Nov. 12, 1929. W. B. CLIFFORD 1,734,963

THERMOSTATIC CONTROL OF COOLING CIRCULATION

Filed Nov. 24, 1926

Fig. 1

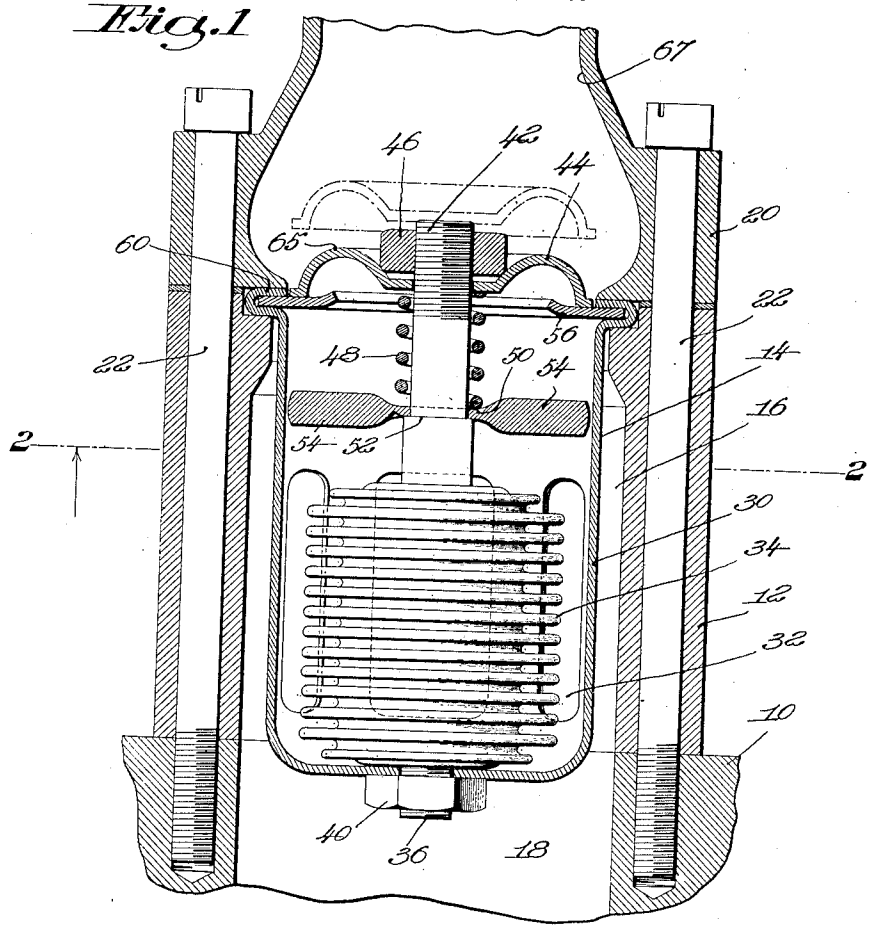
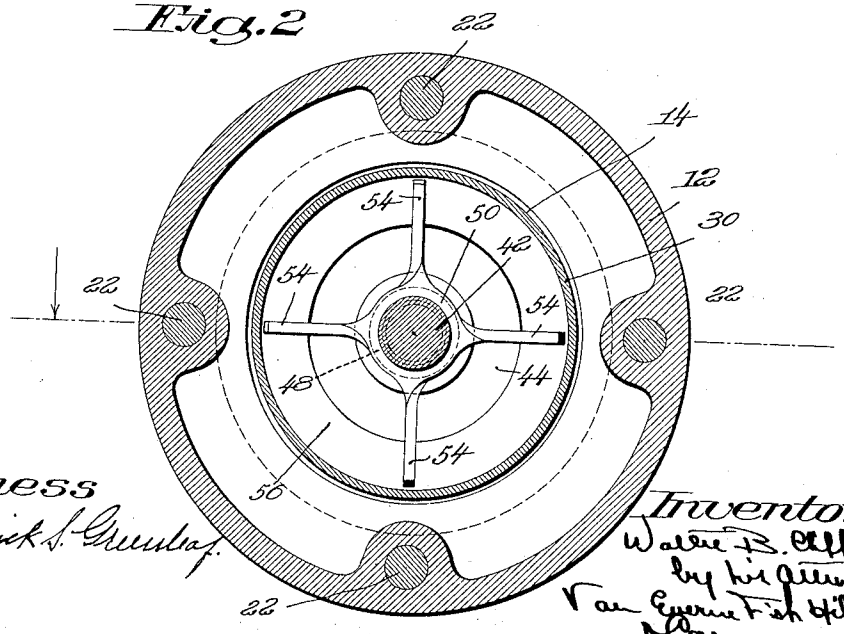


Fig. 2



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UNITED STATES PATENT OFFICE

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THERMOSTATIC CONTROL OF COOLING CIRCULATION

Application filed November 24, 1926. Serial No. 150,581

The present invention relates to improvements in apparatus for controlling cooling fluid flow of an internal combustion motor thermostatically, and more particularly to to an apparatus of this character employed in motor vehicles.

In a typical installation of this character a thermostatically-controlled valve is inserted directly in the circulating system, either adjacent to the upper portion of the motor block or the upper portion of the radiator. This valve remains closed, retarding or completely stopping circulation through the block until the temperature of the cooling fluid therein has been elevated to a predetermined point. Thereafter, operation of the thermostat opens the valve and permits circulation of water, or other cooling fluid, into and through the radiator.

In typical installations of this character the valve is designed to open from 135° to 165° F., depending upon the circulating system and the location of the valve. Ordinarily, when the thermostat unit is located in the radiator inlet, the valve is caused to open at a lower temperature than when the unit is located in immediate proximity to the motor block. In either event, it is desirable that when the predetermined temperature within the circulating system has been reached that the valve shall open as rapidly as possible and permit a relatively free circulation of water with a minimum rise of temperature above the opening point.

To this end the primary object of the present invention is to provide a thermostatically controlled unit in which the range or spread of temperature from commencement of opening to full opening of the valve is reduced to a minimum.

With this and other objects in view, therefore, the various features of the invention consist in certain novel features of construction, combinations and arrangements of parts hereinafter described and claimed, the advantages of which will be obvious to those skilled in the art from the following description.

In the accompanying drawings illustrating the preferred form of the invention,

Fig. 1 represents a section in elevation of an installation embodying the features of the invention; and

Fig. 2 is a cross section taken upon the line 2—2 of Fig. 1.

Referring to the drawings, the top of the cylinder block is indicated at 10, and has connected thereto a sleeve casting 12 which encloses a thermostatic unit 14. The casting is provided interiorly with a chamber 16 communicating directly with the water space 18 of the block and permitting the passage of water upwardly about the thermostatic unit. The upper portion of the sleeve casting is surmounted by an outlet casting 20, which is adapted to be connected in any desired manner with the usual radiator connections. The entire assembly is rigidly connected to the top of the cylinder block by through bolts 22. The thermostatic unit comprises essentially a thin drawn or stamped shell 30 having a series of openings 32 for the free passage of water. Mounted within the shell is a metallic bellows 34 rigidly connected to the shell at the closed end by a threaded stud 36 and nut 40. The opposite free end of the bellows carries an elongated stud 42 upon the upper end on which is mounted a valve 44. This valve is retained in adjusted position upon the stud by a nut 46 and a spring 48 surrounding the stud and holding the valve against the nut. Mounted on the stud below the valve is a stop member 50 held against a shoulder 52 by the spring 48, and comprising generally radiating arms 54 which engage with the under side of an annulus 56 to limit the opening movement of the valve. The annulus 56, as indicated particularly in Fig. 1, is formed by a bent metal strip clamped in the upper portion of the shell 30 by the inturned flange 60. This annulus not only limits the upward movement of the valve but the upper portion of the annulus constitutes a seat for the valve 44 when in the closed position shown in the drawing. As will be evident to those skilled in the art, the metallic bellows is filled with a vaporizable liquid at a pressure substantially less than atmospheric, and for all temperatures below the predetermined opening point exerts a pull upon the valve sufficient to main-

tain it in closed position against the head of water therebeneath. When the predetermined opening point is reached, the water head, due to the action of the pump, is sufficient to overcome the pull of the bellows which has been reduced by increase of vapor pressure therein, and the valve opens. According to the present invention, this opening tendency is greatly accentuated by a velocity or reaction head created through the novel shape of the valve. As will be observed from an inspection of Fig. 1, the valve 44 is provided with a raised annular portion 65 intermediate its inner and outer circumferences to form a reversely curved annular chamber at the under side of the head, of such a character that the water is turned through 180 degrees and a substantial reaction effect is exerted thereby. It will be evident that when the valve rises from its seat, the water current, due to its substantial change in direction, exerts a reaction effect tending to further elevate the valve without any increase in pressure head. This substantial addition to the elevating force beneath the valve causes it to open with a range of temperature materially less than would be possible if the pressure head alone were relied upon. After the water has passed from beneath the valve, it is guided upwardly by the converging walls 67, shaped to avoid the formation of an eddy current and to reduce the desired reaction effect. In connection with the utilization of this velocity head, it will be noted that the arms 54 of the stop member 50 are relatively thin transversely of the direction of flow of the water, and are relatively thicker in the direction of flow, which is accomplished by stamping the arms from a thin sheet and thereafter turning the arms through an angle of 90° with the plane of the sheet. This causes the arms, in fully open position, to present the least obstruction to the water way and avoids, so far as possible, the formation of undesirable eddy currents below the valve.

What is claimed is:

1. Temperature-controlled apparatus comprising metallic bellows, an open cage connected with the bellows at one end, a valve opening formed in the cage, a valve connected with the opposite end of the bellows and cooperating with the opening, the valve being shaped and designed in conjunction with the valve opening to reverse the direction of flow of water therebeneath upon opening in a manner to cause the exertion of a substantial reaction head in a direction to open the valve.

2. Temperature-controlled apparatus comprising an expansible metallic bellows, a cage connected to the bellows at one end having a valve opening therein, a valve connected with the free end of the bellows and having a reversely-curved, annular chamber adjacent the valve opening, and means for directing liquid flow through the valve opening against the inner portion of the valve from whence the direction of flow is reversed in contact with the annular chamber to exert a reaction effect on the valve.

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