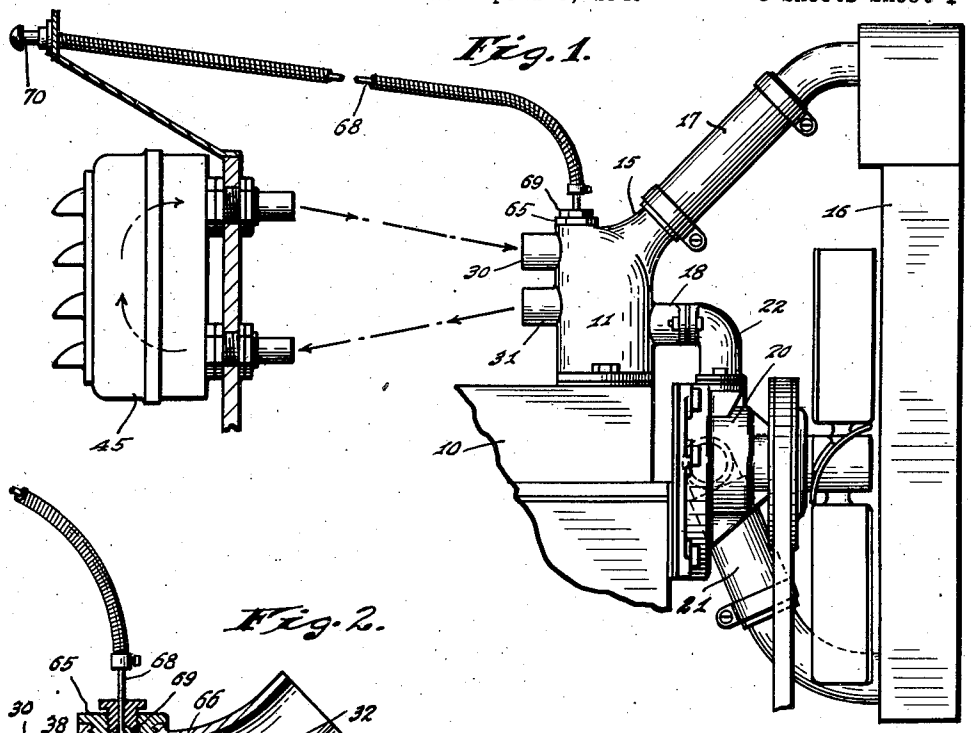


Fig. 2.

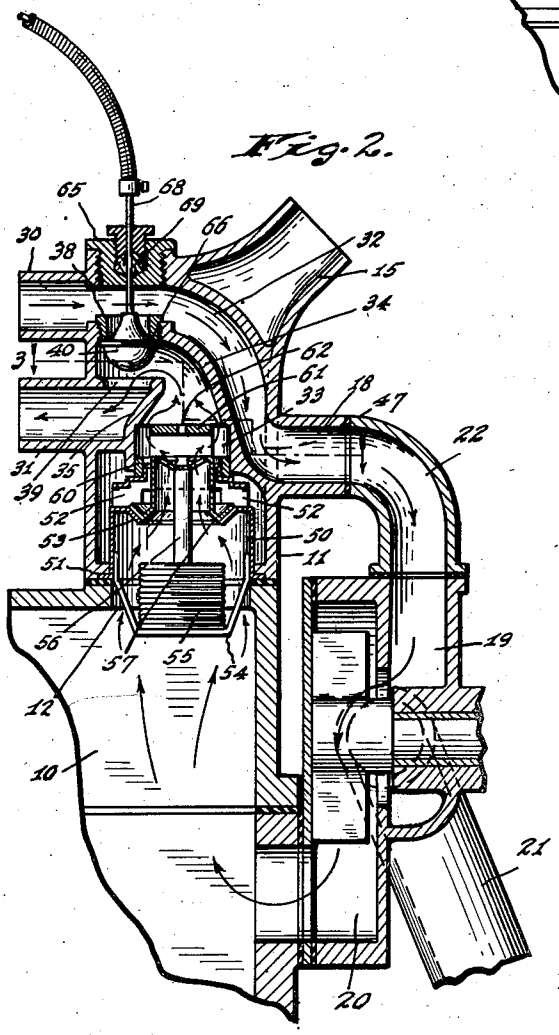
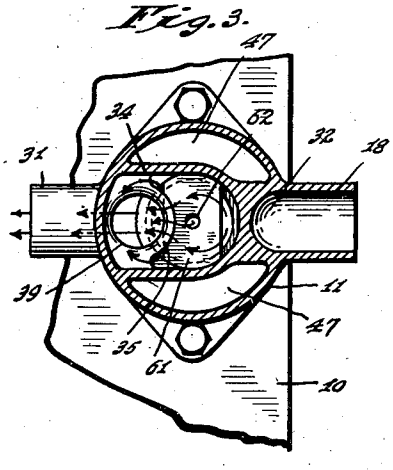


Fig. 3.



INVENTOR.
EARL C. BOOTH,
BY Fehley & Tuck
ATTORNEYS.

March 31, 1942. E. C. BOOTH 2,277,814

AUTOMOBILE HEATING SYSTEM

Filed April 8, 1940 3 Sheets-Sheet 2

Fig. 4.

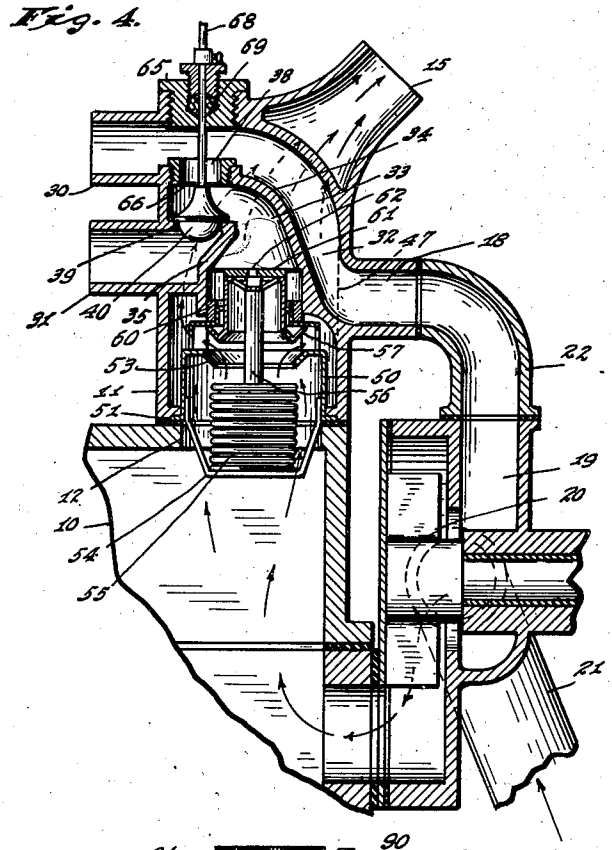
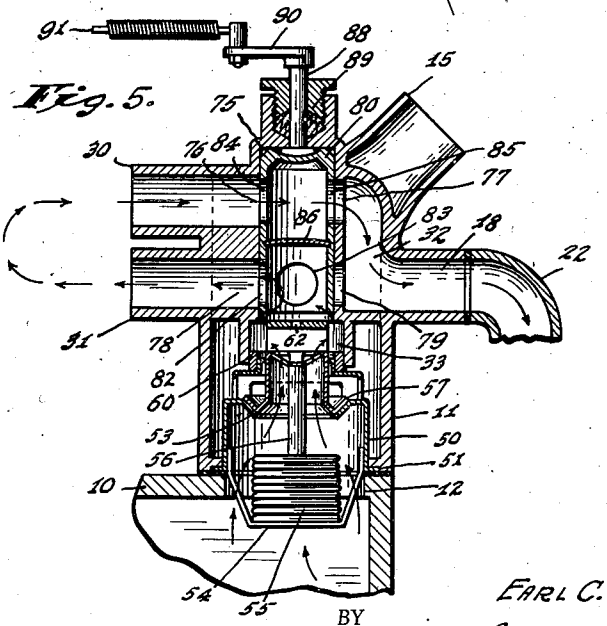


Fig. 5.



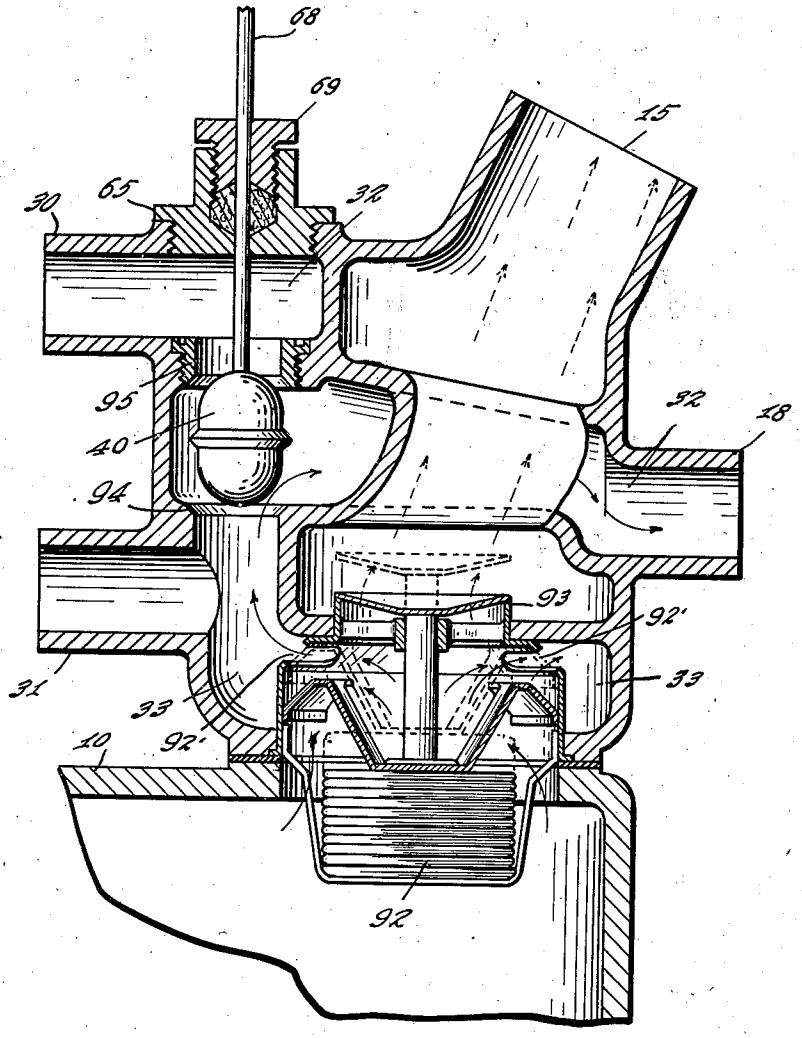
INVENTOR.
EARL C. BOOTH,
BY
Schley & Trask
ATTORNEYS.

March 31, 1942. E. C. BOOTH 2,277,814

AUTOMOBILE HEATING SYSTEM

Filed April 8, 1940 3 Sheets-Sheet 3

Fig. 6.



INVENTOR.
EARL C. BOOTH,
BY Schley & Tresk
ATTORNEYS.

Patented Mar. 31, 1942

2,277,814

UNITED STATES PATENT OFFICE

2,277,814

AUTOMOBILE HEATING SYSTEM

Earl C. Booth, Columbus, Ind., assignor to Noblitt-Sparks Industries, Inc., Columbus, Ind., a corporation of Indiana

Application April 8, 1940, Serial No. 328,464

8 Claims. (Cl. 237—2)

One method being used at the present time for controlling the temperature of the cooling water in internal combustion engines for automobiles involves the use of a temperature-responsive valve which acts to direct the water leaving the engine water jacket either through the usual radiator or through a by-pass which does not include the radiator. In one standard make of automobile embodying this expedient, the temperature-responsive valve is disposed within a housing attached to the water jacket of the engine, such housing receiving water from the water jacket and being provided with a main outlet nipple connected to the automobile radiator and with an auxiliary outlet nipple connected to the inlet of a water-circulating pump which discharges directly into the water jacket.

My invention relates to the connection of an automobile-body heater in a cooling system of the type described, to control means for regulating the flow of water through the heater, and more particularly to the incorporation of such control means together with suitable connections in a housing which can be substituted for the standard housing above described.

In carrying out my invention, I employ a housing designed to be held in place on the water jacket by the same means as is employed in the attachment of the standard housing, and I provide the housing with main and auxiliary outlet nipples substantially the same as those of the standard housing. In addition, the housing is provided with two nipples adapted respectively for connection to the water-supply and water-return conduits of an automobile-body heater. The housing is formed interiorly to provide a chamber and a transverse passage, the latter interconnecting the auxiliary outlet nipple and the nipple connected to the return line from the heater. The customary temperature-responsive valve is disposed within the housing and operates to direct water received from the water jacket either to the main outlet nipple or to the chamber. A manually controlled valve disposed within the housing is selectively operable to cause water from the chamber to flow either into the transverse passage or to the nipple which is connected to the supply line of the heater.

The accompanying drawings illustrate my invention: Fig. 1 is a fragmental side elevation illustrating the arrangement of the housing and the manner in which it is connected to the radiator and to the automobile-body heater; Fig. 2 is a vertical section on an enlarged scale through the housing and the parts directly associated with it showing the thermostatic valve in the position it occupies at low temperatures and the manually controlled valve arranged to effect the supply of water to the heater; Fig. 3 is a horizontal section on the line 3—3 of Fig. 2; Fig. 4 is a view similar to Fig. 2, but showing the thermostatic valve in the position it occupies at high temperatures and the manually controlled valve arranged to prevent the supply of water to the heater; Fig. 5 is a vertical section through a housing containing a modified form of manually controlled valve; and Fig. 6 is a vertical section through a device embodying a modified form of thermostatic valve.

In the device illustrated in Figs. 1 to 4, there is mounted on the water-jacket 10 of the engine and near the front end thereof a housing 11 the interior of which communicates with the water-jacket through an opening 12 in the upper wall thereof. The housing 11 is provided with a main discharge nipple 15 adapted for connection to the automobile radiator 16 by means of a hose 17, and with a second, or auxiliary, outlet nipple 18 connected to the auxiliary inlet opening 19 of a pump 20, by means of which cooling water is forced into and through the engine water-jacket. The main inlet opening of the pump 20 is connected through a conduit 21 to the lower portion of the radiator 16. Desirably, the parts described are disposed adjacent the front end of the engine, so that a simple elbow 22 will serve to connect the auxiliary outlet nipple 18 with the auxiliary inlet 19 of the pump 20.

The construction as so far described is standard. Within the housing 11 it is customary to dispose a valve controlled by a temperature-responsive element responsive to the temperature of water in the water-jacket 10 and operative to divide water leaving the water-jacket between the main outlet 15 and the auxiliary outlet 18. When the engine is cold, this valve operates to direct substantially all the water through the auxiliary outlet 18, whence the water is returned to the water jacket without passing through the radiator 16. As the engine warms up, however, the temperature-responsive valve operates to direct some of the water through the main outlet 15, whence it is returned to the water jacket through the radiator. By controlling the division of water between the radiator and the by-pass, the temperature-responsive valve functions to maintain substantially constant the temperature of the water in the water-jacket 10.

In practicing my invention, the housing 11 is provided exteriorly with nipples 30 and 31 and

interiorly with partitions defining a transverse passage 32 and a chamber 33, one of such partitions, shown as the partition 34, separating the chamber and the transverse passage. In addition, in the form shown in Figs. 1 to 4, the housing is provided with a hollow boss 35 extending inwardly into the chamber 33, such boss serving as a continuation of the nipple 31. Portions of the partition 34 and of the boss 35 are disposed in opposed relation and provided respectively with alined openings 38 and 39 through which the passage 32 and the nipple 31 respectively communicate with the chamber 33. A valve member 40 is movably mounted between the openings 38 and 39 so that either opening may be closed.

The nipple 31 on the housing 11 is adapted for connection to a supply conduit for a heater 45 mounted within the automobile body, as indicated in Fig. 1; while the nipple 30 is adapted for connection to the conduit through which water from the heater 45 is returned.

The passage 32 and the chamber 33, as will be evident from Fig. 3, occupy less than the entire width of the housing 11 so that there remain at the sides of the passage and chamber passages 47 through which the lower portion of the housing 11 communicates with the main outlet 15. Within the lower portion of the housing there is disposed valve mechanism controlled by a temperature-responsive element and operative to control the supply of water from the water-jacket to the main outlet 15 or to the chamber 33. If the valve member 40 is in the upper position where it closes the opening between the passage 32 and chamber 33, water supplied to the chamber 33 will pass through the opening 39 and the nipple 31 to the heater, returning by way of the nipple 30, passage 32, nipple 18, and elbow 22 to the pump 20. If the valve 40 is in its lower position, in which it closes the opening 39, water supplied to the chamber 33 will flow through the opening 38 into the passage 32 and be returned to the pump. When the water temperature reaches the value which is to be maintained, the temperature responsive valve operates to permit some of the water emerging from the water-jacket to flow through the passages 47 to the main outlet 15, whence it will return to the pump through the radiator 16, being cooled on the way.

One form of temperature-responsive valve suitable for use in practicing my invention is illustrated in Figs. 2 to 5 and comprises an inverted cup-shaped member 50 provided at its lower end with an outwardly turned flange 51 adapted to be received between the lower end of the housing 11 and the top of the water-jacket 10 to hold the valve in place. The cup-shaped member 50 is provided in its side wall with laterally directed discharge openings 52 which communicate with the interior of the housing 11. Below the openings 52 the member 50 is provided with a horizontal partition having a central opening the edges of which are turned downwardly to form a frusto-conical valve seat 53. Across the bottom end of the member 50 there extends a stirrup 54 to which is secured the lower end of a temperature-responsive sylphon bellows 55. A rod 56 secured to the upper end of the bellows 55 extends upwardly through the valve seat 53 and bears at its upper end an inverted cup-shaped valve member 57 having its edge turned outwardly to form a flange complementary to the valve seat 53. The valve member 57 is received and is slidable in a central opening provided in the upper end of the member 50 and, in its end wall, has openings affording communication between the interior of the member 50 and the chamber 33.

When the temperature of water in the water-jacket 10 is relatively low, the bellows 55 is collapsed as shown in Fig. 2, and the valve member 57 is in engagement with the valve seat 53 to prevent the escape of water otherwise than into the chamber 33 through the holes in the upper end of the valve member 57. As the temperature of the water within the water-jacket 10 increases, the bellows 55 expands and lifts the valve member 57 from the valve seat 53, thus permitting some of the water from the water-jacket to escape through the lateral openings 52 into the interior of the housing 11 and thence through the nipple 15 and conduit 17 to the radiator.

I find it advantageous, in order to prevent overheating of the engine, to prevent or at least materially reduce the flow of water through the heater or through the by-pass 18—22 should the temperature of water within the water-jacket exceed a predetermined maximum. To this end, I provide means which, under conditions of extreme high temperature, will close the openings in the upper end of the valve member 57 and thus prevent the escape of water into the chamber 33. In the arrangement illustrated in Figs. 2 to 5, the upper end of the cup-shaped member 50 is formed with an upwardly projecting neck somewhat smaller in diameter than the open lower end of the chamber 33; and in the annular space thus provided I dispose a ring or collar 60 which closes such annular space to prevent the escape of water from the chamber 33 and which carries a diametrically extending yoke 61 overlying the upper end of the valve member 57 and wide enough to close the openings in the upper end of the valve member. When the temperature of water in the water-jacket is low, the upper end of the valve member 57 is spaced downwardly from the yoke 61, so that water can freely escape from the openings in the upper end of the valve member into the chamber 33. When, however, the temperature of the water in the water-jacket 10 exceeds a predetermined maximum, the valve member 57 engages the yoke 61, as shown in Fig. 4, to shut off the flow of water into the chamber 33. Desirably, in order not to prevent all flow through the heater 45 when it is connected to the water-circulating system of the engine, the yoke 61 is provided centrally with a small bleed opening 62 through which a small quantity of water can escape into the chamber 33 even when the valve member 57 is in engagement with the yoke.

The valve member 40 employed in the construction shown in Figs. 2 to 4 inclusive is desirably a body of rubber or similar resilient material having an annular flange or other central portion large enough in diameter to close the openings which afford communication between the chamber 33 and the passage 32 and nipple 31 respectively. In order to provide for insertion of the valve member, the upper wall of the housing 11 is provided in line with the openings just referred to with a screw-threaded opening for the reception of a plug 65, and the lower wall of the passage 32 is provided with a screw-threaded opening for the reception of a valve seat 66. The opening in the bottom wall of the passage 32 is large enough to pass the valve member 40 while the opening in the upper wall of the

housing 11 is large enough to pass the valve seat 66.

The valve 40 is arranged to be moved vertically between its respective controlling positions. The control means illustrated in the drawings takes the form of a Bowden wire 68 which is secured at one end to the valve member 40 and which extends upwardly therefrom through a stuffing box 69 in the plug 65, and thence to a control member 70 accessible for operation by the driver of the automobile.

When operating the device illustrated in Figs. 1 to 4 inclusive, the flow of cooling water will depend upon the respective positions of the manually controlled valve 40 and thermostatically-controlled valve 57. When the temperature of the water in the water-jacket 10 is below that desired at normal operating conditions, the valve 57 will be seated on the valve seat 53 to prevent water from escaping through the openings 52 into the interior of the housing 11 and thence through the discharge nipple 15 to the radiator. As a result, all water leaving the water-jacket will flow through the openings in the end of the valve member 57 into the chamber 33. If the manually controlled valve member 40 is in its upper position as illustrated in Fig. 2, direct communication between the chamber 33 and passage 32 will be prevented, and the water will flow from the chamber 33 to the nipple 31 and thence to the heater, returning through the nipple 30, passage 32, and elbow 22 to the pump 20. If the manually controlled valve 40 is in its lower position, as illustrated in Fig. 4, and if the thermostatically controlled valve is still closed, water entering the chamber 33 will pass into the passage 32 and will be returned directly to the pump 20 without passing through the heater. As the temperature of the water within the water-jacket 10 increases the bellows 55 will expand to raise the valve member 57 from the seat 53 and permit some of the water to enter the interior of the housing 11 and to pass therefrom through the nipple 15 and conduit 17 to the radiator 16. Such water as does not flow over the course just described will enter the chamber 33 through the openings in the ends of the valve member 57 and will escape from the chamber 33 either through the heater 45 or directly into the passage 32, depending upon the position of the manually controlled valve member 40.

The device illustrated in Fig. 5 employs a different type of manually controlled valve, but is otherwise substantially the same as that shown in Figs. 2 to 4. The housing 11 is formed interiorly with a valve chamber 75, desirably coaxial with the thermostatically controlled valve 57. Near its upper end, the valve chamber 75 is provided with diametrically opposite ports 76 and 77 communicating respectively with the nipples 30 and 18; and near its lower end, the valve chamber is provided with a similar pair of diametrically opposite ports 78 and 79 communicating respectively with the nipples 31 and 18. The lower end of the valve chamber 75 is open and in communication with the chamber 33 into which water is discharged through the upper end of the valve member 57.

Within the valve chamber 75 there are rotatably mounted a hollow valve member 80 having an open lower end and provided in the plane of the ports 78 and 79 with a pair of ports 82 and 83 spaced at 90° from each other. In its upper end, the valve member 80 is provided with diametrically opposite ports 84 and 85 in the plane of the ports 76 and 77. Between the plane of the ports 82 and 83 and the plane of the ports 84 and 85, the valve member 75 is divided interiorly by a horizontal partition 86.

For controlling the valve member 80, it may be provided with an axial shaft 88 which extends upwardly through a stuffing box 89 in the housing 11. A crank 90 secured to the upper end of the shaft 88 is connected to one end of a Bowden-wire control device 91 by means of which the valve 80 may be rotated about its axis.

In the position illustrated in Fig. 5, the valve 80 operates to direct water through the heater connected to the nipples 30 and 31, the port 82 being in alinement with the port 78, the ports 84 and 85 being respectively alined with the ports 76 and 77, and the port 79 being closed. As a result, water discharged into the chamber 33 will enter the interior of the valve member 80 below the partition 86, and will escape through the port 78 and the nipple 31 to the heater, from which it will be returned by way of the nipple 30, ports 76, 84, 85, 77, nipple 18, and elbow 22 to pump. If the valve 80 is rotated 90° from the position illustrated in Fig. 5, the ports 76, 77, and 78 will all be closed, and the port 83 in the valve member will be brought into alinement with the port 79. With the valve so adjusted, water entering it from the chamber 33 will escape by way of the ports 83 and 79 directly into the auxiliary outlet nipple 18.

In the arrangement shown in Fig. 5, the thermostatic valve operates as before to direct all water leaving the water-jacket into the chamber 33 until that water has reached a predetermined temperature. Thereafter, the valve 57 opens and permits the escape of at least part of the water into the body of the casing 11 from which it will emerge through the main outlet 15 and flow through the radiator.

In Fig. 6 I have illustrated a device embodying a different form of thermostatic valve 92 which, when cold, discharges laterally through ports 92 and, when hot, through an upwardly directed, central opening 93. When such a valve is to be employed, the chamber 33 is made in annular form so that the ports 92' will discharge into it, and the interior of the housing 11 is so arranged that water emerging from the opening 93 will flow to the main outlet nipple 15.

The arrangement of the manually controlled valve means illustrated in Fig. 6 is somewhat different from that illustrated in any of the other modifications so far described. In Fig. 6 the chamber 33 communicates with the passage 32 through an upwardly directed opening 94, and the passage 32 is formed with a vertical stretch in which there is disposed a valve seat 95 alined with the opening 94. The valve member 40 is disposed between the opening 94 and the valve seat 95, and is vertically movable under the control of the Bowden wire 68, as in the construction illustrated in Figs. 2 and 4.

When the valve 40 in Fig. 6 is in its lowermost position closing the opening 94, escape of water from the chamber 33 into the passage 32 is prevented, and water emerging from the ports 92' of the thermostatic valve flows through the chamber 33 to the nipple 31 and thence through the heater, being returned through the nipple 30 and passage 32 to the elbow 22. When it is desired to cut off the flow of water through the heater the valve member 40 is moved upwardly to close the valve seat 95. Since this closes the return line from the heater, no water will flow

therethrough, and water emerging through the ports 92 of the thermostatic valve will flow through the chamber 33 and opening 94 directly into the passage 32, whence it will be returned directly to the pump.

I claim as my invention:

1. In combination with the engine water-jacket and radiator of an automobile, a pump discharging into said water-jacket and having a main inlet connected to said radiator, said pump also having an auxiliary inlet, said water-jacket having an upwardly directed outlet opening, a hollow casing disposed over said outlet opening, said casing being provided exteriorly with a main outlet nipple connected to said radiator, with an auxiliary outlet nipple connected to the auxiliary inlet of said pump, and with two additional nipples, an automobile body heater of the circulating fluid type having supply and return conduits connected respectively to said two additional nipples, said casing being provided interiorly with a chamber and with a transverse passage connecting said auxiliary outlet nipple with that one of said additional nipples which is associated with the return conduit of said heater, temperature-responsive valve means disposed within said casing and responsive to the temperature of water in said water jacket to divide between said chamber and said main outlet nipple water entering the casing from the water jacket, and valve means within said casing and selectively operable under manual control to cause water from said chamber to flow either into said transverse passage or into that one of said additional nipples which is associated with the supply conduit of said heater.

2. In combination with the engine water-jacket and radiator of an automobile, a pump discharging into said water-jacket and having a main inlet connected to said radiator, said pump also having an auxiliary inlet, said water-jacket having an upwardly directed outlet opening, a hollow casing disposed over said outlet opening, an automobile-body heater of the circulating fluid type, said casing being provided exteriorly with two outlet nipples connected respectively with said heater and said radiator, a return conduit connecting said heater with the auxiliary inlet of said pump and including a portion disposed within said casing, said casing being provided interiorly with a chamber, temperature-responsive valve means responsive to the temperature of water in the water-jacket for dividing between said chamber and said radiator water entering the casing from the water jacket, and manually controlled valve means within said casing and selectively operable to cause water from said chamber to flow either to said heater or to said return conduit.

3. In combination with the engine water-jacket and radiator of an automobile, a pump discharging into said water-jacket and having a main inlet connected to said radiator, said pump also having an auxiliary inlet, said water-jacket having an upwardly directed outlet opening, a hollow casing disposed over said outlet opening, an automobile-body heater of the circulating fluid type, said casing having main and auxiliary outlets connected respectively to said radiator and to the auxiliary inlet of said pump, supply and return conduits interconnecting said casing and heater, said casing being provided interiorly with a chamber, temperature-responsive valve means responsive to the temperature of water in the water-jacket for dividing between said chamber and said radiator water entering the casing from the water jacket, and manually controlled valve means within said casing and selectively operable to cause water from said heater or to said auxiliary pump-inlet.

4. Means for controlling the supply of water from the water-jacket of an internal combustion engine to an automobile body heater of the circulating fluid type, comprising a hollow casing adapted to receive water from the engine water-jacket and being provided interiorly with a chamber, said chamber having an inlet opening for the admission of water received by said casing from the engine water-jacket, temperature-responsive valve means responsive to the temperature of water entering said casing for restricting water-flow into said chamber through the inlet opening thereof when the temperature of such water exceeds a predetermined maximum, said chamber being adapted for connection to the heater, and manually operable valve means associated with said chamber for controlling the flow from said chamber to said heater of water passed by said temperature-responsive valve means.

5. In combination with the engine water-jacket and radiator of an automobile, an automobile-body heater of the circulating fluid type, a hollow casing adapted to receive water from said water jacket, conduits for conveying water from said casing to said radiator and heater respectively, conduits for returning water from said radiator and heater, a normally closed valve for controlling the flow of water from said casing to said radiator, a normally open valve for controlling the flow of water to said heater, and means responsive to the temperature of water entering said casing for opening said normally closed valve when such water is at or above a predetermined temperature and for at least partially closing said normally open valve when the temperature of such water reaches a predetermined maximum.

6. In combination with the engine water-jacket and radiator of an automobile, an automobile-body heater of the circulating fluid type, a hollow casing adapted to receive water from said water jacket, conduits for conveying water from said casing to said radiator and heater respectively, conduits for returning water from said radiator and heater, a normally closed valve for controlling the flow of water from said casing to said radiator, a normally open valve for controlling the flow of water to said heater, and a single temperature-responsive element operatively connected to both said valves and responsive to the temperature of water entering said casing for opening said normally closed valve when such water is at or above a predetermined temperature and for at least partially closing said normally open valve when the temperature of such water reaches a predetermined maximum.

7. In combination with the water-jacket of an automobile engine, said water-jacket having an inlet and an outlet, a cooling radiator, an automobile-body heater of the circulating fluid type, conduits connecting said radiator and heater in parallel between the outlet and inlet of said water-jacket, a normally closed valve for controlling flow of water through said radiator, a normally open valve for controlling flow of water through said heater, and means responsive to the temperature of water passing through said water-jacket outlet for opening said normally closed valve when such water is at or above a

predetermined minimum temperature and for at least partially closing said normally open valve when the temperature of such water reaches a predetermined maximum, said valves being located adjacent the inlet ends of the conduits with which they are respectively associated.

8. In combination with the water-jacket of an automobile engine, said water-jacket having an inlet and an outlet, a cooling radiator, an automobile-body heater of the circulating fluid type, conduits connecting said radiator and heater in parallel between the outlet and inlet of said water-jacket, a normally open valve for controlling flow of water through said heater, and means responsive to the temperature of water passing through said water-jacket outlet for at least partially closing said valve when the temperature of such water reaches a predetermined maximum, said valve being located adjacent the inlet end of the conduit with which it is associated.

EARL C. BOOTH.