

April 19, 1966

J. W. WALSH

3,246,637

CROSS FLOW DEAERATION ENGINE COOLING SYSTEM

Filed Sept. 18, 1964

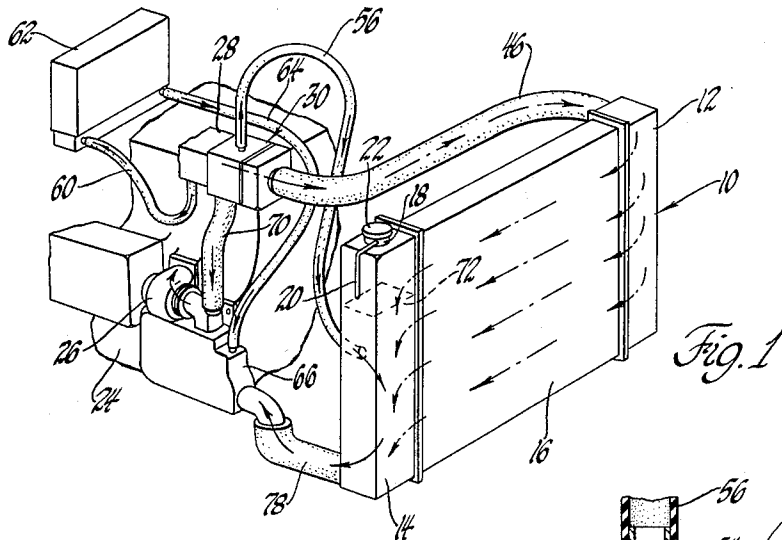


Fig. 1

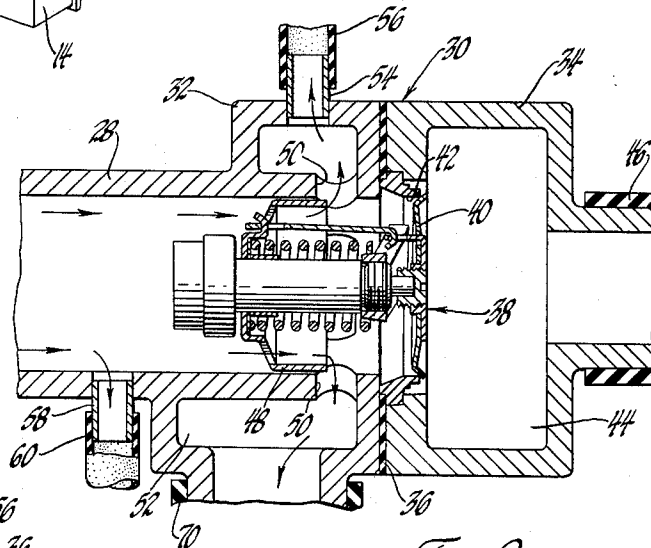


Fig. 2

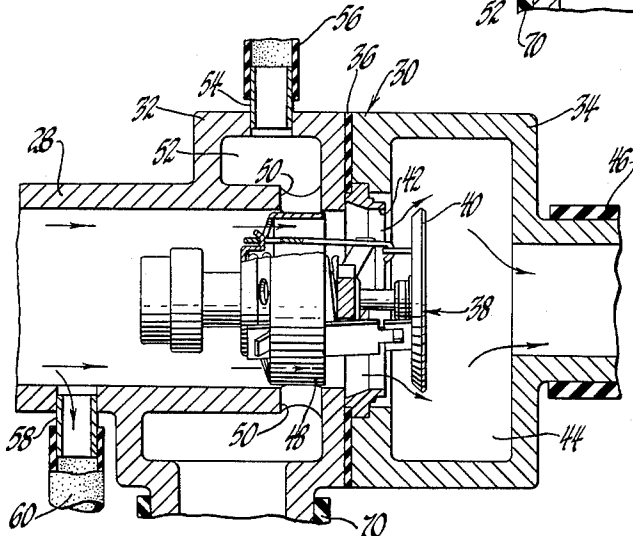


Fig. 3

INVENTOR.
John W. Walsh
BY
George E. Johnson
ATTORNEY

1

3,246,637

CROSS FLOW DEAERATION ENGINE COOLING SYSTEM

John W. Walsh, Lockport, N.Y., assignor to General Motors Corporation, Detroit, Mich., a corporation of Delaware

Filed Sept. 18, 1964, Ser. No. 397,415

5 Claims. (Cl. 123—41.1)

This invention relates to engine cooling systems and more particularly to internal combustion engine cooling systems involving crossflow radiators.

Internal combustion engines and particularly diesel engines are often troubled by the entry of combustion gases into the engine jackets and sometimes to such an extent as to render the water or engine coolant pump ineffective because of "air-lock." It is for this and other reasons obviously advantageous to vent entrapped air or gases from the engine coolant as promptly and thoroughly as possible. A common and only part solution has been to add bleed holes to the thermostat valve controlling the engine temperature. This expedient causes loss of coolant temperature control, however, so that radiator shutters are needed to keep the radiator from becoming too cold. A given engine as conventionally cooled may be provided with adequate cooling at an ambient of 100° F., but, in this event, the engine is over-cooled at 0° F. ambient. A problem has been to give automatic control of engine cooling over a wide range of conditions.

An object of the present invention is to provide an engine cooling system with a cross-flow radiator and in which deaeration is achieved without the use of extra tanks, baffles, carefully sized and balanced flow capacity lines or ram air deflecting shutters while retaining automatic control of the engine coolant temperature.

A feature of the present invention is an engine cooling system having a cross-flow radiator and a thermostatic valve with conduit means so arranged that venting occurs from a tank at the coolant discharge end of the radiator regardless of whether the engine is hot or cold and while optimum engine temperature for efficient operation is achieved.

This and other important features of the invention will now be described in detail in the specification and then pointed out more particularly in the appended claims.

In the drawings:

FIGURE 1 is a perspective and diagrammatic view of the main components of an engine cooling system embodying the present invention, a passenger compartment heater core and an oil cooler being included merely as a preferential arrangement;

FIGURE 2 is an enlarged sectional view of a two-way thermostatic valve used in the system of FIGURE 1 and showing a main valve closed and a bypass valve open as would occur when the engine being served is cold; and

FIGURE 3 is a view similar to that of FIGURE 2 but showing the main valve open and the bypass valve closed as would occur when the engine is heated.

In conventional designs of diesel engine cooling systems the thermostats are located at the engine water manifold outlets. These thermostats have important coolant deaeration design purposes for each of three basic thermostatic primary valve positions (a) full closed to bypass a radiator (extremely low ambients); (b) control with partial flow through a radiator (low to moderate ambients); (c) full open with entire flow through a radiator (high ambients). Deaeration of the coolant is most difficult when the thermostat is at full closed position, in very low ambients, and this is when the maximum control of the coolant temperature is required.

Up to the present, if these cooling systems are to be capable of divesting combustion gases without adversely

2

affecting the functions of the thermostat in its control of the coolant temperature, then any deaeration bypass lines provided must be carefully sized and balanced in order to maintain stable coolant levels in any deaeration chamber provided. Such sizing and balancing are difficult and must be undertaken for each engine.

The present system satisfies the situation despite a complicating factor, the utilizing of what is commonly known as a "cross-flow radiator." It does so without sizing of conduits or balancing of flow lines for temperature control attainment and without the use of baffles or supplementary tanks.

Two-way thermostats have been conventionally used to control radiator bypass and through connections. Such a thermostat is described in the United States Patent 2,899,026, granted August 11, 1959 in the names of P. E. Hitch and J. W. Walsh. Such a thermostat may be used in place of the specific type of thermostat shown in the present drawings for it embodies a main valve and a bypass valve controlling the main flow and a bypass flow or two-way connection in the thermostatic valve.

Conventional radiators are today provided with filler necks and they are closed by means of a pressure cap for maintaining the pressure in the radiator or cooling system at a predetermined value and arrangements are provided with a vent line so that when the pressure in the radiator unduly increases or decreases, it will vent by the valve and relieve the undesirable condition. Such a filler neck and cap is described in the United States Patent 3,047,235, granted July 31, 1962 in the names of J. E. Eshbaugh and J. A. McDougal. The use of such a neck and cap is contemplated in the practice of the present invention but the specific cap and neck of the patent is merely exemplary.

In FIGURE 1, a cross-flow radiator is generally indicated at 10 and this radiator comprises a vertical inlet tank 12 and a vertical outlet tank 14. These two tanks are connected by means of horizontal or "crossflow" liquid passages in a core 16 interposed between the two tanks. The upper portion of the outlet tank 14 is provided with a filler neck 18 having an overflow vent 20 and a pressure cap 22. This arrangement of cap and vent is as described above.

An engine coolant jacket is fragmentarily disclosed as at 24 and the outlet to the coolant pump 26 is shown as connected to that jacket. The outlet for the coolant from the jacket 24 is disclosed at 28 and to this outlet is connected a two-way thermostatic valve 30. The valve 30 is formed of two casing halves 32 and 34 between which is interposed a sealing gasket 36 and inside these two casing halves is mounted a thermostatic valve proper indicated generally at 38. The latter includes two valves, one of them being a main valve 40 closing a port 42 leading to a chamber 44, and this chamber is preferably connected by means of a conduit 46 to the top portion of the inlet tank 12 of the radiator. It could be connected lower down without departing from the spirit of the present invention. The secondary or bypass valve 48 has been referred to as a part of the thermostatic valve and this valve is adapted to control radial passages 50 leading from the engine jacket and to an annular passage 52. The latter is provided with a small nipple 54 by means of which a hose 56 is connected to lead to the outlet tank 14 of the radiator. The outlet portion 28 of the engine jacket (which may or may not be integral with the part 32) is provided with a nipple 58. This in turn is connected to a hose 60 which leads to a heater 62 of a conventional type employed in heating passenger compartments or driver cabs. A heater discharge line 64 connects the heater core 62 to an oil cooler 66 that is to a place in the system upstream from the pump 26.

When the engine being served by the cooling system

3

is cold, the main valve 40 of the thermostatic valve 30 will be closed as shown in FIGURE 2 and the bypass valve 48 will be open so that all circulated coolant will bypass the radiator and it will do so by way of a bypass conduit 70 leading to the intake of the pump 26 and by way of the hose 60 leading to the heater 62. In this full closed situation, any air or gas entrapped in the coolant will pass through the line 56 into the radiator outlet tank 14 and will gather at the top of that tank for venting by way of the vent pipe 20. A coolant level will be maintained as indicated by the dash lines at 72 of FIGURE 1.

Under conditions where the engine temperature is controlled by the valve 30, the main valve 40 will be opened partially and the bypass valve 48 will be closed partially and in this situation part of the engine coolant circulation will be as previously described and the remaining part will be by way of the conduit 46 and through the core 16 to the tank 14 and the hose 78 leading to the pump 26 by way of the cooler 66. Under this situation, the coolant level will remain at or near the level indicated by the dash lines 72.

Under full open conditions, that is, when the engine is at its highest temperature, the valve 40 will be fully open and the bypass valve 48 will be closed. In this situation, all the coolant flow will be through the radiator as will be understood. The level 72 will be maintained under these conditions as under the others and adequate opportunity presents itself in the upper portion of the outlet tank 14 for the air or gas to separate from the coolant and be discharged by the vent line 20. Ordinarily pump pressure will be such as to keep the inlet tank 12 full of coolant despite a lower level existing in the tank 14 so that the radiator will operate at maximum efficiency.

I claim:

1. An engine cooling system comprising an engine jacket, a cross-flow radiator having an inlet tank and an outlet tank connected by a core, a pump, a 2-way thermostatic valve, a vent on said outlet tank, first conduit means cooperating in connecting said jacket, one way of said valve, said inlet tank, said core, said outlet tank, said pump and said jacket in a closed path, second conduit means cooperating in connecting said jacket, the other way of said valve, said pump, and said jacket in a closed path, a bypass conduit connecting said other way of said valve to said outlet tank, and a vent for said outlet tank.

4

2. An engine cooling system comprising an engine jacket, a radiator having a coolant inlet tank and a vertically disposed coolant outlet tank, a pump, a 2-way thermostatic valve, a vent leading from an upper part of said outlet tank, first conduit means cooperating in connecting said jacket, one way of said valve, said inlet tank, said outlet tank, said pump and said jacket in a closed coolant flow path, second conduit means cooperating in connecting said jacket, the other way of said valve, said pump and said jacket in a closed coolant flow path, a bypass conduit connecting said other way of said valve to said outlet tank, and a vent for said outlet tank.

3. An engine cooling system comprising an engine jacket, a radiator having a core with horizontal coolant passages connect a vertical inlet tank to a vertical outlet tank, a vent leading from an upper zone of said outlet tank, a coolant pump having its outlet connected to said jacket, a 2-way thermostatic valve having a single inlet, said single inlet being connected to said jacket, first conduit means connecting one-way of said valve, said inlet tank, said outlet tank and said pump, second conduit means connecting the other way of said valve to the inlet of said pump, a bypass conduit connecting the said other way of said valve to said outlet tank, and a vent for the upper portion of said outlet tank.

4. An engine cooling system as set forth in claim 3, said one way of said valve being open and said other way closed when said system is at an elevated operating temperature, and said one way being closed and said other way open when said system is at below desired operating temperature.

5. An engine cooling system as set forth in claim 3, said thermostatic valve including a main valve controlling the coolant flow through the radiator core and a bypass valve controlling the coolant flow around said core.

References Cited by the Examiner

UNITED STATES PATENTS

1,311,809	8/1919	Giesler	236—34.5
2,296,641	9/1942	Hawkins	123—41.1
2,332,680	10/1943	Wallace	123—41.1 X
2,336,068	12/1943	Charles	123—41.1 X
2,988,068	6/1961	Waydak	123—41.1

KARL J. ALBRECHT, *Primary Examiner.*