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ENGINE COOLING SYSTEM

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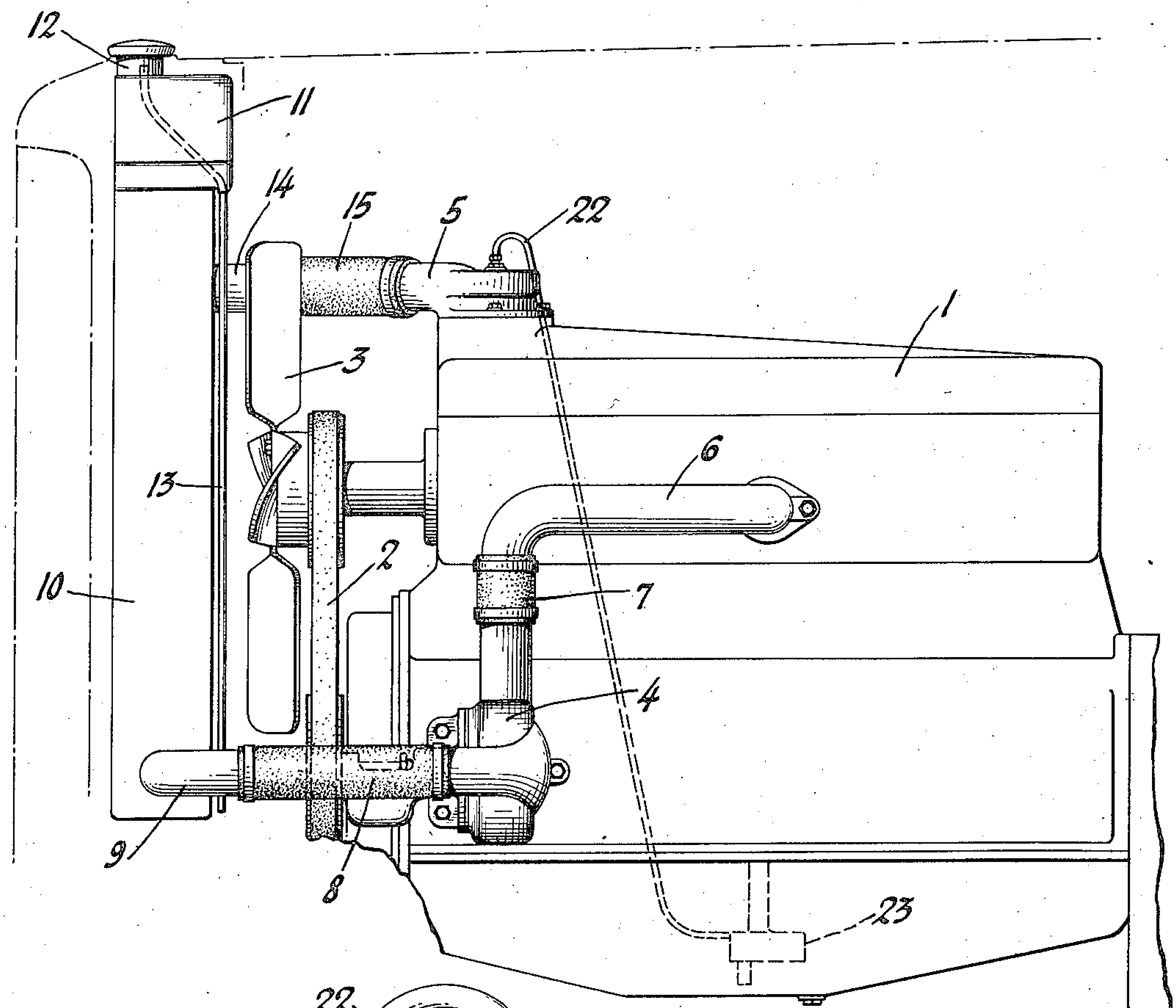


Fig. 1

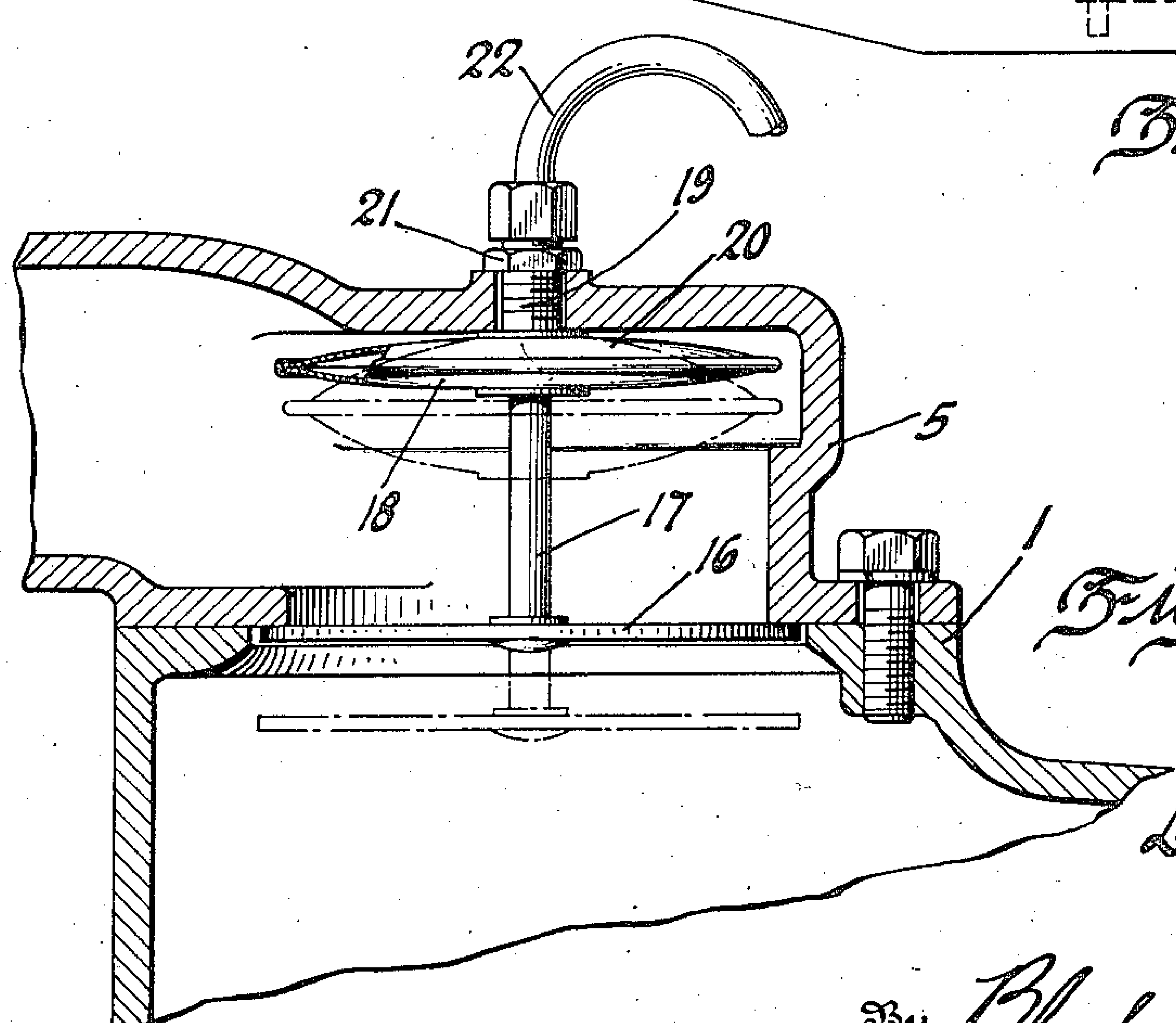


Fig. 2

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## ENGINE COOLING SYSTEM

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4 Claims. (Cl. 123—178)

Liquid circulating systems for internal combustion engines require frequent replenishment of cooling medium and the loss is due largely to thermal expansion of the liquid. This loss occurs during ordinary operation, but more so in a short interval immediately following the stopping of the hot engine after a hard run, when both the forced circulation of water through the system and draft of air through the radiator are cut off. Under such conditions after-boiling occurs, with the water standing idle in the hot cylinder block, forming steam and so increasing in volume as to force the liquid out of the block and the water and steam in excess of system capacity passes out of the air vent or overflow provided in the radiator assembly.

An object of the present invention is to reduce after-boiling loss and eliminate need for frequent replenishment and careful attention of the cooling system. A further object is to provide a cooling system which may be operated successfully with about half the amount of liquid used in the conventional system, so that the engine may be run at a higher and more efficient temperature than is the ordinary water cooled job.

For a better understanding of the invention, reference may be made to the accompanying drawing, wherein Figure 1 is a side elevation of a power plant for motor vehicles, and Figure 2 is a detail sectional view taken at the outlet of the engine cooling jacket.

Referring to the drawing, the numeral 1 indicates an internal combustion engine which when in operation drives through a belt 2, a radiator fan 3 and a water pump 4. The water jacket of the cylinder block is provided with an outlet fitting 5 and with an inlet fitting 6, which inlet fitting may be connected through a hose section 7 with the discharge end of the pump 4. The suction side of the pump 4 is connected through a hose 8 with an elbow fitting 9 near the bottom of the outlet header or tank 10 of the radiator assembly.

For the purposes of the present invention it is proposed to use a cross flow radiator of conventional design in which spaced horizontal water tubes provide a heat dissipating core extending between and connecting vertically disposed inlet and outlet tanks on opposite sides of the core. Either the inlet or the outlet header, but preferably the latter, is provided with a lateral extension or top tank 11, lying above the core and having in its top wall a filler spout 12 by which water may be introduced into the system. Near the uppermost portion of the top tank 11 is an overflow opening or air vent which may be in the form of a pipe or tube 13 that extends from a point interiorly of the filler spout 12 and through a wall of the tank to a convenient point of discharge, as for instance, near the bottom of the assembly. Adjacent the top of the inlet tank, which in the drawing is on the far side of the radiator assembly, there is provided a fitting 14 for connection through the hose 15 with the jacket outlet fitting 5.

In the normal operation of the system the engine driven water pump 4 forces water from the bottom of the outlet tank 10, through the engine jacket to the inlet tank, for return to the outlet header through the cooling unit, where the heat taken up by the water in its passage through the block is dissipated to an air stream drawn through the radiator by the engine driven fan 3. Since it is proposed to operate the circulatory system with a body of liquid having a volume of substantially half system capacity, it will be apparent that under ordinary operating conditions the pump tends to maintain the bulk of the liquid in the cylinder block jacket and because of the small amount of water used, the engine will run at a comparatively high temperature with the water at or near boiling. Water and steam leaving the system will be quickly cooled and condensed in the cross flow radiator by the time it reaches the outlet header for return to the jacket.

The cross flow type of radiator with the air vent overflow associated with the outlet header, is particularly well adapted for use in the system for the operation described, inasmuch as the air vent is separated from the hot liquid by the cooling core and the water tends to drop to the bottom of the vertical inlet tank for flow across the lowermost tubes leaving the upper tubes free for the passage and condensation of vapors. Consequently, the steam gives up its heat freely to the air draft induced by the engine driven fan and is converted into liquid before reaching the vented side of the tank.

However, when the engine driven fan is no longer active, the extraction of heat would not be fast enough to prevent loss through the air vent, and in order to eliminate surging and gushing of the liquid and steam from the system as a result of after-boiling, it is here proposed to block the jacket outlet as soon as engine operation is stopped. For this purpose there is shown in the drawing a plate valve 16 seating on the underside of the attachment face of the fitting 5 and being mounted through a stem 17 on one of the flexible walls 18 of an expansible chamber, anchored by means of a hollow stud 19 associated with the other wall 20 of the chamber and projected through an opening in the fitting wall for attachment by a nut 21 threaded thereon. Communicating with the interior of the expansible chamber through the hollow stud 19 is a suitable pipe or conduit 22 leading from a convenient engine controlled source of pressure, such as the engine driven oil pump 23, which forms a part of the conventional pressure feed lubricating system for the engine. When the engine is being operated the pump 23 delivers oil under pressure through the conduit 22 and expands the chamber to the broken line position illustrated in Figure 2, in which the disc valve 16 is unseated to allow free circulation of the cooling medium as heretofore described.

So soon as the engine is turned off and the oil pump 23 ceases to operate, the pressure being relieved, the expansible chamber contracts to the full line position shown in the drawing and closes the valve 16 to block further flow through the outlet connection to the inlet of the radiator. Under these conditions any boiling and expansion due to steam formation tends to push the body of water in the reverse direction and out through the inlet fitting to the outlet header of the radiator assembly. Since, however, the system is only half full, the body of liquid within the radiator assembly will not reach the level of the overflow, even though all the water is expelled from the cylinder jacket and, furthermore, the water in the radiator separates the overflow vent from the steam filled jacket and serves as a trap against escape of vapors and to condense any steam which leaves the jacket.

While the above description has been more or less specific, the invention is not limited necessarily to the exact details shown, and it will be understood that radiators other than the cross flow type referred to may be used, and that the closure valve may depend for its automatic action on devices other than the pressure pump of the engine lubricating system.

I claim:

1. The combination with a pressure lubricating system for an engine, including an engine driven oil pump, and a circulatory engine cooling system including a radiator having inlet and return connections with the engine jacket and an engine driven pump for forcing cooling liquid through the return connection during engine operation, of a valve normally closing the radiator inlet connection, pressure actuated means for opening the valve and a pressure line for delivering oil under pressure from the engine oil pump to said means to hold the valve open throughout the period of engine operation.

2. In a liquid cooling system for engines, a cooling core for the flow of cooling medium therethrough, an overflow device associated with the core, an engine jacket connection to one end of the core, a valved connection to the other end of the core, said valved connection including a valve adapted to open in opposition to the flow of cooling medium through the connection and irrespective of flow pressures, and means to open and to close the valve automatically with the starting and the stopping respectively of the engine whereby to allow free flow of cooling medium through the connection throughout engine operating periods and to stop flow throughout intervals between engine operating periods.

3. The combination with an engine jacket and a radiator having inlet and outlet connections with the jacket, of a normally closed valve controlling communication between the jacket and the radiator inlet, a pressure responsive device operatively connected with and adapted to open the valve in response to pressure, an engine driven pressure pump, and means affording free and open communication at all times between said pressure pump and pressure responsive device.

4. In an engine cooling circuit, a valve controling the engine jacket outlet, and automatic means responsive to changes in the oil pressure of the engine to open the valve simultaneously with the starting of engine operation and to close the valve simultaneously with the stopping of engine operation.

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