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ENGINE COOLING SYSTEM WITH RADIATOR BY-PASS

Filed Jan. 18, 1956

2 Sheets-Sheet 1

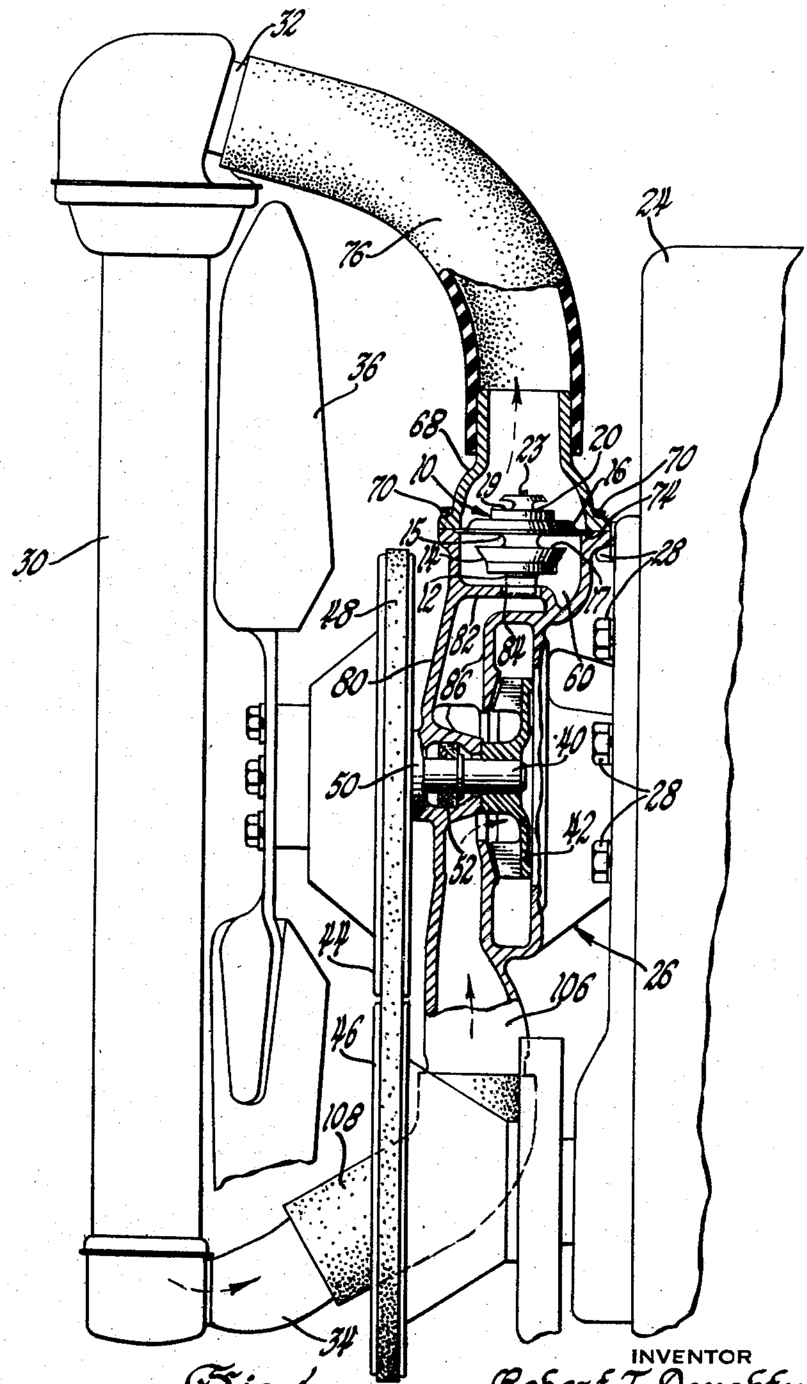

Fig. 1

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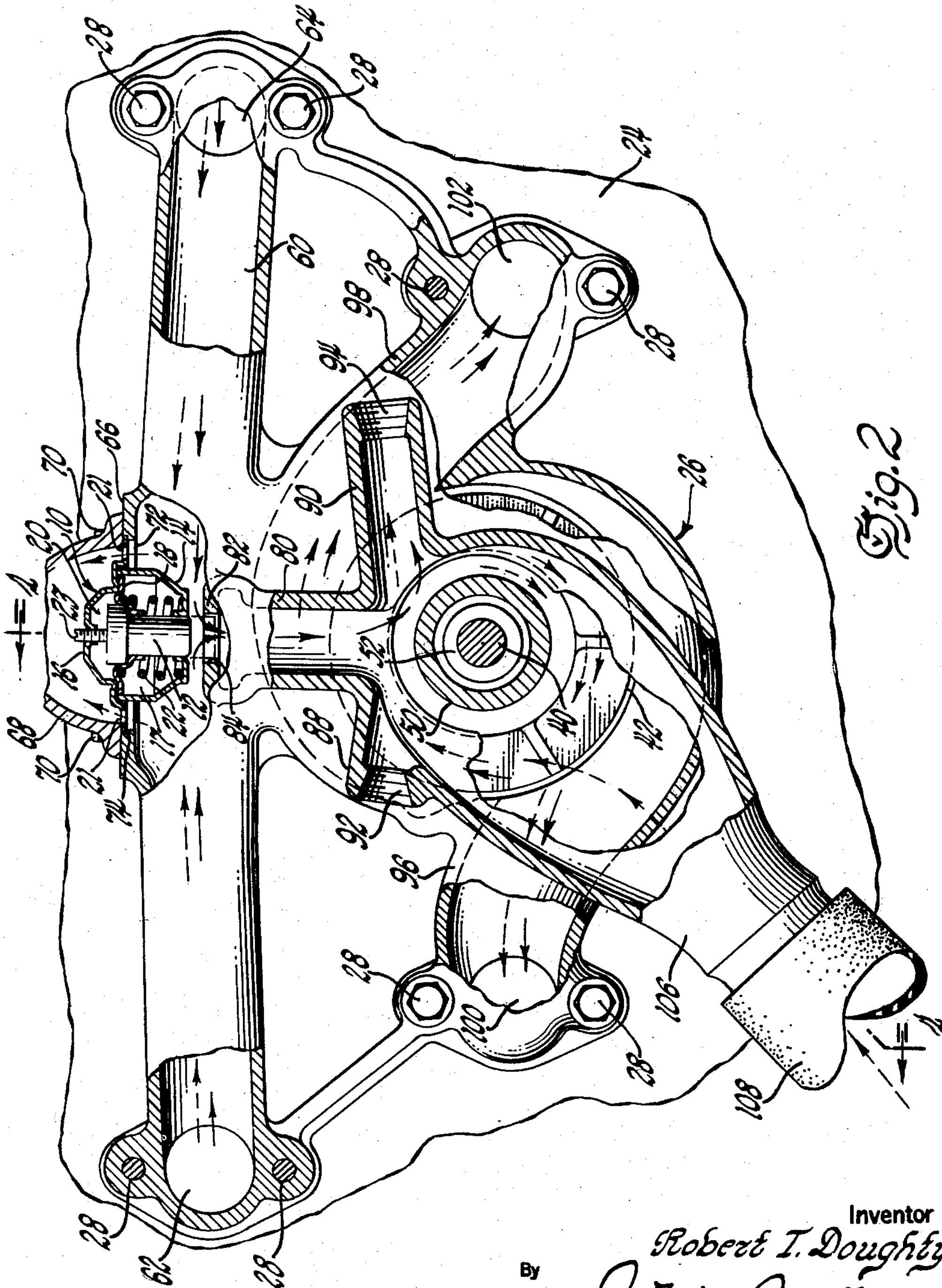

Fig. 2

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ENGINE COOLING SYSTEM WITH RADIATOR BY-PASS

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Application January 18, 1956, Serial No. 559,882

5 Claims. (Cl. 123—41.1)

This invention relates to engine cooling systems and more particularly to such systems each employing a radiator in combination with a thermostatic valve for by-passing the radiator when the systems are at below normal operating temperatures. A satisfactory system of this type is disclosed in the United States Patent No. 2,244,932, issued June 10, 1941, in the name of Orlin L. Anderson and entitled "Thermostatically Controlled Engine Cooling System." Other systems of this general type are also known and have obtained various degrees of success but each is subject to one or more of the following disadvantages: complexity of structure; costly to manufacture; lack of desired reliability and ruggedness; and unduly restrictive to radiator by-pass coolant flow.

An object of the present invention is to provide an improved engine cooling system of simple construction giving a maximum flow of coolant for circulation through the cooling jacket arrangement of an engine when the function of a radiator is not required.

Another object is to provide a system in which a thermostatic valve is so associated as to provide coolant flow through an engine coolant jacket arrangement when the engine or coolant is at below normal operating temperature thereby reducing localized engine heating and possible fuel detonation, as well as to reduce the engine block warm-up period.

To these ends, a feature of the invention pertains to a thermostatic valve so associated with ports in a cooling system that one of those ports is restricted or cleared by an imperforate cylindrical portion of the valve dependent upon the temperature of the coolant. Another feature is an imperforate cylindrical valve portion of substantially less diameter than that of an associated port whereby the restriction of the port by the valve portion cannot be complete and thereby avoiding undue chilling of the valve portion.

These 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:

Fig. 1 is a fragmentary side elevation, with parts in section, of an internal combustion engine of a type conventionally used in automobiles and equipped with a cooling system embodying the present invention and looking substantially in the direction of the arrows **1—1** in Fig. 2; and

Fig. 2 is an elevational view drawn to an enlarged scale of a portion of the cooling system as supported on an engine and as shown in Fig. 1, parts of the system being broken away better to illustrate the construction.

In utilizing the present invention, a thermostatic valve **10** is employed which is of a type utilizing an imperforate cylindrical portion **12**. Such a valve is disclosed in the United States application for Letters Patent Serial No. 510,210, filed May 23, 1955, in the names of Hugh J. Clifford and Adolf Schwarz and entitled "Thermo-Responsive Control Valve Assembly." Details of this valve may be modified or other forms of such valves may

be employed without departing from the present invention and, accordingly, a detailed description of the specific valve construction is not included herein. It may be stated, however, that the valve shown in the drawings includes a frame **14** supported on a flange member **16** and the cylindrical valve portion **12** is of pellet type construction to function as a heat actuated motor—i. e.—encloses a thermo-sensitive material which, upon expansion, causes the portion **12** to lower and thereby carry with it a disc valve **18** into an open position away from an annular seat on the member **16**. The frame **14** has two oppositely disposed arcuate openings **15** and **17**. The flange member **16** is provided with main ports **19** and **20** (Fig. 1) and with one or more small ports **21** (Fig. 2) near its periphery. When the disc valve **18** is caused to open, it must do so against the compressive force of a coil spring **22** located within the frame **14**. The application of heat causes the portion **12** to withdraw from a stationary threaded pin **23** as disclosed in the patent application above referred to.

In Fig. 1, an internal combustion engine **24** is depicted with a cooling system casting **26** affixed thereto by means of bolts **28**. A conventional radiator **30** is mounted forwardly of the engine and is provided with inlet and outlet fittings **32** and **34**, respectively. A conventional cooling fan **36** is mounted between the radiator and the casting **26** on a shaft **40** which also serves as a power shaft for a water pump impeller or rotor **42**. The pump impeller and fan are rotated by means of conventional pulleys **44** and **46** connected by a belt **48** and actuated by the engine. The fan and pump shaft **40** are journaled in a hub **50** formed on the casting **26** and sealing means **52** are provided in the casting and around the shaft **40** to prevent water leakage.

The top portion of the casting **26** is provided with a substantially horizontal passage **60** having end ports **62** and **64** communicating wtih the cooling jacket arrangement employed on the engine. An intermediate portion at the top of the casting **26** is flattened off to present a supporting surface **66** for a conduit fitting **68** fixed thereto as by means of screws **70**. The casting **26** bears a top opening **72** in which the thermostatic valve **10** is supported. A recess **74** is provided in the casting so that the flanged member **16** is snugly held therein when confined by the fitting **68**. A flexible hose **76** connects the fittings **68** and **32**.

The casting **26** also includes a vertical duct **80** which terminates with a horizontal wall **82** spaced from the valve frame **14** and having a port **84** coaxial with the valve port controlled by the valve disc **18**. It will be noted that the port **84** is appreciably or substantially larger than the cylindrical valve portion **12** with which the port or duct is associated or aligned. The relationship of the portion **12** with the port **84** forms an important and novel aspect of the present invention.

Also integral with the casting **26** is a coolant pump casing **86** having tangential connections **88** and **90** to which hose may be connected as at **92** and **94**, respectively, for directing and receiving water for the vehicle heaters. The pump casing **86** is provided with outlet conduits **96** and **98** which lead to ports **100** and **102**, respectively. These ports are adapted to lead to the engine block arrangement at points spaced from the ports **62** and **64**, as will be understood. Passages for the engine block arrangement are not described herein. It will be understood that the casting **26** is specifically adapted for use with an engine of the V-type and that liquid passing through the port **100** will circulate through the cooling jacket of one engine block and then be discharged through the port **62**. The same is true with regard to the ports **102** and **64** on the other block of the engine. The casting **26** would, of course, be modified to suit in the event the invention is to be used on a single block engine such as a conventional four or six cylinder engine.

Also integral with the pump casing **86** is an inlet conduit **106** which is connected by means of a hose **108** to the radiator outlet fitting **34**.

It will be appreciated that the thermostatic valve **10** may be removed or replaced simply by disconnecting the fitting **68** from the casting **26**.

In operating the cooling system and assuming that the associated engine **24** is cold, the temperature sensitive material in the cylindrical valve portion **12** will be contracted permitting the spring **22** to hold the valve disc **18** on its seat and causing the cylindrical valve portion **12** to clear the port **84**. These positions are illustrated by solid lines in Fig. 2 in which figure it will be noted that the arrows showing the flow and drawn with solid lines illustrate that the coolant flowing from the engine by way of ports **62** and **64** passes downwardly through the port **84** and the duct **80** again to be discharged by the pump impeller **42** back to the engine by way of ports **100** and **102**. The port **84** or the duct **80** is, accordingly, free of obstruction or restriction and maximum flow of coolant is assured for the engine cooling jacket so that no localized hot spots may develop therein. Simultaneously with this action a small quantity of the coolant may flow through the openings **21** to the radiator **30** so that the radiator and associated inlet and outlet fittings may gradually increases in temperature without detracting appreciably from the rate of warm-up of the engine.

After the engine **24** or coolant has become adequately heated or has acquired a normal operating temperature, the valve **12** will be affected thereby and expansion of the thermo-sensitive material within the cylinder portion **12** will cause the latter to assume the position indicated by the dash lines in Fig. 2. As a result, the port **84** will be partially restricted by the cylindrical portion **12** and the valve **18** will be opened accompanied by forced compression of the spring **22**. Under these circumstances the by-pass connection to the pump by way of the duct **80** is curtailed in its operation or rendered less effective and the primary flow of coolant is then upwardly directed through the frame openings **15**, **17**, **19**, **20** of the valve **10**, fitting **68** and the hose **76** to the top of the radiator **30**. After being cooled in the radiator the coolant again enters the pump by way of the hose **108** and the conduit **106** for conventional or normal circulation through the engine cooling jacket arrangement by way of the ports **100** and **102**.

The cylindrical valve member **12** has been described as substantially smaller in diameter than the port **84**. As a consequence, a substantial clearance exists when the port **34** is restricted by the portion **12**. This clearance is sufficient to prevent the portion **12** from becoming chilled when the engine is warm or heated to a normal operating temperature. It will be appreciated that the valve **10** should maintain an open passage into the fitting **68** when the engine is at operating temperature and with this end in mind, the thermo-sensitive material in the valve **10** must not be subjected to the possible cooling effect of a closed pocket of coolant within the duct **80**. Regardless of the engine coolant temperature at any given time it is obvious that the portion **12** is so located as to function rost efficiently in that a substantial portion of it is always in intimate contact with the coolant immediately after the latter's emergence from the engine block.

I claim:

1. An engine cooling system comprising conduit means arranged to recirculate a cooling medium through an engine cooling jacket arrangement by way of a radiator, said means including a duct by-passing said radiator, a port in said means controlling flow to said radiator, a thermostatic valve controlling said port and including an imperforate cylinder portion arranged to enter and emerge from said duct dependent upon the temperature of said medium, and said portion enclosing thermo-sensitive material causing said portion to function as a heat actuated motor.

2. An engine cooling system comprising a radiator, a pump and conduit means for conducting a cooling medium to and from an engine cooling jacket arrangement by way of said radiator, said conduit means including a duct leading to a pump and by-passing said radiator, a port in said conduit means controlling flow to said radiator, the said duct and port being substantially coaxial, a thermostatic valve having a valve disc arranged to control said port and including an imperforate cylinder portion arranged to clear said duct when said valvle is cooled by said medium and to partially restrict said duct when said valve is heated by said medium, and said cylinder portion being a heat actuated motor which is bodily movable with said valve disc.

3. An engine cooling system comprising a radiator, a pump and conduit means for conducting a cooling medium to and from an engine cooling jacket arrangement by way of said radiator, said conduit means including a duct leading to a pump and by-passing said radiator, a first port controlling fluid flow through said duct, a second port in said conduit means controlling flow to said radiator, the said ports being substantially coaxial, a thermostatic valve having a valve disc arranged to control said second port and including an imperforate cylinder portion with a substantially smaller diameter than that of said first port, said cylinder portion being arranged to clear said duct when said valve is cooled by said medium and partially to restrict said first port when said valve is heated by said medium, and said cylinder portion being a heat actuated motor enclosing thermo-sensitive material located on one side of said valve disc.

4. An engine cooling system comprising a radiator and conduit means for circulating a cooling medium through an engine cooling jacket arrangement, said means including a duct leading to a pump and by-passing said radiator, a main port in said conduit means leading to said radiator, a valve disc arranged to control said main port, an imperforate cylinder portion fixed bodily to move with said valve disc and arranged to enter and emerge from said duct dependent upon the temperature of said medium, a pin fixed in said conduit means, and said cylinder portion retaining thermo-sensitive material around one end of said pin.

5. A system such as set forth in claim 4 in which the structure defines a restricted flow path for said cooling medium around each end of said cylinder portion.

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