

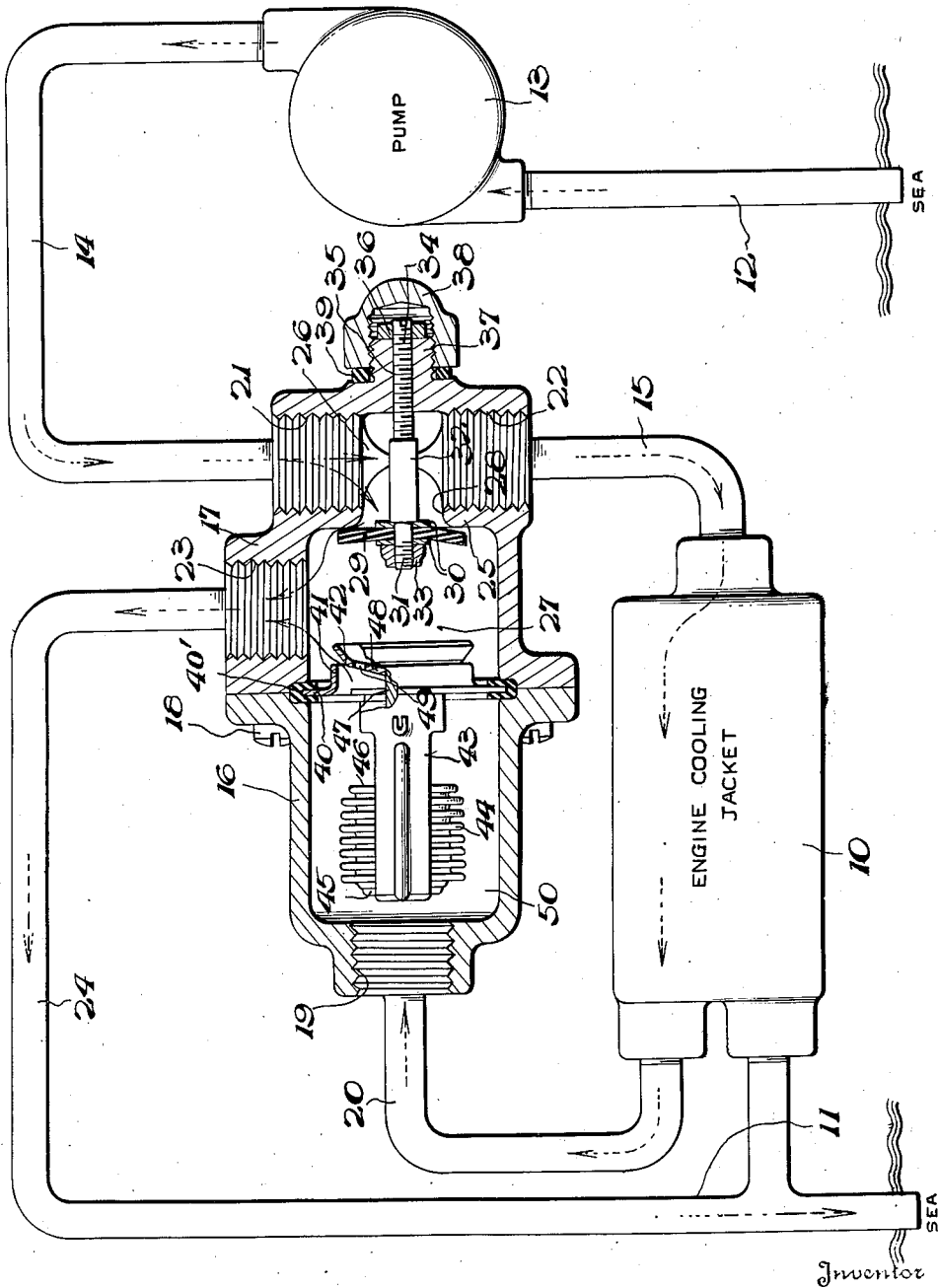
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D. L. MORGAN

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TEMPERATURE REGULATOR FOR INTERNAL-COMBUSTION ENGINES

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Inventor

David L. Morgan

By Cameron, Kerkam & Sutton

Attorneys

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TEMPERATURE REGULATOR FOR INTERNAL-COMBUSTION ENGINES

David L. Morgan, Bridgeport, Conn., assignor to
Robertshaw-Fulton Controls Company, a corporation of Delaware

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This invention relates to a temperature regulator for the cooling system of an internal combustion engine of the marine type, the term "marine engine" being used herein to embrace any suitable internal combustion engine used for propelling boats or comparable vehicles on water whether fresh or salt.

Temperature regulators have long been used for maintaining a predetermined range of temperature in the cooling medium circulating through the cooling systems of internal combustion engines employed for propelling land vehicles, but in such systems the same cooling medium is circulated through the cooling system over and over again, so that the function of the temperature regulator is merely to establish and maintain within a predetermined range the temperature desired in the water circulating back and forth into and out of the engine jacket and a radiator associated with the circuit. In the case of marine engines, on the other hand, the cooling water is taken from the body of water in which the boat is disposed, and after circulation through the engine jacket, it is returned to that body of water, usually after being passed into heat interchanging relationship with the exhaust pipe of the engine so as to prevent overheating of the latter. As the cooling system must function satisfactorily when the engine is operating at full load when the source of water may be of summer temperature, it follows that when the engine is operating at less than full load or when the water is at cooler temperatures, the engine is overcooled because of the passage of excessive quantities of cooling medium through the engine jacket.

If the temperature of the engine can be kept within closely predetermined limits, many advantages are obtained in smoother and less noisy operation, more complete combustion and less carbon formation, higher compression, better lubrication, higher efficiency, longer engine life, etc.

It is an object of this invention to provide the cooling system of a marine engine of the internal combustion type with an improved temperature regulator which will control the flow through the engine jacket of water derived from the body in which the boat is disposed so as to maintain the temperature of said medium within closely predetermined limits under varying temperatures of the cooling water, varying loads on the engine, etc.

Another object of this invention is to provide a temperature regulator of the type characterized

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which assures that cooling water is at all times flowing in heat interchanging relationship with the exhaust pipe so as to prevent overheating of the same.

Another object of this invention is to provide a temperature regulator of the type characterized which is of relatively simple construction, easily fabricated and installed, and certain in operation. Other objects will appear as the description of the invention proceeds.

The invention is capable of receiving a variety of mechanical expressions only one of which is shown on the accompanying drawing, but it is to be expressly understood that the drawing is for purposes of illustration only, and is not to be construed as a definition of the limits of the invention, reference being had to the appended claims for that purpose.

Referring in detail to the accompanying drawing, a temperature regulator embodying the present invention is shown in association with a cooling system for a marine engine of the internal combustion type, the engine and cooling system being represented only schematically.

Referring to the drawing, 10 designates the jacket of an internal combustion engine of any suitable size, character and construction, the exhaust pipe of said engine being designated 11. As usual with marine engines of the internal combustion type, water is withdrawn from the body of water in which the boat is disposed through an intake pipe 12 leading to a pump 13 of any suitable size and character but conventionally of such capacity as to provide an adequate circulation of water when the engine is operating at full load under summer conditions. The outlet of the pump is in communication through conduits 14 and 15 with the inlet to the engine jacket 10. Interposed between the conduits 14 and 15 is a temperature regulator embodying the present invention as now to be described.

As illustrated, the regulator comprises a housing composed of two sections 16 and 17 secured together in any suitable way as by a plurality of screws or bolts 18 passed into or through suitable flanges of said sections. Section 16 of the housing has an inlet opening 19 in association with which is secured in any suitable way the outlet end of a conduit 20 that, at its opposite end, is in communication with the outlet of the engine jacket 10. Section 17 of said housing is provided with a pair of openings 21 and 22, preferably in alignment, in association with which is secured in any suitable way the outlet of the conduit 14

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and the inlet of the conduit 15. Section 17 of the housing is also provided with a third opening 23 in association with which is secured in any suitable way the inlet to a conduit 24 that preferably leads the cooling water from the jacket into heat interchanging relationship with the exhaust pipe 11 in any suitable way and only indicated diagrammatically in the drawing, after which it is returned to the body of water in which the boat is disposed.

Internally of the section 17 of said housing a partition 25 separates the interior into a passage 26, which connects the openings 21 and 22, and a chamber 27. Said partition 25 is provided with a suitable aperture 28 between the passage 26 and the chamber 27, and cooperating with the valve port thus formed is a pressure operated valve member shown as composed of a flexible disk 29 of any suitable material stationarily retained in position at its central portion between a pair of washers 30 on a stem 32 having a threaded extremity 31 on which a lock nut 33 is secured to lock said valve disk in position. Valve disk 29 is preferably made of an elastic or resilient material to operate as hereinafter explained, but if preferred a coil spring of any suitable construction may cooperate with said valve disk to provide the requisite resiliency for operation as described. Stem 32 has its opposite end 34 provided with threads for reception in a threaded aperture 35 extending through the outer wall of the housing where said stem is adjustably locked in position by a jam nut 36 cooperating with said threaded end 34. The exterior wall of the housing may be provided with a threaded boss 37 surrounding the aperture 36 and an acorn nut 38 may be threadably mounted on said boss 37 to enclose the jam nut 36, a gasket 39 being preferably interposed between the acorn nut 38 and the wall of the housing so as to minimize corrosion.

Mounted within the housing, to the left of the partition 25 as shown in the drawing, is a thermostatically operated valve of any suitable construction. As shown, said thermostatically operated valve is secured in position between the flanges on the two sections 16 and 17 of the housing, and to this end said valve is shown as including a disk-like member 40 which is received in U-shaped grommet 40' secured between the flanges of the housing sections 16 and 17, said grommet being of any suitable material so as to minimize electrolytic corrosion. Member 40 is shown as having a right angularly extending circular flange 41 surrounding a valve port 42. Secured to said member 40 in any suitable way, or formed integrally therewith, is a U-shaped strap 43, and mounted on said strap is a thermostat 44 having its lateral wall in the form of an expansible and collapsible corrugated tubular wall or bellows, said thermostat having a stationary end wall 45 secured to the base of the strap 43 in any suitable way and having a movable end wall 46 to which is secured a valve stem 47. Mounted on said valve stem in any suitable way is a cup-shaped valve member 48 positioned for cooperation with the seat provided by the extremity of the flange 41 around port 42. The thermostat 44 is charged with any suitable volatile fluid so that it will expand and contract under variations of temperature in a manner well understood in the art and move the valve member 48 away from or toward the seat 41 at predetermined temperatures selected for the particular engine whose cooling system is to be controlled. Valve member

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48 is shown as provided with one or more apertures 49 for a purpose to be explained, although if preferred the aperture or apertures could be formed in the member 40 or the flange 41.

By appropriately selecting the size, material and construction of the pressure operated valve 29 said valve may be so formed as to provide predetermined flows of cooling fluid from the passage 26 into the chamber 27 for predetermined variations of fluid pressure in the passage 26. This range of pressures can be adjusted by moving the stem 32 in the aperture 35, after which the stem can be locked in position by the jam nut 36.

When the engine is in operation and driving the pump 13, water from the body of water in which the boat is disposed is drawn through pipe 12 and delivered through conduit 14, passage 26 and conduit 15 to the cooling jacket 10, from which it may flow through the conduit 20 into the chamber 50 in which is disposed the thermostat 44. When the engine is first started the water so passed through the cooling jacket will be relatively cool so that the thermostat 44 will be contracted, holding the valve member 48 on its seat 41. However, a small circulation over the thermostat 44 will be maintained owing to the one or more apertures 49 in the valve member 48, said apertures as to size and number being so selected as to obtain the desired circulation over the thermostat 44. As the valve member 48 is now closed, however, a back pressure will be built up in passage 26. This back pressure acting on the valve member 29 will open the latter proportionately to the magnitude of the back pressure, so that the water being delivered through conduit 14 by pump 13 will largely flow through the port 28 into the chamber 27, and thence through the conduit 24 to the exhaust pipe.

As the temperature of the cooling medium rises due to continued operation of the engine the temperature of the water flowing through chamber 50 will be correspondingly raised until that temperature is reached at which the thermostat 44 is designed to initiate its expansion, whereupon any further rise in the temperature of the water flowing through the chamber 50 will cause the thermostat 44 to expand, opening the valve 48 so as to permit the water flowing through the engine jacket and chamber 50 to flow through the port 42 into the chamber 27, and thence through the conduit 24 to the exhaust pipe. When thereafter the temperature of the water flowing through the chamber 50 starts to decrease the thermostat 44 will correspondingly contract and move the valve member 48 toward its seat, proportionately decreasing the flow of water through the engine jacket.

Thereby the temperature of the water flowing through the engine jacket can be nicely controlled within predetermined limits selected as desirable for the particular engine under regulation. At the same time the volume of water flowing through the port 42 predetermines the back pressure existing in the passage 26 so that the amount of water flowing through the port 28 past the pressure operated valve 29 is generally in inverse proportion to the quantity of water flowing through the engine jacket. Thereby, irrespective of the load on the engine and the temperature of the water being pumped, the temperature of the water in the engine jacket may be nicely controlled so as to be kept within predetermined limits, while at all times an adequate volume of

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water is flowing through the conduit 24 to prevent overheating of the exhaust pipe. The pump may accordingly be given adequate capacity to afford proper cooling of the engine under the most adverse conditions, and even though the pump is thereby delivering a quantity of water in excess of the requirements of the engine cooling system, the portion of the water flowing through the engine jacket is so predetermined as to maintain the desired range of temperature while all excess water flows through the pressure operated valve 29 to the outlet conduit 24 where it is effective in cooling the exhaust pipe.

Thus a temperature regulator having the desired characteristics has been provided to maintain the engine temperature with certainty and efficiency within the desired limits notwithstanding wide variations of load or the temperature of the water available for cooling. At the same time the device is of relatively simple construction so that it is inexpensive to fabricate and install.

While the embodiment of the invention illustrated on the drawing has been described with considerable particularity, it is to be expressly understood that the invention is not restricted thereto, as other embodiments will now be apparent to those skilled in the art, while changes may be made in the details of construction, arrangement, proportion, material, etc., without departing from the spirit of this invention. Reference is therefore to be had to the appended claims for a definition of said invention.

What is claimed is:

1. A temperature regulator for the cooling system of an internal combustion engine of the marine type including an engine jacket and a pump for delivering water from an external source to the engine jacket in excess of the requirements of the cooling system under at least some conditions, a housing providing a passage in communication with said pump and with the inlet of the engine jacket, said housing also providing a chamber in communication with the outlet of the engine jacket and an outlet chamber, an outlet conduit in communication with said outlet chamber, a valve port between said passage and said outlet chamber, a pressure responsive valve cooperating with said port and operable under variations in pressure in said passage for delivering variable quantities of water to said outlet chamber, a valve port between said first named chamber and said outlet chamber, and a thermostatically operated valve cooperating with said last named port and responsive to the temperature in said first named chamber.

2. A temperature regulator for the cooling system of an internal combustion engine of the marine type including an engine jacket and a pump for delivering water from an external source to the engine jacket in excess of the requirements of the cooling system under at least some conditions, a housing providing a passage in communication with said pump and with the inlet of the engine jacket, said housing also providing a chamber in communication with the outlet of the engine jacket and an outlet chamber, an outlet conduit in communication with said outlet chamber, a valve port between said passage and said outlet chamber, a pressure responsive valve cooperating with said port and operable under variations in pressure in said passage for delivering variable quantities of water to said outlet chamber, a valve port between said first named chamber and said outlet chamber, a thermostatically operated valve cooperating with said last named

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port and responsive to the temperature in said first named chamber, and means in association with said last named valve for maintaining a predetermined flow of water over said thermostat when said thermostatically operated valve is closed.

3. A temperature regulator for the cooling system of an internal combustion engine of the marine type including an engine jacket and a pump for delivering water from an external source to the engine jacket in excess of the requirements of the cooling system under at least some conditions, a housing providing a passage in communication with said pump and with the inlet of the engine jacket, said housing also providing a chamber in communication with the outlet of the engine jacket and an outlet chamber, an outlet conduit in communication with said outlet chamber, a valve port between said passage and said outlet chamber, a pressure responsive valve cooperating with said port and operable under variations in pressure in said passage for delivering variable quantities of water to said outlet chamber, a valve port between said first named chamber and said outlet chamber, a thermostatically operated valve cooperating with said last named port and responsive to the temperature in said first named chamber, and means for adjusting said pressure responsive valve to predetermine the extent of its opening under variations of pressure in said passage.

4. A temperature regulator for the cooling system of an internal combustion engine of the marine type including an engine jacket and a pump for delivering water from an external source to the engine jacket in excess of the requirements of the cooling system under at least some conditions, a housing providing a passage in communication with said pump and with the inlet of the engine jacket, said housing also providing a chamber in communication with the outlet of the engine jacket and an outlet chamber, an outlet conduit in communication with said outlet chamber, a valve port between said passage and said outlet chamber, a pressure responsive valve cooperating with said port and operable under variations in pressure in said passage for delivering variable quantities of water to said outlet chamber, a valve port between said first named chamber and said outlet chamber, and a thermostatically operated valve cooperating with said last named port and responsive to the temperature in said first named chamber, said pressure responsive valve including a flexible valve disk cooperating with said first named port and variably flexing under variations of pressure in said passage to predetermine the flow of cooling medium through said port.

5. A temperature regulator for the cooling system of an internal combustion engine of the marine type including an engine jacket and a pump for delivering water from an external source to the engine jacket in excess of the requirements of the cooling system under at least some conditions, a housing providing a passage in communication with said pump and with the inlet of the engine jacket, said housing also providing a chamber in communication with the outlet of the engine jacket and an outlet chamber, an outlet conduit in communication with said outlet chamber for delivering water into heat interchanging relationship with the exhaust pipe of the engine, a valve port between said passage and said outlet chamber, a pressure responsive flexible valve disk cooperating with said port and operable under variations in pressure in said passage for deliver-

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ing variable quantities of water to said outlet chamber, a valve port between said first named chamber and said outlet chamber, and a thermostatically operated valve cooperating with said last named port and responsive to the temperature in said first named chamber, said thermostatically operated valve predetermining the pressure in said passage effective to operate said pressure responsive valve disk and maintain substantially the same water flow into heat interchanging relation with said exhaust pipe whether said thermostatically operated valve is open or closed.

6. A temperature regulator for the cooling system of an internal combustion engine of the marine type including a housing provided with a passage having an inlet adapted to be connected to a pump and an outlet adapted to be connected to the inlet of an engine jacket, said housing also providing a chamber having an inlet adapted to be connected to the outlet of the engine jacket and an outlet chamber having an outlet adapted to be connected to an outlet conduit, a valve port

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between said passage and said outlet chamber, a pressure responsive valve cooperating with said port and including a flexible valve disk which is variably flexible under variations of pressure in said passage to predetermine the flow of medium through said port, a second valve port between said first named chamber and said outlet chamber, a valve member cooperating with said second named valve port, and a thermostat subjected to the temperature in said first named chamber and operatively connected to said last named valve member.

DAVID L. MORGAN.

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