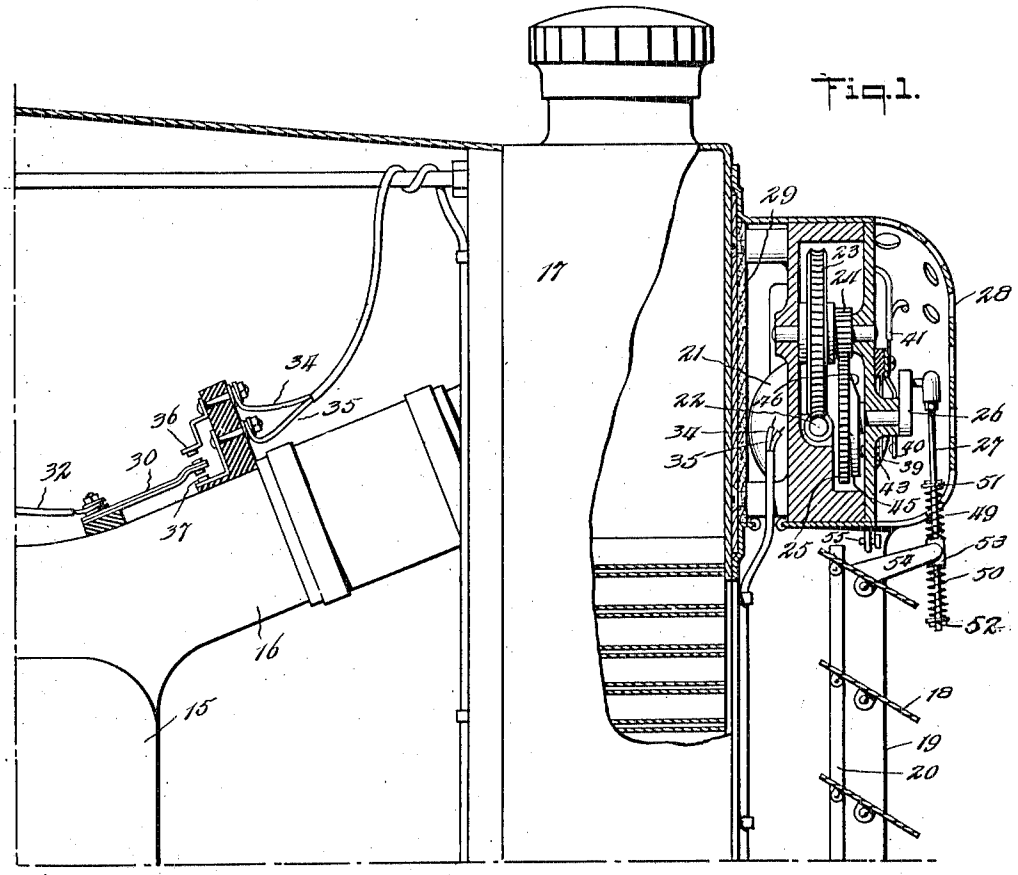
Aug. 23, 1927. 1,640,233

W. A. COLLINS

SHUTTER OPERATING MEANS

Filed Sept. 17, 1925 2 Sheets-Sheet 1

Fig. 1.



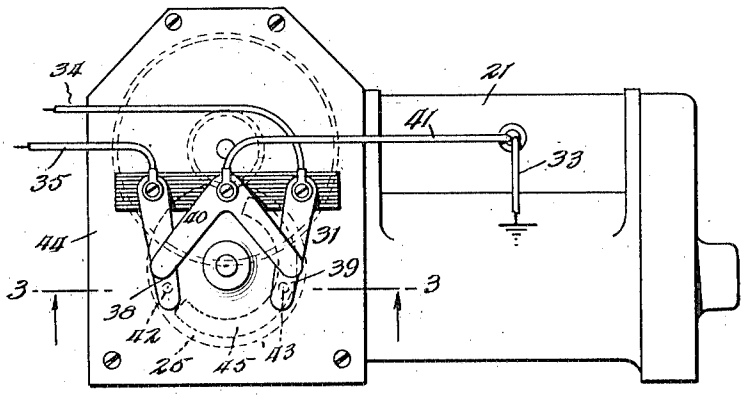


Fig. 2.

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Fig. 3.

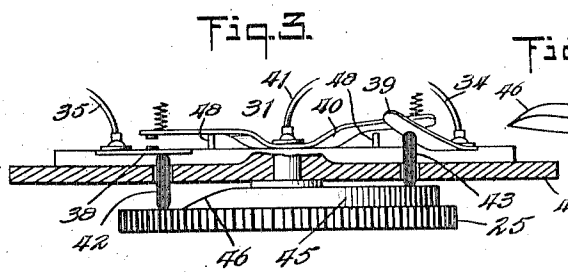
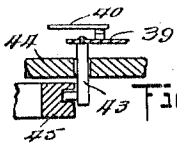


Fig. 9.

Fig. 10.



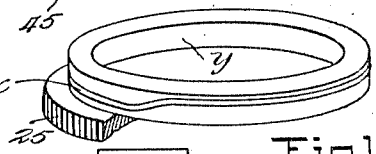


Fig. 11.

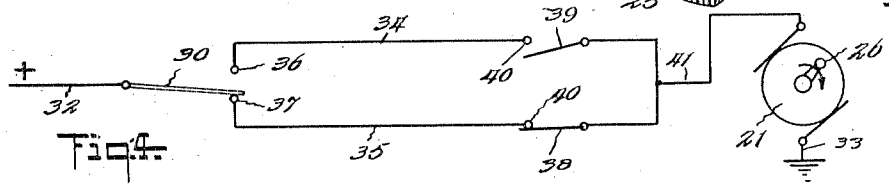


Fig. 4.

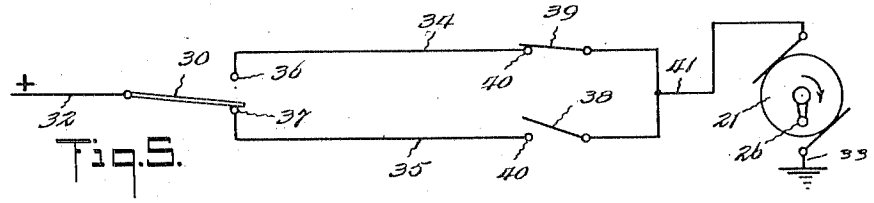


Fig. 5.

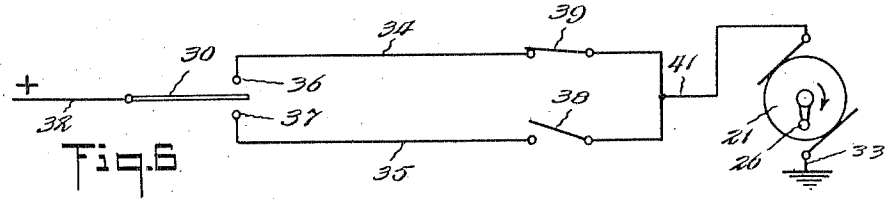


Fig. 6.

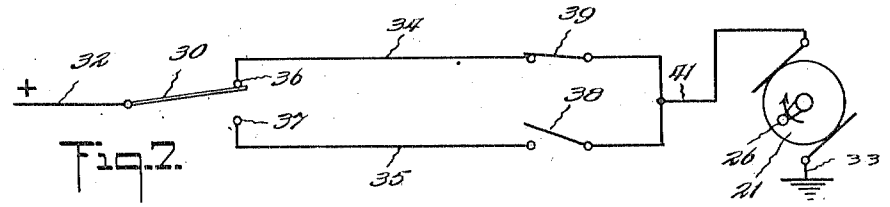


Fig. 7.

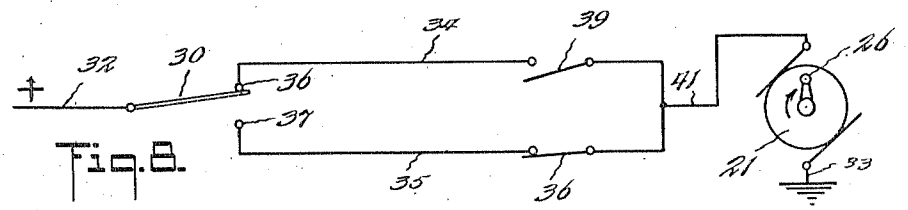


Fig. 8.

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UNITED STATES PATENT OFFICE.

WILLIAM A. COLLINS, OF BROOKLYN, NEW YORK.

SHUTTER-OPERATING MEANS.

Application filed September 17, 1925. Serial No. 56,928.

My invention relates to shutter operating means, and is particularly adapted to the automatic operation of shutters for automobile radiators. Among the objects of my invention may be mentioned—first, the thermostatic control of the shutter operating motor circuit to maintain the explosion engine at its most efficient working temperature; second, a self-contained unit comprising a motor and automatic switch for opening the motor circuit when the shutter has been operated; third, an appropriate mounting for this unit in the shutter frame so that the shutter and its operating motor unit constitute a unitary appliance readily mountable at the front of the radiator; fourth, variuos features of novelty in the motor circuit, switch and shutter connections hereinafter described or shown in the accompanying drawings, in which

Fig. 1 is a broken side elevation of portion of the engine block, radiator and shutter showing my invention applied thereto;

Fig. 2 is a front elevation of the electric motor and its associated switch;

Fig. 3 is a section drawn to a larger scale showing the electric motor-operated switch;

Figs. 4–8 inclusive are diagrams illustrating the automatic control of the motor circuit;

Fig. 9 is a perspective of the cam illustrated in Fig. 3;

Fig. 10 is a section; and

Fig. 11 is a perspective of a modified form of cam and operating connection.

The advantage in efficiency which results from maintaining an explosion engine at high temperature within a predetermined range is well understood. Various devices for this purpose have been suggested, but have not gone into general use by reason of their complications, their delicacy or their expensive construction.

My invention provides a simple, inexpensive and efficient layout for accomplishing this result. In Fig. 1 I have indicated the application of my invention to the operation of a radiator shutter for an automobile engine of conventional type. Its adaptation to other engine or shutter constructions will be readily understood by those dealing with the problem.

The water jacket of the engine block 15 is connected by pipe 16 with the head of radiator 17. In front of the latter are arranged the shutters 18 by which the flow of air to the radiator passages is controlled. In the form here shown the shutters are pivoted in a frame 19 attached to the radiator or to its casing, but they may be mounted directly in the radiator casing if preferred. A bar 20 joined to the several shutters moves them in unison.

To operate the shutters I provide an electric one-way motor 21, the rotor shaft of which is provided with a worm 22 meshing with worm wheel 23. Pinion 24 fast with the worm wheel drives gear 25, on the shaft of which is a crank arm 26. Connecting rod 27 is jointed to the crank at one end, and to the shutter mechanism at its other end so that upon rotation of the crank its swing through half a rotation opens the shutters, while its rotation through the balance of the circle closes the shutters. The motor and its associated parts are mounted and housed within a ventilated casing 28 at the head of the frame and preferably integral therewith, and are protected from the heat of the radiator 17 by an asbestos sheet 29, or the like.

The motor circuit is subject to dual control, on the one hand, by a thermostat 30 which may be conveniently mounted on the water pipe 16 of the engine block, and on the other hand by a switch 31 (Fig. 2) operated by a motor driven member. A feed wire 32 is connected to the thermostat 30 from any suitable source of current supply, for example a generator (not shown) associated with the engine. The lead 33 from the motor is grounded to the engine frame, or the like. Between the thermostat 30 and switch 31 the circuit is branched to afford leads 34 and 35 arranged in parallel and connected respectively at one end to the thermostat contacts 36 and 37, and at their opposite ends to the contact arms 38 and 39 of the switch 31. The contact arms 38 and 39 cooperate respectively with the branches of the V-shaped contact 40 from which wire 41 leads to the motor winding.

The thermostat may be of any appropriate character. For simplicity I prefer to use a bi-metallic strip 30 having at its free end platinum contacts adapted to engage corresponding tips on the contacts 36 and 37 between which the free end of the strip 30 plays. When the fluid circulating through the engine jacket is at a predetermined desired temperature for high engine efficiency, the thermostatic strip 30 occupies

a position intermediate the contacts 36 and 37. When the temperature of the fluid reaches the upper limit of its predetermined range, the strip is warped into engagement with the contact 36 and thus closes the motor circuit at this point through branch 34. When the temperature of the fluid reaches the lower limit of the range, the thermostatic strip is warped into engagement with the contact 37 and establishes the motor circuit at this point through branch 35.

The two contact arms 38 and 39 of the motor controlled switch 31 are preferably of spring metal, as also the arms of the V-contact 40. Open-circuit position is normally assumed by both contact arms 38—39. Co-operating with the latter, however, are pins 42 and 43 guided for rectilinear movement by apertures in base plate 44. On the opposite side of the plate and underlying and supporting the plungers is the side face of the gear 25. On this face of the gear is arranged an arcuate cam rib 45 which, on the rotation of the gear, engages and lifts the pins 42 and 43. The arcuate extent of the cam is such that on its rotation it lifts the pins 42—43 successively against their respective contact arms 38—39, and displaces these contacts into engagement with one or the other of the arms of the V-contact 40. At its leading end 46 the cam is beveled to ride under and lift the pins 42—43, while at its following end 47 the cam is abrupt, so that the pin riding off the cam drops quickly and the associated contacts part with a quick circuit-opening action. Preferably the pins 42 and 43 are diametrically arranged upon opposite sides of the axis of the gear 25, while the cam 45 has an arcuate extent slightly exceeding 190°, so that when one of the contacts 38—39 parts from the V-contact 40, the other contact is lifted into engaging position. Thus as the circuit is broken at this point in one of the branches 34—35 it is re-established in the other branch.

The operation of the device will be readily followed from the diagrams 6 to 10. Assuming that the shutters 18 have been open sufficiently long to chill the fluid in the engine jacket to a temperature below the lower limit of the desired range for engine efficiency, the thermostat 30, responding to this change of temperature, is warped into engagement with the contact 37. On the preceding opening movement of the shutters, the rotation of the gear 25 and its associated cam 45 terminated when the motor operated switch opened the motor circuit at 39 in branch 34, at which time the circuit in branch 35 was completed by establishing contact at 38. Consequently when the thermostat 30 engages the contact 37 in branch 35, the motor circuit is again completed and the motor 21 is again set in motion. As the gear 25 rotates, the crank arm 26 moves downward, thus closing the shutters and shutting off the draft to the radiator. As the shutters 18 close, the motor circuit through branch 35 automatically opens at 38 as the pin 42 drops from the following end of the cam 45 and the motor halts. Before this occurs, however, the pin 43 rides up the leading incline 46 of the cam 45 and closes branch 34 of the circuit. In this branch, however, the motor circuit is open at the thermostat contact 36. The explosion engine now runs while the shutters 18 remain closed. As temperature of the fluid in the engine jacket rises through the desired range for engine efficiency, the thermostat 30 gradually shifts (Fig. 6) from its shutter closing position (Fig. 5) until the temperature of the fluid reaches the upper extreme of the desired range, when the thermostat engages (Fig. 7) the contact 36 in branch 34 of the motor circuit. Since the motor switch is closed at the contact 39, the motor is again energized and the gear 35 again set in motion, causing the crank arm 26 to complete its revolution. As the crank swings upward the shutter slats 18 are opened and the draft is again admitted to the radiator 17. The motor automatically halts in open shutter position when the pin 43 for contact 39 runs off the following end of the cam, thus opening branch 34 of the circuit, at which time branch 35 is closed at contact 38, since the leading end of the cam has now passed beneath the pin 42 and lifted the latter to cause the closing of the motor switch at this point.

From the foregoing it will be seen that the temperature of the fluid in the engine water jacket is automatically maintained within the desired range for the highest engine efficiency. The warping of the thermostat 30 accurately follows the temperature change of the engine fluid. The upper and lower limits of the range may be readily varied to meet the requirements of particular engines, by adjusting the position of the contacts 36 and 37, or by altering the character or length of the thermostatic element 30.

The one-way motor 21 is inexpensive and utilizes very little current, and that only intermittently. Motors such as are now used for operating wind-shield wipers are well adapted for this service.

The motor switch is positive in its closing action. The opening of the contacts may be made more certain by reinforcing the contact strips 38—39 by auxiliary springs, if desired. The opening and closing movements of the contacts 38—39 can be made positive by forming a cam groove x (Fig. 11) in the side face of a flange y on the gear 25, in which groove the adjacent ends of the pins 43 are guided while their opposite

ends are positively connected to the contacts 38 and 39 (Fig. 10). The approach of the arms of the V-contact 40 toward the contacts 38 and 39 may be limited by stop pins 48. Various other forms of switch construction will readily occur to those dealing with the problem. I have found that shown sufficient for the purpose and economically manufactured and assembled.

While I have shown shutter bars 18 of a type commonly used, it will be realized that these may be varied in many ways. In the construction shown in Fig. 1, I have indicated a lost motion connection between the connecting rod 27 and the shutters in order to relieve the motor of any strain, and to prevent possible halt of the motor, by a positive limitation of movement of the shutters in either direction, before the gear 25 has rotated sufficiently to open the motor circuit. To this end the operating connection between the rod 27 and the shutters 18 is effected through springs 49 and 50 interposed between stops 51 and 52 on the rod 27, and the interposed collar 53 connected to bracket 54, which may be secured either to the bar 20 or to one of the shutters 18 as indicated.

This lost motion connection between the rod 27 and the shutter system has another function. In winter it may not be desirable to fully open the shutters at any time. I therefore provide an adjustable stop 55 which is adapted to engage one of the shutters, or bracket 54, to limit its play. Since the throw of the crank is constant, the spring 50 is placed under compression as the crank completes its throw after the shutters have been halted by the stop. The same result could be accomplished in various ways; for example by adjusting the crank pin along the length of the crank 26; but this would necessitate the opening of the casing or the location of a door therein in order to obtain access to make such an adjustment, and I prefer a device such as the present which is readily accessible and sufficient for the purpose. In many localities such a winter adjustment would not be desirable. Nor is it necessary in any case. It merely prevents an undesirably frequent opening and closing of the shutters incident to the admission of very cold air to the radiator.

As above stated, the shutter may be built into the radiator casing, in which case the operating motor unit would be appropriately located therein. The invention also is applicable to air cooled engines, in which case the thermostat would be located upon some portion of the engine block instead of upon the pipe 16. However located, it will be noted that the motor operates the shutter positively in both directions, and the closing movement is not dependent upon the action of springs as is now customary in manually operated devices.

Various modifications in details of construction and arrangement of parts, as well as their adaptation to other types of engines and shutters, will readily be perceived by those dealing with the problem. In the following claims I use the word "shutter" in a sense broad enough to include any appropriate means for cutting off the air supply from the radiator or engine.

I claim—

1. For use with a shutter regulating the flow of cooling air to an explosion engine, an automatic shutter regulating device comprising an electirc motor operatively connected with the shutter to open and close the same, a thermostat responsive to the engine temperatiure, a motor feed circuit branched to afford lines arranged in parallel adjustable, means associated with the thermostat for closing alternatively one or the other of said parallel lines at opposite extremes of a predetermined range of engine temperature, together with a switch device operatively associated with a motor driven member, said switch device serving, after predetermined motor operation, automatically to open the thermostatically closed branch line, and automatically to close the switch contacts in the other branch line, so that the latter may be thermostatically closed and the motor re-energized when the engine reaches the opposite extreme of its predetermined temperature range.

2. The combination with a shutter regulating the flow of cooling air to an explosion engine, of a one-way electric motor, gearing directly connected to the motor shaft and operatively connected to the shutter for opening and closing the same, and means associated with the gearing for opening the motor circuit after predetermined motor operation.

3. The combination with a shutter, of a one-way, rotary, electric motor, and a spring between the motor and shutter to permit the shutter to halt before the motor stops, together with adjustable means for regulating the play of the shutter.

4. Shutter operating mechanism for use with an internal combustion engine comprising a casing, a one-way, rotary electric motor for opening and closing the shutter mounted in said casing, a parallel branched motor circuit, a bi-metallic thermostat associated with the internal combustion engine and adapted to close the motor circuit through said branches alternatively at opposite extremes of a predetermined temperature range, and a switch adapted to open the motor circuit after predetermined operation of the motor, in combination with a crank mounted in the casing, gearing operatively interposed between said motor and

said crank, and a rod connecting said crank with the shutter adapted both to open and to close the shutter.

5. In connection with the cooling system of an explosion engine, a motor and a shutter for regulating the air supply to the cooling system, in combination with means having a crank connecting the motor and the shutter, said means being adapted to open and close the shutter in response to rotary movements of the motor in the same direction.

6. For regulating the flow of cooling air to an explosion engine radiator, a shutter frame, a shutter carried by said frame, a rotary electric motor housed in said frame, a train of gears driven directly by said motor, a crank operated by said gears and a rod connecting said crank with said shutter for opening and closing the latter, in combination with a switch automatically opening the motor circuit after predetermined motor operation.

7. For regulating the flow of cooling air to an explosion engine radiator, a shutter frame, a shutter carried by said frame, a rotary electric motor housed in said frame, a train of gears driven directly by said motor, a crank operated by said gears, and a rod connecting said crank with said shutter for opening and closing the latter, in combination with a yielding connection between said rod and said shutter to permit the motor to complete its operation when the shutter movement is arrested, and a switch automatically opening the motor circuit after predetermined motor operation.

8. In an apparatus for regulating the flow of air to an explosion engine, a thermostat mounted on a part of the engine and responsive to its temperature variation, a one-way electric motor, a parallel branched motor circuit, adjustable means associated with said thermostat for closing the motor circuit through said branches alternatively at opposite extremes of a predetermined temperature range, and means operated by the motor for admitting or excluding the air.

In testimony whereof I have signed my name to this specification.

WILLIAM A. COLLINS.