Jan. 30, 1923. 1,443,465.

W. M. FULTON.

AUTOMATIC RADIATOR CURTAIN.

FILED FEB. 6, 1917. 2 SHEETS—SHEET 1.

Fig. 2.

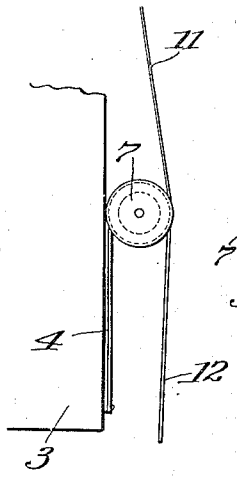
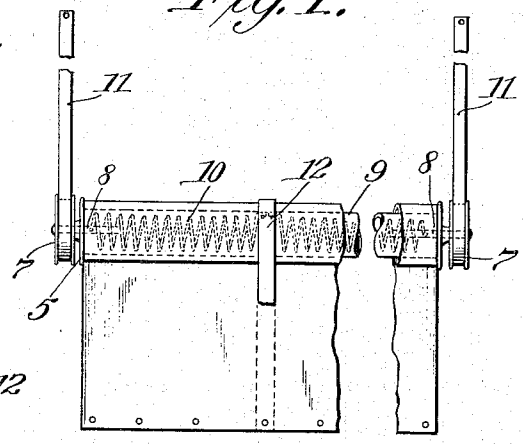


Fig. 1.



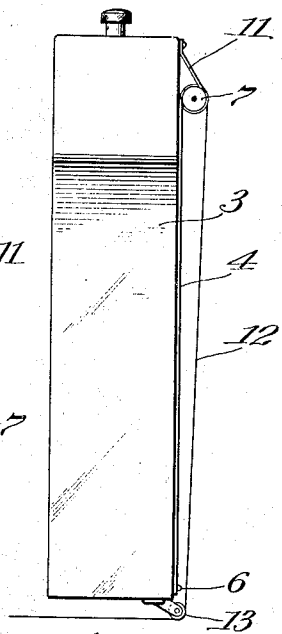


Fig. 3.

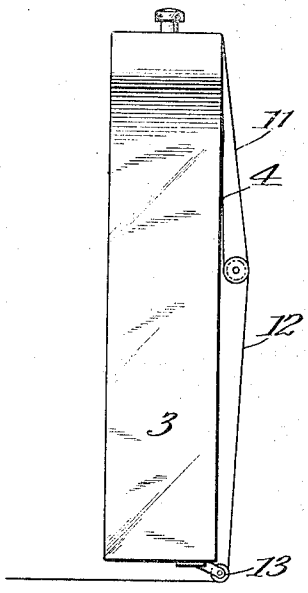


Fig. 4.

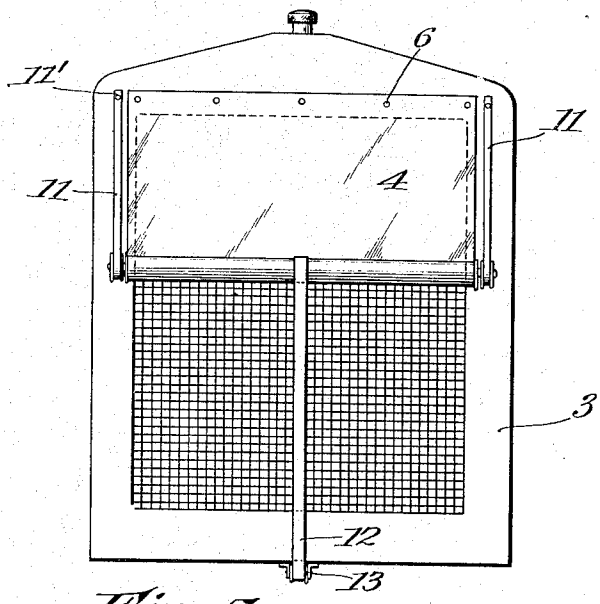


Fig. 5.

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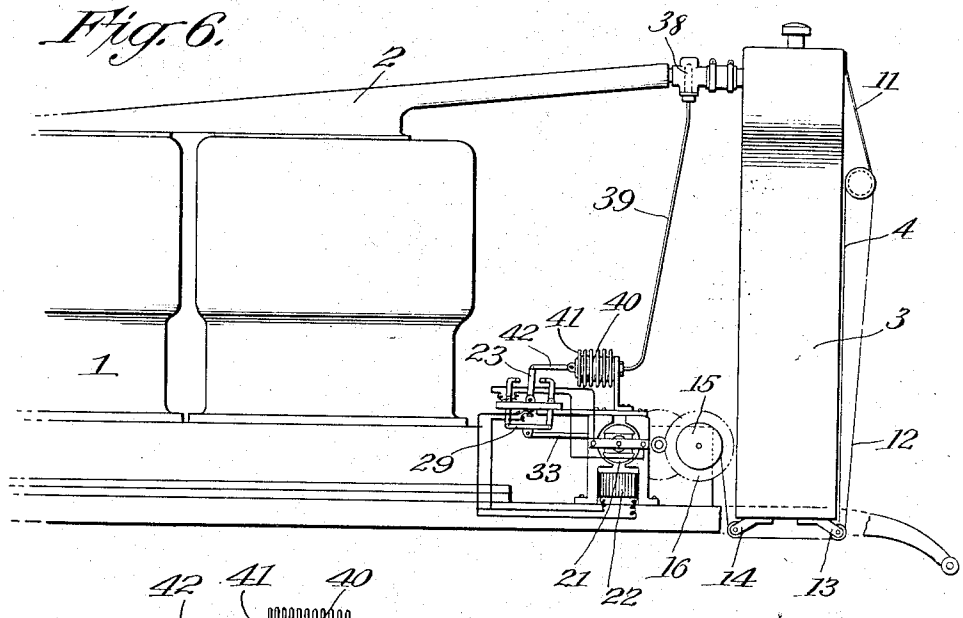
Jan. 30, 1923. 1,443,465.

W. M. FULTON.

AUTOMATIC RADIATOR CURTAIN.

FILED FEB. 6, 1917. 2 SHEETS—SHEET 2.

Fig. 6.



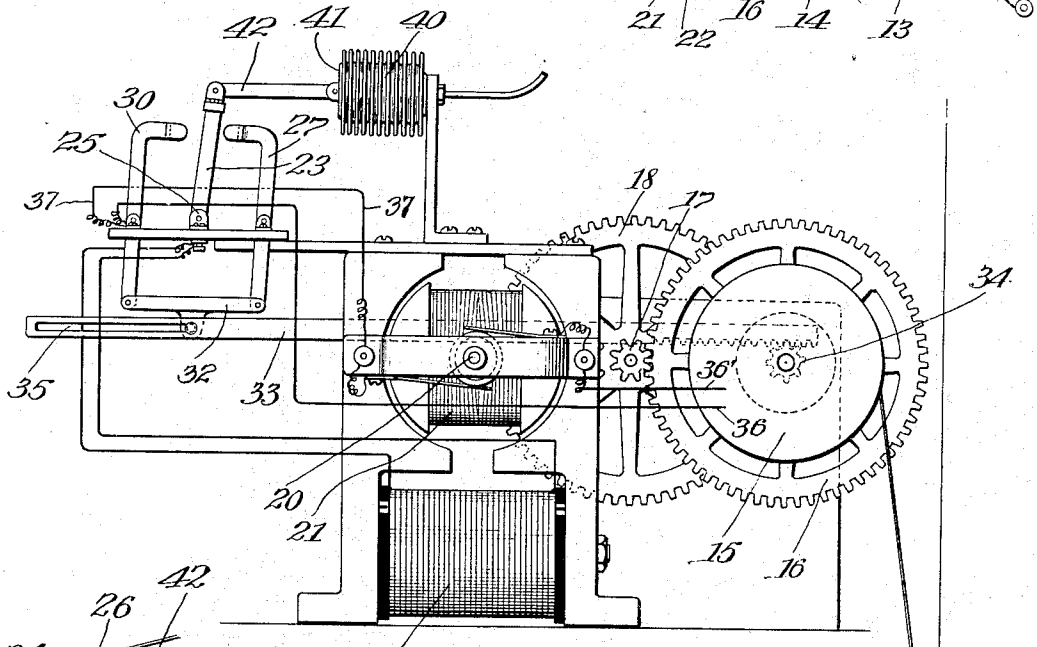


Fig. 7.

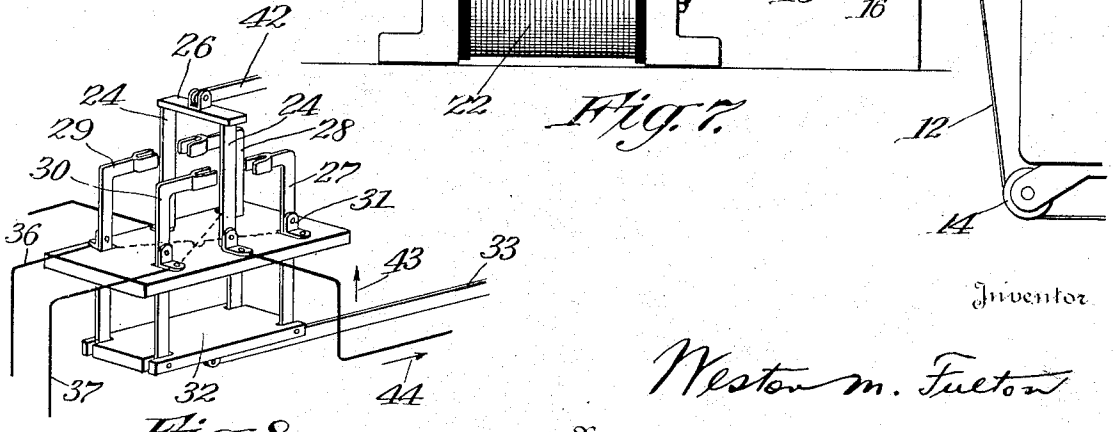


Fig. 8.

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Patented Jan. 30, 1923. 1,443,465

UNITED STATES PATENT OFFICE.

WESTON M. FULTON, OF KNOXVILLE, TENNESSEE.

AUTOMATIC RADIATOR CURTAIN.

Application filed February 6, 1917. Serial No. 146,964.

To all whom it may concern:

Be it known that I, WESTON M. FULTON, a citizen of the United States of America, and a resident of Knoxville, Tennessee, have invented a new and useful Improvement in Automatic Radiator Curtains, which invention is fully set forth in the following specification.

This invention relates to devices for regulating the flow of air in heat-interchanging relation with a radiator, particularly radiators used in cooling systems for internal combustion engines and, while capable of use with a wide variety of engines of this type, is especially designed for use in combination with radiators in the cooling systems of internal combustion engines used on automobiles.

It is an object of this invention to provide an improved system for maintaining an internal combustion engine at a desired temperature, preferably that temperature at which the engine operates most efficiently.

It is a further object of this invention to provide in a system of the type characterized means for controlling the cooling effect of the cooling system and improved motive means for automatically operating said controlling means.

Yet another object of this invention is to provide a radiator, particularly for an internal combustion engine, with a curtain and automatic means for moving said curtain relatively to the radiator to vary the flow of air in heat-interchanging relation therewith.

Still a further object of this invention is to provide a radiator, particularly for an internal combustion engine, with a motor-operated curtain for controlling the flow of air in heat-interchanging relation with said radiator and thermosensitive means for controlling the operation of said motor.

Other objects relate to the provision of a device of the type characterized which is simple in construction, easy to install, inexpensive to manufacture, and efficient and inexpensive in operation.

Stated broadly, the invention comprises, in combination with a radiator, a curtain for covering and uncovering said radiator and automatic means for operating said curtain, said automatic means preferably taking the form of a motor and thermosensitive means for initiating the operation of said motor.

Stated somewhat more specifically, the invention comprises, in combination with an internal combustion engine, a system for circulating a cooling medium in heat-interchanging relation with said engine, means for controlling the cooling effect of said system, preferably in the form of a radiator in said system and a curtain for covering and uncovering said radiator, and means for automatically operating said controlling means, said last-named means in the embodiment illustrated taking the form of a motor, a motor-controlling device and thermosensitive means operatively connected to said motor-controlling device to move the same to motor-starting position, means being further provided for moving said motor-controlling device to motor-stopping position at predetermined times.

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

In said drawings—

Fig. 1 is a fragmentary front view of a preferred form of curtain to be employed in the present invention:

Fig. 2 is a fragmentary end elevation of said curtain:

Fig. 3 is an end elevation of a radiator showing the curtain in position;

Fig. 4 is an end elevation of a radiator showing a different arrangement of the curtain;

Fig. 5 is a face view of the radiator and curtain of Fig. 4;

Fig. 6 is a diagrammatic elevation of the cooling system of an internal combustion engine embodying the present invention, and illustrates an automatic means for operating the curtain;

Fig. 7 is an enlarged elevation of the motor and its associated devices; and

Fig. 8 is a perspective of the motor-controlling switch.

Referring in detail to said drawings, wherein the same reference characters designate corresponding parts in the several figures, 1 represents the cylinders of any preferred form of internal combustion engine, such, for example, as is commonly employed on automobiles. The cylinders 1 are provided with the usual jackets for circulating a cooling medium in heat-interchanging relation therewith, said jackets being provided with the usual outlet manifold 2 communicating with any suitable form of radiator 3, from which the cooling medium returns to the cylinder jackets.

In accordance with the present invention, a curtain is provided for covering and uncovering the face of radiator 3. Any suitable form of curtain may be employed, that illustrated comprising a rectangular piece 4 so constructed as to size, thickness and material that when covering the face of the radiator 3 it will effectively exclude the passage of air therethrough. This curtain is shown as designed to be rolled on and unrolled from a roller 5 which, in the embodiment illustrated on the drawings, is designed to move relatively to the radiator, one end of the curtain being secured to the radiator as shown at 6. Any suitable form of roller may be employed, that illustrated comprising a pair of pulleys 7 rotatably mounted on pins 8 extending within a roller casing 9 and rotable with respect thereto. Within the roller casing are one or more springs 10 connected at one point to the roller casing 9 and at opposite ends to the pins 8. Bands, cords or wires 11 are secured at one end to the radiator, as shown at 11′, and at their opposite ends are wrapped about the pulleys 7. An operating band, cord or wire 12 is connected to the roller casing at one end and extends around a pulley 13 secured to the radiator and thence to curtain-operating means to be described hereinafter. In the embodiment of the invention shown in Fig. 3, the curtain is secured to the radiator along the lower edge thereof and normally covers the face of the radiator. When the curtain is rolled onto the roller 5, the spring or springs 10 are tensioned by the relative rotation of the pulleys 7 and roller casing 9, so that upon release of the curtain it is returned to cover the face of said radiator. In the embodiment illustrated in Figs. 4 and 5, the curtain is secured to the radiator along the upper edge thereof, and the spring or springs 10 are tensioned by unrolling the curtain to cover the face of the radiator, whereby, upon release of the curtain, it is returned to a position uncovering the face of the radiator.

Any suitable form of automatic curtain-operating means may be employed, such means, however, preferably being thermo-sensitively controlled as by the temperature of the medium flowing through the cooling system. In the form shown, the curtain-operating member 12 extends around a second pulley 14, which may also be mounted on the radiator or any other suitable support, and thence extends around a winding drum 15 driven by a gear 16 in mesh with a gear 17, which latter gear is coaxial with a gear 18 in mesh with a gear on the motor shaft 20. Any suitable form of motor may be employed, that illustrated being an electrical motor comprising the armature windings 21 and the field windings 22. Any suitable means may be employed to start and stop the motor, a double knife-switch 23 being illustrated. In the form shown, said switch comprises a pair of conducting arms 24 pivoted to the frame at 25 and connected by a cross bar 26. Two pairs of terminals 27, 28 and 29, 30 are pivotally mounted in the frame, as shown at 31, and connected by a plate 32 which is operatively connected to a rack bar 33, the latter coacting with a pinion 34 coaxial with gear 16 and winding drum 15. The connection between plate 32 and rack bar 33 is shown as a pin-and-slot connection 35, the purpose of which will appear hereinafter.

The type of motor chosen for illustration is series wound, one line wire 36 leading to terminal 29 and the other line wire 36′ leading to the armature winding 21. The opposite armature lead 37 extends from terminal 30, while the terminals 27 and 28 are respectively connected with the terminals 29 and 30, as shown in Fig. 8. The field connections extend from the two arms 24 of the knife switch, as is also clearly illustrated in this figure.

For operating knife switch 23 to move the same to motor-starting position, a thermo-sensitive device is provided, the same being shown as subjected to the temperature of the cooling medium flowing through the cooling system, although the same could, if desired, be subjected to the air flowing through the radiator. Any suitable form of thermosensitive means may be employed, that illustrated comprising a bulb 38 extending within one of the conduits in said cooling system, said bulb being in communication through flexible pipe 39 with an expansible and collapsible vessel 40 having a displaceable wall 41 connected by a link 42 to cross bar 26 of switch 23. Vessel 40 is preferably constructed of corrugated resilient metal,

and said vessel, conduit 39 and bulb 38 are charged with a thermosensitive fluid, preferably at a pressure below that of the surrounding medium.

Upon starting the engine, cooling medium flows through the jackets of the engine, the radiator 3 and back to said jackets. The curtain 4 is now in position to cover the face of the radiator and substantially exclude the passage of air therethrough. The cooling medium flowing through the cooling system is cooled little, if at all, and quickly rises in temperature until it approximates the selected temperature, preferably that temperature at which the engine operates most efficiently. While the engine is warming up, the thermosensitive fluid in bulb 38, pipe 39 and vessel 40 is condensed, said vessel is contracted, and switch 23 is held in its neutral position. When the desired temperature is reached, said thermosensitive fluid responds to the increase in temperature and the pressure within the thermosensitive device increases sufficiently to expand vessel 40 and move knife switch 23 until its arms 24 engage terminals 29 and 30. Current now flows to the motor through line wire 36, terminal 29, switch arm 24, through the field-windings in the direction indicated by the arrow 43 in Fig. 8, through switch arm 24, terminal 30, armature connection 37 and back through line wire 36'. The motor rotates winding drum 15 through the gearing shown, and the curtain (in the embodiment of Figs. 1 to 3) is rolled onto the roller 5, uncovering the face of the radiator. As the curtain is rolled onto said roller, the bands 11 unroll from the pulleys 7, rotating the latter in the opposite direction to that in which roller casing 9 is rotated, and tensioning the spring or springs 10. During the rotation of winding drum 15, pinion 34 reciprocates rack 33, and just when the curtain entirely uncovers the face of the radiator, rack 33 engages the end of its slot 35 with the depending pin on plate 32, and moves the terminals 27, 28, 29 and 30 to disengage the latter two terminals from the arms of the switch 23. The switch is now in neutral or motor-stopping position. Upon a decrease in the temperature of the medium flowing through the cooling system the thermosensitive fluid within the thermosensitive device condenses, vessel 40 is collapsed, and the arms 24 of switch 23 are drawn into engagement with the terminals 27 and 28. Current now flows to the motor through line wire 36, terminal 27, arm 24, through the field windings in the direction indicated by the arrow 44 in Fig. 8, through switch arm 24, terminal 28, armature connection 37, and back through the line wire 36'. The motor now turns in the opposite direction. Drum 15 is rotated in the opposite direction, the tension on curtain 4 is relieved, and the spring or springs 10, owing to their tensioned condition, unroll the curtain from roller 5 until the former entirely covers the face of the radiator. Just as the curtain covers the face of the radiator, rack 33, moved in the opposite direction by the opposite rotation of gear 34 from that heretofore described, engages the end of its slot with the depending pin on plate 32 and moves terminals 27, 28, 29 and 30 to disengage terminals 27 and 28 from the arms 24 of switch 23. Said switch is therefore again moved to its neutral or motor-stopping position.

Under normal conditions, the vessel 40 is partially collapsed owing to the excess of the external pressure over the internal pressure, such collapse occuring against the resiliency of the metal walls of said vessel. Upon equalization of the external and internal pressures, as when there is a leak, the elasticity inherent in the walls of said vessel 40 causes expansion of the same and moves switch 23 to that position in which it is designed to start the motor to uncover the face of the radiator. If said curtain is already withdrawn from the face of the radiator, this movement will have no effect except to render the switch unresponsive upon the occurrence of subsequent temperature changes and therefore incapable of actuating the motor to release the curtain to cover the face of the radiator. If the curtain is covering the face of the radiator upon the occurence of a leak, the motor is started to withdraw the curtain from the face of the radiator and maintain the latter uncovered. Obviously, in place of a vessel having a wall possessing inherent resiliency, a vessel of non-resilient material could be employed together with a spring, within or without said vessel, tending to move the displaceable wall 41 in a direction to expand said vessel.

It will be understood that in the structure of Figs. 4 and 5, wherein the spring or springs tend to withdraw the curtain to uncover the face of the radiator, the winding drum 15 unrolls the curtain to cover the face of the radiator in one direction and releases the tension on the curtain to permit the spring or springs to roll up the curtain in the opposite direction to uncover the face of the radiator.

While the illustrated embodiment has been described with considerable particularity, it is to be expressly understood that the invention is not to be restricted to the constructions illustrated on the drawings, for it is capable of receiving a variety of mechanical expressions, some of which will now readily suggest themselves to those skilled in the art, while certain features of the invention are susceptible of use without

other features thereof. Reference is therefore to be had to the claims hereto appended for a definition of the limits of said invention.

What is claimed is:—

1. In combination with an internal combustion engine, a system for circulating a cooling medium in heat-interchanging relation therewith, a radiator in said circulating system, a curtain for said radiator, a roller onto and from which the curtain is adapted to be wound and unwound, spring means cooperating with said roller and tending to maintain said curtain unwound therefrom, and thermostatically controlled motive means for winding said curtain onto said roller.

2. In combination with an internal combustion engine, a system for circulating a cooling medium in heat-interchanging relation therewith, a radiator in said circulating system, a curtain for said radiator, an electric motor for operating said curtain, a reversing switch in the motor circuit, means for throwing said switch to neutral position at predetermined points in the movement of said curtain, and a thermostat for operating said switch to start said motor.

3. In combination with an internal combustion engine, a system for circulating a cooling medium in heat-interchangng relation therewith, a radiator in said circulating system, a curtain for said radiator, a motor for operating said curtain, a thermostat for starting said motor, and automatic means for stopping said motor.

4. In combination with an internal combustion engine, a system for circulating a cooling medium in heat-interchanging relation therewith, a radiator in said circulating system, a curtain for said radiator, an electric motor for operating said curtain, a switch in the motor circuit, a thermostat for throwing said switch to motor-starting position, and automatic means for throwing said switch to motor-stopping position.

5. In combination, an automobile radiator, a curtain for said radiator, a motor for moving said curtain, thermostatically-controlled means for starting said motor, and automatic means for moving said motor-starting means to motor-stopping position.

6. In combination, an automobile radiator, a curtain for said radiator, an electric motor for moving said curtain, a switch in the motor circuit, a thermostat for throwing said switch to motor-starting position, and means for automatically throwing said switch to motor-stopping position.

7. In combination, an automobile radiator, a curtain for said radiator, an electric motor for operating said curtain, a reversing switch in the motor circuit, means for throwing said switch to neutral position at predetermined points in the movement of said curtain, and a thermostat for operating said switch.

8. In combination with an internal combustion engine, a system for circulating a cooling medium in heat-interchanging relation therewith, a radiator in said circulating system, a curtain for said radiator, means for operating said curtain, and thermosensitive means for controlling said operating means, said thermosensitive means being so constructed as to actuate said operating means to withdraw the curtain from in front of said radiator upon failure of the temperature control.

9. In combination with an internal combustion engine, a system for circulating a cooling medium in heat-interchanging relation therewith, a radiator in said circulating system, a curtain for said radiator, a motor for operating said curtain, motor-controling means, and thermosensitive means for operating said motor-controlling means, said thermosensitive means being so constructed as to move said motor-controlling means to the position for actuating the motor to withdraw the curtain from in front of the radiator upon failure of the temperature control.

10. In combination with an internal combustion engine, a system for circulating a cooling medium in heat-interchanging relation therewith, a radiator in said circulating system, a curtain for said radiator, means for operating said curtain, and thermosensitive means for controlling said operating means, said thermosensitive means comprising a vessel provided with a wall displaceable against an elastic force and operatively connected to said operating means, said vessel being charged with a fluid exerting a pressure interiorly thereof less than the pressure to which said vessel is exteriorly subjected and said wall being so connected to said operating means as to actuate said operating means to withdraw said curtain from in front of the radiator upon equalization of the internal and external pressures acting on said vessel.

11. In combination with an internal combustion engine, a system for circulating a cooling medium in heat-interchanging relation therewith, a radiator in said circulating system, a curtain for said radiator, a motor for operating said curtain, motor-controlling means, and thermosensitive means for operating said motor-controlling means, said thermosensitive means comprising a vessel provided with a wall displaceable against an elastic force and operatively connected to said motor-controlling means, said vessel being charged with a fluid exerting a pressure interiorly thereof less than the pressure to which said vessel is exteriorly subjected, and said wall being so connected to said motor-controlling means as to move the same to

the position for actuating the motor to withdraw the curtain from in front of the radiator upon equalization of the internal and external pressures acting on said vessel.

12. In combination with an internal combustion engine, a system for circulating a cooling medium in heat-interchanging relation therewith, a radiator in said circulating system, a curtain for said radiator, motive means for operating said curtain, means to stop said motive means at predetermined points in the movement of said curtain, and a thermostat for operating said last-named means to start said motive means.

In testimony whereof I have signed this specification.

WESTON M. FULTON.