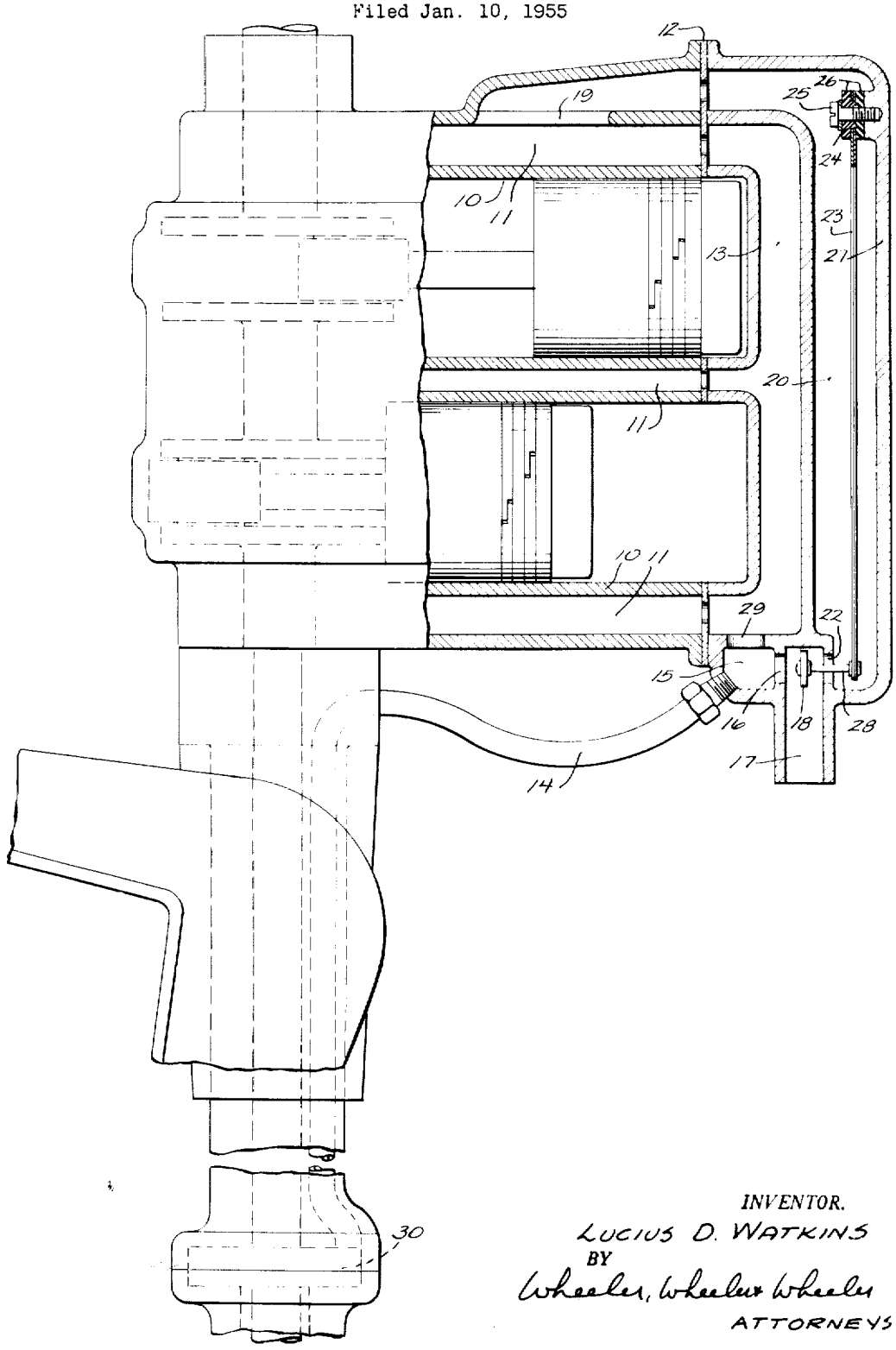
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THERMAL CONTROLS FOR ENGINE COOLING SYSTEMS

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THERMAL CONTROLS FOR ENGINE COOLING SYSTEMS

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This invention relates to thermal controls for engine cooling systems, particularly for the initially drained cooling systems of engines of outboard motors.

The purpose of this invention is to provide a thermostatic control which, with the engine cool, will permit the empty cooling jacket to fill with water, and which will thereafter control the flow of water into the block according to water temperature, the control being independent of pressure and effected without altering pump operation.

These results are secured by providing a coolant bypass in parallel with the cooling jacket and by locating the control valve where it is subject in all positions to substantially equalized pressures on its opposite faces.

The drawing is a schematic view partially in elevation and partly in cross section of the cylinders and cooling jacket of an outboard motor engine.

The invention is applicable to any engine, compressor, or the like and is illustrated for purposes of exemplification, as applied to an outboard motor engine, where it has specific advantages.

The drawing shows an engine having the customary cylinders **10** surrounded by jacket **11** having restricted communication through cylinder head gasket **12** with the cylinder head coolant passage **13**. Coolant supplied by the pump **30**, as from the body of water in which the outboard motor operates, is delivered through passage **14** and by-pass chamber **15** into the head passage **13**. The by-pass chamber **15** communicates through port **16** with outlet conduit **17** and is controlled by thermostatically operable valve **18**.

When the engine jacket **11** is full, coolant flows through jacket **11** and overflows through outlet port **19** into return passage **20**, through which all water from the cooling jacket flows. Passage **20** leads via port **22** into outlet tube **17**, through which coolant returns to the coolant source. In the case of an outboard motor, this would be the body of water on which the boat is floating. Valve **18** "floats" between ports **16** and **22** to vary relative flow to the discharge pipe **17**.

Bimetallic strip **23** has a hole **24** near the upper end, which hole is of greater diameter than screw **25**. To prevent electrolytic action, the gaskets **26** may desirably be of electrically non-conductive material. They are positioned at opposite sides of strip **23** so that when the strip is mounted to outside wall **27** by screw **25** it is electrically insulated from the screw as well as from the wall.

Affixed in any suitable manner to the lower end of bimetallic strip **23** is a valve stem rod **28** extending through port **22** into the upper portion of outlet tube **17**. Valve member **18** is mounted on rod **28** between port **16** and port **22**, in such a position that upon axial movement of rod **28** caused by bending of bimetallic strip **23**, valve member **18** will vary the relative volume of water admitted to outlet tube **17** from port **16** as compared to that admitted from port **22**. Either of ports **16** and **22**

may be completely closed by an extreme movement of valve member **18**. Since both ports are alike subject to pump pressure, the pressures on the valve are substantially balanced at all times when the system is full of coolant.

In operation, water driven by pump **30** enters the inlet tube **14**. It may follow either or both of two paths, depending on the position of valve **18**. One path is through by-pass chamber **15** into the water jacket passages **13**, **11** and returning through passage **20** and port **22** to the water exhaust tube **17**. The other path is through the by-pass port **16** past the valve member **18**, directly to the water exhaust tube **17**.

In the case of an outboard motor engine, the cooling jacket **11** and **13** may be empty when the engine is started due to gravity discharge during the period the pump **30** was not in operation. The by-pass port **16** is substantially fully open and port **22** is substantially fully closed when the engine is cold. The pump **13** will then direct the major portion of the water through the by-pass port **16**, since gravity will tend to resist any flow of water upwardly in the jacket **13**. Since the cooling jacket is empty, engine heat rapidly warms the thermostatic element **23** and the valve member **18** is moved toward the by-pass port **16**, overcoming the head of pump pressure and diverting the flow of water through port **15** into the jacket **13**. As soon as the thermostatic element **23** becomes immersed in water returning through passage **20** from the water jacket, and its temperature is modified thereby, valve member **18** moves toward port **22** and enough water is allowed to by-pass the jacket **11** and passage **20** to maintain the water therein at the proper temperature. In normal operation, the valve will tend to "float" between the ports which it controls and approximately in the mid-position in which it is illustrated.

Ports **16**, **29** and **22** are substantially the same size and are subject to substantially the same water pressure after the jacket is filled. Also, the stream of water from tube **14** is directed to substantially bisect the angle between port **16** and port **29**. Therefore, valve member **18** is not urged in either direction by water pressure during normal operation, nor is it subject to variations in operation due to variations in water pressure, since the pressure on both sides is substantially equal.

It will be understood that the thermostatic element might be of a different type and could be positioned differently and connected differently to the valve without departing from the spirit of this invention. The arrangement disclosed has the advantage of great simplicity and effectiveness. It substantially balances water pressures upon opposite sides of the valve, leaving the valve free to respond readily to relatively light thermostat pressure.

I claim:

1. In an internal combustion engine having a cooling jacket, a pump for coolant, a coolant intake duct from said pump to said cooling jacket, and a return passage opening from the jacket; the combination of means providing an outlet duct and having ports respectively leading from the intake passage and the return passage to the outlet duct, and apportioning valve means positioned at said ports for opening either and simultaneously restricting the other to control the relative flow of water through the ports, and an actuating element connected to said valve means.

2. The device of claim 1 in which said actuating element is a thermostat.

3. The device of claim 1 in which said ports are opposed and said valve means is a single valve disposed between the ports for approach toward one and from the other as impelled by said element.

4. The device of claim 3 in which the connection of the element to the valve means comprises a stem disposed for reciprocating axial movement through the port leading from the return passage to the outlet duct, said actuating element comprising a thermostat exposed to the heat of coolant in said return passage.

5. The device of claim 4 in which said element comprises a bimetallic strip mounted in said return passage.

6. In an outboard motor having a cooling system including an inlet passage and an outlet passage and an intervening jacket connected in series between said passages, the improvement which comprises means providing a by-pass passage from the intake passage to the outlet passage, the outlet passage having admission ports communicating respectively with the jacket and the by-pass passage, and valve means movable oppositely to and from the respective ports for the progressive opening of one and the closing of the other according to the direction of movement of said means, and a thermostat exposed to jacket temperatures and connected with said valve means for effecting movement thereof in a direction to close the by-pass port and open the port from the jacket to the outlet passage as the thermostat responds to an increase in temperature.

7. The device of claim 6 in which the ports opening into the outlet passage are directly opposite, the valve means comprising a single valve normally disposed in the outlet passage between said ports and having a stem extending through one of said ports to said thermostat.

8. The device of claim 6 in which the thermostat is exposed to jacket heat and adapted, even in the absence of coolant in the cooling system, to receive radiant heat from the jacket and thereby to move valve means toward the by-pass port and away from the port opening from the jacket into the outlet passage.

9. An internal combustion engine having cylinder means and a jacket, means providing a coolant intake passage leading to a lower portion of the jacket, means providing an outlet passage in proximity to the intake passage and having two inlet ports, return passage means extending from an upper portion of the jacket externally of the jacket proper to one port of the outlet passage, means providing a by-pass from the inlet passage to the other port of the outlet passage, a thermostat in said return passage means, and valve means in the return passage movable oppositely respecting the said ports and connected with the thermostat through said one port.

10. The device of claim 9 in which the thermostat is disposed opposite the cylinder head to receive radiant heat whether or not the return passage means contains coolant.

11. The device of claim 9 in which the thermostat comprises a bimetallic element disposed in the return passage means and extending transversely across the cylinder head and having a mounting including electrical insulation isolating the thermostat element.

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