Nov. 15, 1938. J. V. GIESLER 2,137,136

TEMPERATURE REGULATOR FOR INTERNAL COMBUSTION ENGINES

Filed March 9, 1936

Fig. 1.

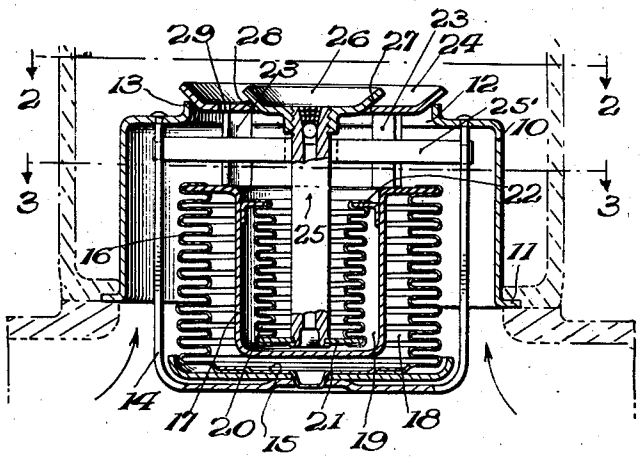


Fig. 2.

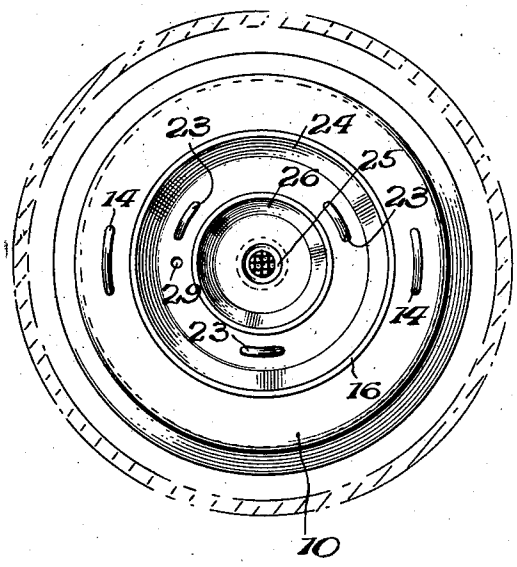
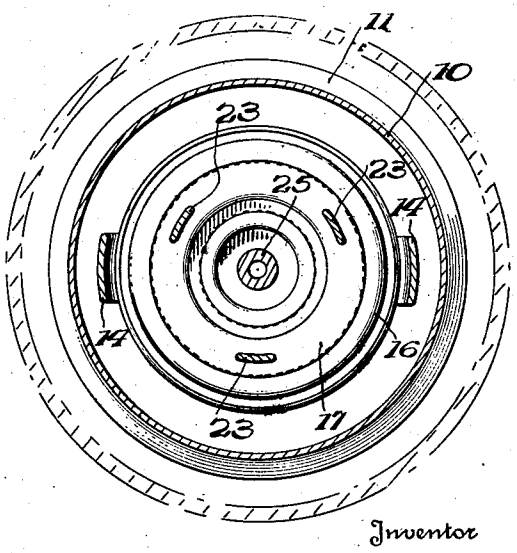


Fig. 3.



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TEMPERATURE REGULATOR FOR INTERNAL COMBUSTION ENGINES

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Application March 9, 1936, Serial No. 67,955

13 Claims. (Cl. 236—34)

This invention relates to temperature regulators for internal combustion engines, and more particularly to a temperature regulator for controlling the circulation of cooling medium through the cooling system of such an engine.

Where heaters for the interiors of automobiles are supplied with their heating medium from the medium circulating through the cooling system of the engine, the effectiveness of the temperature regulator, associated with the cooling system for quickly bringing the cooling medium to a temperature which is suitable for the efficient operation of the engine and thereafter proportioning the circulation of cooling medium through the radiator to maintain the temperature of the cooling medium within a narrow range, in narrowly and accurately controlling the flow of cooling medium becomes of increasing importance. In order that the cooling system may be filled and drained, it is customary to provide the valve member of the temperature regulator with an aperture, ordinarily on the order of ⅛" diameter, so that the medium as well as air may pass readily from one side of said valve member to the other. Experience has demonstrated that with such a constantly open aperture, the amount of circulation through the cooling system under the pressure of the circulating pump is such that, in very cold weather, it is difficult if not impossible to bring the cooling medium up to the designed temperature if the valve member fails to seat tightly or if a bit of great or dirt prevents the valve member from completely closing the port. For example, it has been found that with a main valve of 1⅛" diameter and a leakage opening therein of ⅛" diameter, less than 1/100" lift of the main valve will prevent the temperature of the cooling medium, on a cold day, from being raised above 110° F., and not only is this temperature too low for the efficient operation of the engine but it is also an unsatisfactory temperature for use in a heater for the interior of the automobile. Yet a lift of 1/100" can easily be caused by grit or dirt preventing a proper seating of the main valve member. On the other hand, it is not satisfactory to materially reduce the diameter of the leakage opening, because that much of a passage is required for satisfactorily filling and emptying the cooling system.

It is an object of this invention to provide a temperature regulator for the cooling system of an internal combustion engine that obviates the foregoing difficulties and which while retaining an adequate leakage opening in the valve member includes means whereby the temperature of the cooling medium may be quickly brought to the desired temperature suitable both for the efficient operation of the engine and the desired operation of the heater for the interior of the automobile before such circulation through the system is permitted by the regulator as will prevent the attainment of the desired temperature.

Another object of this invention is to provide a device of the type characterized which includes separately operated valve members, one of relatively small diameter, and which may have a relatively high lift, so that leakage thereby will not materially interfere with prompt attainment and thereafter maintenance of substantially the desired operating temperature, while the other of said valve members provides for an adequate circulation of cooling medium through the cooling system when the desired operating temperature has been exceeded.

Another object of this invention is to provide a device of the type last characterized which employs separate compactly arranged thermostats for operating the two valves at different operating temperatures.

Another object of this invention is to provide a device of the type characterized which is simple in construction, inexpensive to manufacture and install, and efficient in operation.

Other objects will appear as the description of the invention proceeds.

The invention is capable of receiving a variety of mechanical expressions, 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 drawing, wherein the same reference characters are employed to designate corresponding parts in the different figures,—

Fig. 1 is an axial section of an embodiment of the present invention;

Fig. 2 is an end view thereof looking in the direction of the arrows 2—2 in Fig. 1; and

Fig. 3 is a section on the line 3—3 of Fig. 1.

In the form shown, the temperature regulator includes a housing 10 of any suitable size, construction and material and here illustrated as composed of a generally cup-shaped wall which may be conveniently drawn from sheet metal and which is provided at its open end with an outwardly directed peripheral flange 11 so that

said housing may be clamped in position between any suitable members associated with or forming a part of the cooling system. The opposite end of said housing 10 is apertured at 12 to provide a valve port, and as here shown the wall around the said port is flanged axially outward so as to provide a valve seat 13. Suitably attached to the end wall of the housing 10 is a strap 14, to the intermediate portion of which is secured, in any suitable way, the fixed end wall 15 of an expansible and collapsible thermostatic element, here shown as provided with a deeply corrugated expansible and collapsible tubular wall 16 to which said stationary end wall 15 is secured in any suitable way. Attached to the opposite end of said tubular corrugated wall 16 in any suitable way is a cup-shaped movable end wall 17 which constitutes both the inner tubular wall of the chamber of thermostat 18 and the outer peripheral wall of the chamber of an inner thermostat 19, the former chamber having its outer wall formed by said corrugated wall 16 and the latter chamber having its inner wall formed by a second deeply corrugated expansible and collapsible tubular wall 20 secured at one end to a flange 22 attached in any suitable way, as by solder, to the tubular wall 17 and secured at its opposite end in any suitable way to a movable wall 21. Thereby the thermostat 19 constitutes a thermostat of the cup type which is concentrically arranged with respect to thermostat 18 and housed within the movable end wall thereof.

Attached to the radially flanged portion 22 of the movable end wall 17 of the outer thermostat 18, as by a plurality of posts 23, is a valve member 24 of any suitable size, construction and material, and here shown as having a flared periphery adapted to make line contact with the valve seat 13. Attached to the movable end wall 21 of the inner thermostat 19 is a valve stem 25, which may be guided and limited as to its movement in any suitable way as by the combined guide and stop diagrammatically indicated at 25' if desired, to the outer end of which is attached in any suitable way a second valve member 26 also shown as flared outwardly at its periphery and adapted to make line contact with a seat 27 surrounding a valve port 28 formed in the large valve member 24. Either valve member may be provided with a leakage opening 29 of any suitable size, and if desired, said leakage opening may be controlled by an automatically operated valve of any suitable character, such for example as disclosed and claimed in my application, Serial No. 67,550, entitled Temperature regulators for internal combustion engines, filed of even date herewith.

The thermostats 18 and 19 are charged in any suitable way with suitable thermosensitive mediums, and in conformity with the present invention the charges are so selected that the thermostat 18 will expand and open its valve member 24 only after a higher predetermined temperature has been reached than is required to cause thermostat 19 to expand and open its valve member 26. For example, the inner thermostat 19 may be designed to open its valve member at a temperature of 150° F. and the outer thermostat 18 may be designed to open its valve member when a temperature of 160° F. has been reached, but it is to be expressly understood, that any other suitable temperatures or difference in temperatures may be employed, the charges for the respective thermostats being suitably selected to effect the operation of the regulator at the proper temperature to effect the operation herein disclosed.

In operation the cooling system may be normally filled or drained in the usual way, the filling opening 29 permitting an adequate flow of the cooling medium therethrough. When the engine is in operation, circulation through the system is prevented by the regulator, except for such circulation as is permitted by the leakage opening 29, and as hereinbefore explained this flow may also be prevented. The valve members are preferably designed to closely fit their seats, particularly the outer and larger valve member 24, and thereby the temperature of the cooling medium may be promptly raised to its designed temperature. When the designed temperature of operation of the thermostat 19 has been reached, thermostat 19 will expand and open valve member 26 to permit a relatively small circulation through the system, as the valve port 28 is relatively small, while the lift of the valve member 26 may be relatively large so as to assure a flow therethrough that will keep the port clear of dirt. Even the presence of some dirt or lack of tight fit between this valve member and its port will not materially affect the prompt attainment and subsequent maintenance of the designed operating temperature owing to the small volume of cooling medium that may pass through the small diametered part under conditions such as normally cause leakage at the valve member.

If, however, the quantity of circulation permitted by the valve member 26 is insufficient to maintain the temperature of the cooling medium below a designed upper temperature, as for example 160° F. in the illustration above selected, the outer thermostat 18, when the cooling medium rises above the designed temperature, will expand and open the larger valve member 24 to afford an adequate circulation of the cooling medium through the radiator.

The size of the movable end wall 21 and the size of the valve member 26 may be so related that a substantial balance is maintained between the two, and the inner valve member is thereby not raised from its seat under the action of the pump pressure.

While for purposes of compactness the two valves are preferably arranged concentrically as shown, it is to be expressly understood that this is not essential within the broader aspects of the present invention, as the two halves with their thermostatic controls may be entirely separate and control separate valve ports arranged in any suitable way in the same or different walls of the regulator.

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 the same may take a variety of mechanical expressions, some of which will now readily suggest themselves to those skilled in the art, while changes may be made in the details of construction, arrangement and proportion of parts, different forms and construction of thermostats, valve members and connecting means, supporting and housing means, etc., may be employed without departing from the spirit of this invention. Either or both of the thermostats may be so constructed, if desired, that upon failure of the thermostat the valve member is moved to a position of safety. Reference is therefore to

be had to the claims hereto appended for a definition of said invention.

What is claimed is:

1. In a temperature regulator for the cooling system of an internal combustion engine, the combination of means providing a valve port and a thermostatically operated valve member cooperating therewith for controlling the flow of cooling medium therethrough, said valve member being provided with a valve port, and a second thermostatically operated valve member cooperating with said last named valve port and charged to open the same at a temperature below that at which the first named valve member is opened by said first named thermostat.

2. In a temperature regulator for the cooling system of an internal combustion engine, the combination of means providing a valve port, a valve member cooperating therewith, a thermostat operatively connected to said valve member, said valve member being provided with a valve port, a second valve member cooperating with said last named port, and a second thermostat carried by said first named thermostat and operatively connected to said second named valve member.

3. In a temperature regulator for the cooling system of an internal combustion engine, the combination of means providing a valve port, a valve member cooperating therewith, a thermostat operatively connected to said valve member, said valve member being provided with a valve port, a second valve member cooperating with said last named port, and a thermostat operatively connected to said second named valve member and charged to control circulation of the cooling medium unless the temperature exceeds a predetermined maximum, said first named thermostat being charged to open said first named valve member when said temperature is reached.

4. In a temperature regulator for the cooling system of an internal combustion engine, the combination of means providing a valve port, a valve member cooperating therewith, a thermostat operatively connected to said valve member, said thermostat having a cup-shaped movable end wall, and said valve member being provided with a valve port, a second valve member cooperating with said last named port, and a second thermostat disposed in the cavity of said end wall and operatively connected to said second named valve member.

5. In a temperature regulator for the cooling system of an internal combustion engine, the combination with means providing a valve port, a valve member cooperating therewith, a thermostat operatively connected to said valve member, said thermostat including a cup-shaped movable end wall, and said valve member being provided with a valve port, a second valve member cooperating with said last named port, and a cup-type thermostat mounted in the cavity of said movable end wall and having its outer wall formed by said movable end wall of the first named thermostat, said second named thermostat being operatively connected to said second named valve member and charged to open at a lower temperature than said first named thermostat.

6. In a temperature regulator for the cooling system of an internal combustion engine, the combination of means providing a valve port, a valve member cooperating therewith, a thermostat operatively connected to said valve member, said valve member being provided with a valve port, a second valve member cooperating with said last named port, said second named valve member and port being of materially smaller size than said first named valve member and port, and a thermostat operatively connected to said second named valve member and charged to open said second named valve member at a temperature materially below the temperature at which said first named valve member is opened by said first named thermostat.

7. In a temperature regulator for the cooling system of an internal combustion engine, the combination of means providing a valve port, a valve member cooperating therewith, a thermostat operatively connected to said valve member, said valve member being provided with a valve port, a second valve member cooperating with said last named port, said second named valve member and port being of materially smaller size than said first named valve member and port and concentrically arranged with respect thereto, and a thermostat concentrically arranged with respect to said first named thermostat and operatively connected to said second named valve member, said second named thermostat being charged to open said second named valve member at a temperature materially below that at which said first named thermostat opens said first named valve member.

8. In a temperature regulator for the cooling system of an internal combustion engine, the combination of a conduit, means providing a valve port therein, a valve member cooperating therewith to control the flow of cooling medium through said conduit, a second valve port and a second valve member cooperating with said second named valve port for controlling the flow of cooling medium through said same conduit, and two thermostatic means operatively connected to said two valve members, respectively, and adapted to open said valve members at different temperatures to predetermine the volume of flow through said conduit.

9. In a temperature regulator for the cooling system of an internal combustion engine, the combination of a conduit, means providing a valve port therein, a valve member cooperating therewith to control the flow of cooling medium through said conduit, a second valve port and a second valve member cooperating with said second named valve port for controlling the flow of cooling medium through said same conduit, two thermostats operatively connected to said two valve members, respectively, the second named thermostat being charged to open said second named valve member when a predetermined minimum temperature has been reached and said first named thermostat being charged to open said first named valve member when a predetermined maximum temperature has been reached.

10. In a temperature regulator for the cooling system of an internal combustion engine, the combination of means providing a valve port, a valve member cooperating therewith, a valve port arranged centrally in said valve member, a second valve member cooperating with said second named valve port, and a pair of concentrically arranged thermostats respectively connected to said two valve members and adapted to operate the same in sequence.

11. In a temperature regulator for the cooling system of an internal combustion engine, the combination of means providing a valve port, a valve member cooperating therewith, a valve port in said valve member, a second valve member

cooperating with said second named valve port, a thermostat operatively connected to said first named valve member and provided with a cup-shaped movable end wall, a cup-type thermostat having its outer rigid wall formed by said movable end wall of the first named thermostat, and operative connections between two said thermostats and said valve members, respectively.

12. In a temperature regulator for the cooling system of an internal combustion engine, the combination of means providing a valve port, a valve member cooperating therewith, a second valve port, a second valve member cooperating with said second named valve port, and two thermostats respectively connected to said valve members and adapted to operate said valve members in sequence, the movable wall of one of said thermostats providing the relatively stationary wall of the other of said thermostats.

13. In a temperature regulator for the cooling system of an internal combustion engine, the combination of means providing a valve port and a valve member cooperating therewith for controlling the flow of cooling medium therethrough, a thermostat for operating said valve member, means providing a second and smaller valve port, a second valve member cooperating with said last named valve port and a second thermostat for operating said second valve member and charged to open the same at a temperature below that at which the first named valve member is opened by said first named thermostat.

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