Dec. 22, 1931. A. G. McCALEB 1,837,564

THERMOSTATIC CONTROL

Filed Nov. 23, 1929 3 Sheets-Sheet 1

Fig. 1

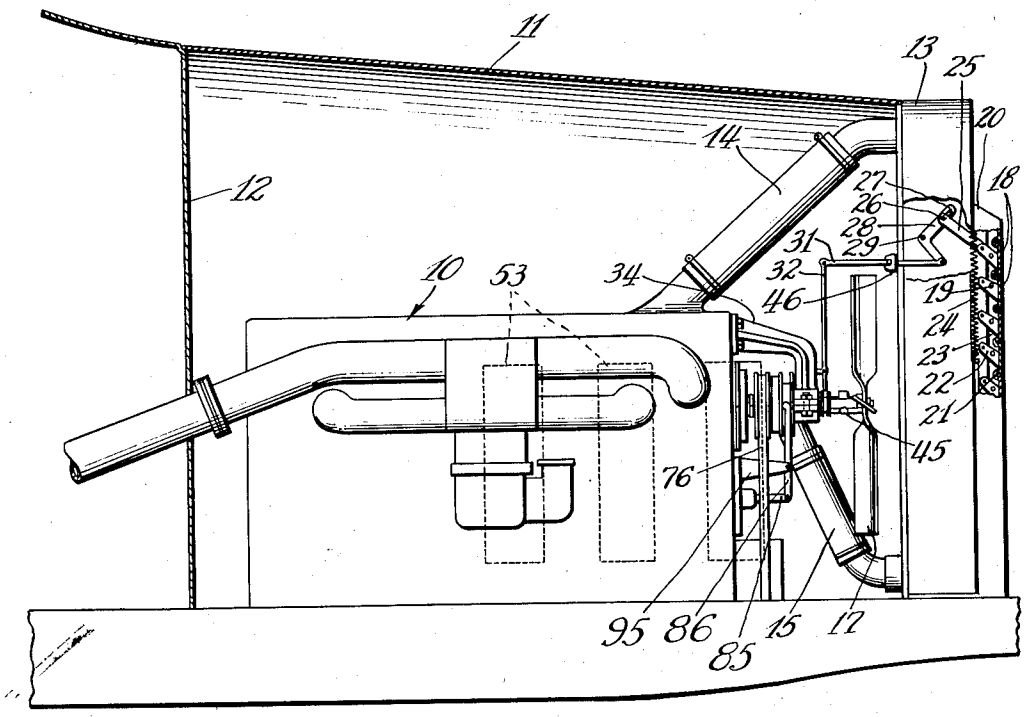
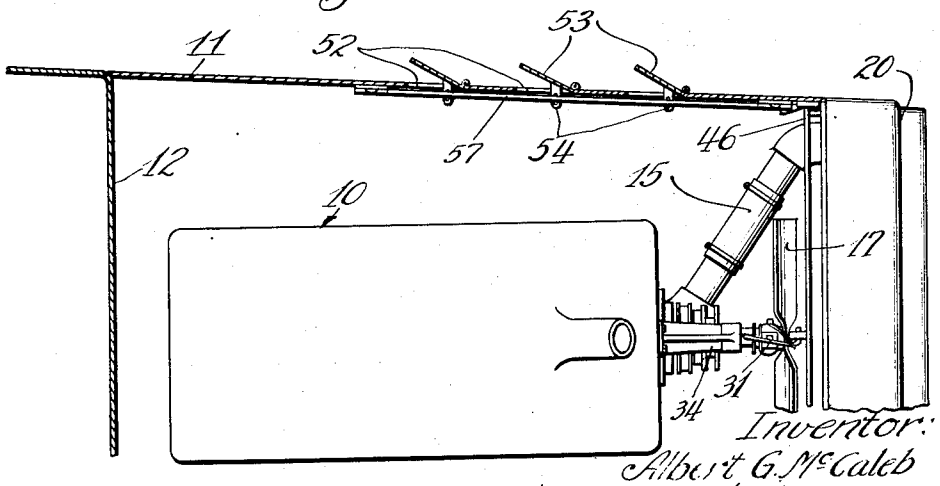


Fig. 2



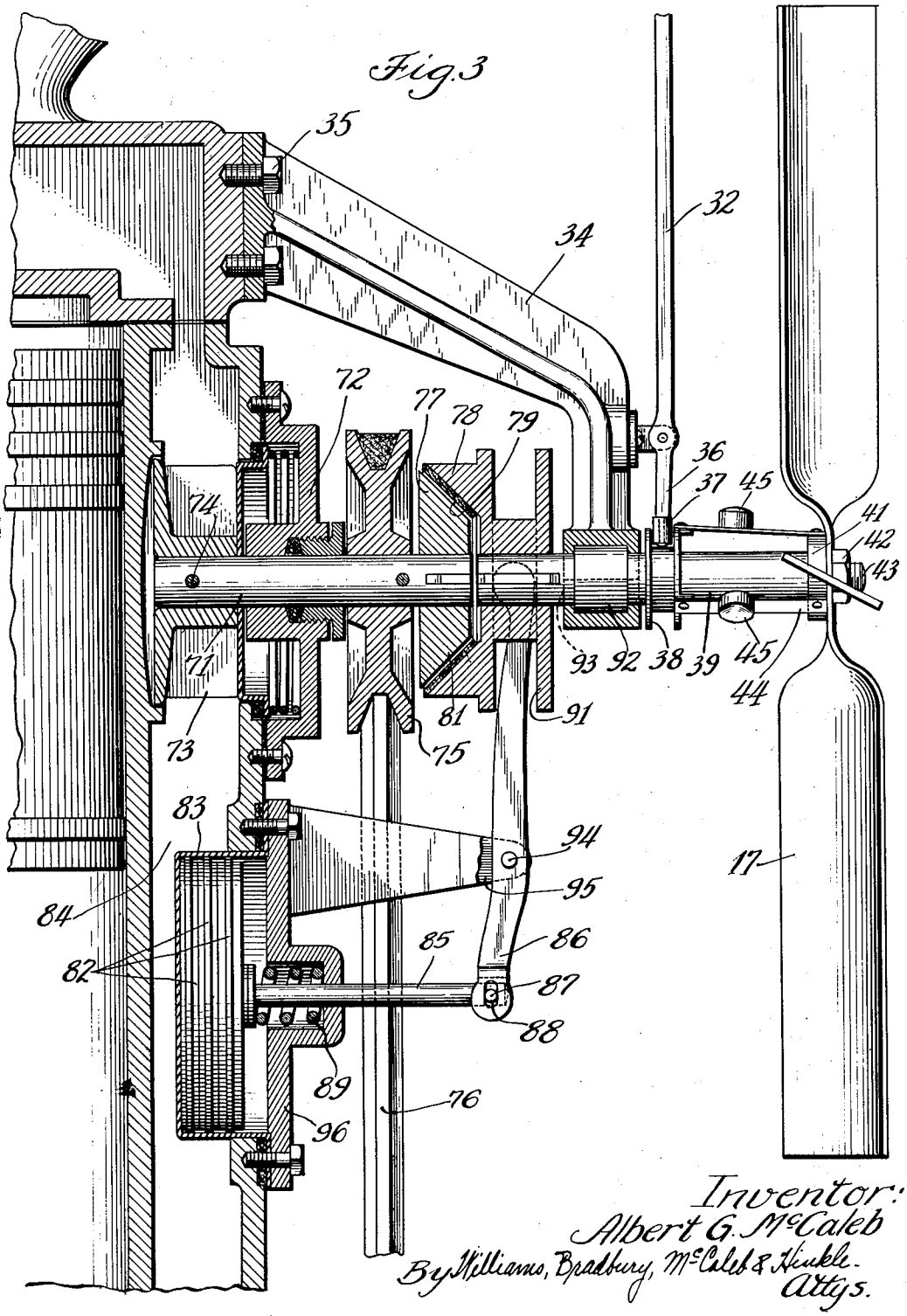
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Fig. 3



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Fig. 4

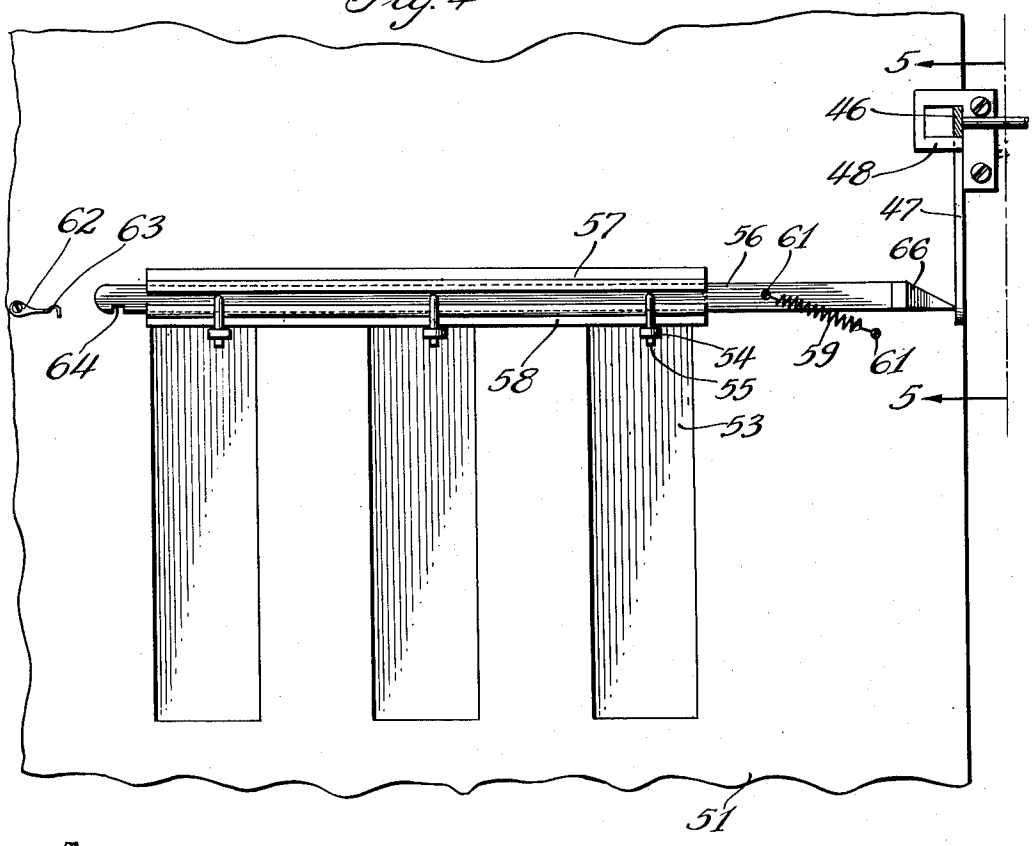
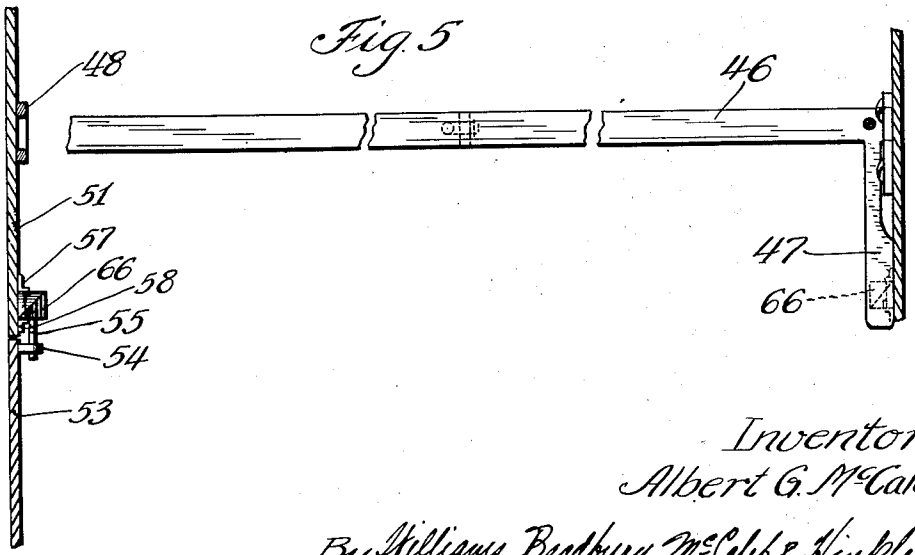


Fig. 5



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Patented Dec. 22, 1931 1,837,564

UNITED STATES PATENT OFFICE

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THERMOSTATIC CONTROL

Application filed November 23, 1929. Serial No. 409,341.

My invention relates to a temperature regulating system for internal combustion engines, and more particularly to means for controlling the opening and closing of shutters on the radiator and hood in combination with means for controlling the operation of the fan.

It is very desirable that the shutters on the hood and on the radiator should be closed immediately upon stoppage of the engine in order to conserve the heat about the engine and in the cooling fluid. When starting operation of the engine it is desirable that all of the cooling fluid be increased in temperature substantially uniformly and that its flow should not be restricted by thermostatically controlled valves which permit the cooling fluid about the cylinders to attain a high temperature while the fluid in the radiator may be at substantially the freezing point. I have found it much more desirable to restrict the cooling of the fluid bv properly operated shutters on the radiator and on the hood and to circulate cooling fluid constantly in proportion to the speed of the engine and when the temperature of the cooling fluid rises above a predetermined value to permit the circulation of air through the radiator.

One of the objects of this invention is the provision of a novel connecting mechanism whereby shutters may be controlled responsive to conditions in different actuating or controlling devices.

Another object is the provision of a novel shutter control which is adapted to control the egress of air from the engine enclosure as well as the ingress responsive to the running conditions of the motor.

Another object is the provision of a novel shutter control which is adapted to close the shutters immediately upon the stoppage of the engine and open the shutters in proportion to the speed of the engine after the temperature of the cooling fluid has attained a predetermined value.

Other objects and advantages of this invention will be apparent from the following description and from the accompanying drawings, of which similar characters of reference indicate similar parts throughout the several views.

Referring to the drawings, of which there are three sheets:

Fig. 1 is a diagrammatic view in elevation showing the invention applied to an internal combustion engine having a water cooling system, parts being shown in section;

Fig. 2 is a plan view of that shown in Fig. 1 showing the hood in section and parts broken away to more clearly illustrate the invention;

Fig. 3 is a medial sectional view taken through the controlling device of Fig. 1 with parts in the position corresponding to their positon when the engine is cold and not running;

Fig. 4 is a fragmentary elevation showing the inside of the hood with the shutters and shutter operating mechanism.

Fig. 5 is a sectional view taken substantially on the line 5—5 of Fig. 4.

Referring to Fig. 1, 10 indicates an internal combustion engine in its entirety which is provided with the usual hood or enclosure 11, dashboard 12 and radiator 13 for enclosing the engine. The present invention may be applied universally to heat engines whether having water cooling systems or air cooling systems, but the embodiment chosen for illustration purposes has a water cooling system including the radiator 13 with the usual air passages and with water connections 14 and 15. The engine is provided with a fan 17.

The radiator 13 is preferably provided with a plurality of shutters 18 being pivotally mounted at 19 in the shutter frame 20 having a fenestration 21. The shutters are provided with rearwardly extending arms 22 which are pivotally secured to a vertically extending shutter actuating bar 23 and the shutters are constantly urged to closed position by the coil spring 24 tensioned between the frame 20 and a lug on the shutter bar 23.

An arm 25 fixed to one of the shutters 18 and to the upper end of the actuating bar 23 extends rearwardly into the radiator and engages by means of a pivot pin 26 into a slot 27 providing lost motion therefor in the bell

crank lever 28 pivoted at 29. The lower arm of the bell crank lever 28 is pivoted to a link 31 which is adapted to reciprocate rearwardly and forwardly and is pivoted at its rearward end to a link 32 pivoted at 33 to a rigid arm 34 fixed on the forward end of the engine by bolts 35 as best shown in Fig. 3. The lower end 36 of link 32 is provided with a roller 37 which engages within an annular channel member or collar 38 which is movably fitted on the fan shaft 39. The fan 17 is fixed on shaft 39 by engagement between a fixed collar 41 and a nut 42 on the reduced threaded portion 43.

Leaf spring members 44 having weights 45 fixed thereon, secure collar 41 to the collar 38 and are adapted to yield outwardly by the centrifugal force of the weights 45 and to draw the collar 38 forwardly when the speed of the fan shaft attains a predetermined value and continue to draw the collar 38 forwardly in substantial proportion to the speed of the shaft, thereby actuating the link mechanism above described and opening the shutters 18.

A cross bar 46 extending from side to side of the radiator is fixed on the link 31 as shown in Figs. 1 and 5. The bar 46 has depending end portions 47 shown in Figs. 4 and 5 and are adapted to be moved rearwardly by the rearward movement of bar 46 in the guide brackets 48. The hood 11 has movable side portions 51 with openings or loops 52 therethrough which may be closed by shutters 53. The shutters 53 have inwardly extending lugs 54 with slots therein through which pins 55, which are fixed to the reciprocating bar 56, are adapted to extend. The bar 56 may reciprocate in guideways formed by members 57 and 58. A spring 59 secured to bar 56 and to the hood by screws 61 normally urges the bar forwardly. A spring member 62 having an upwardly arched portion 63 is adapted to engage within an aperture 64 on the rearward end portion of bar 56 for retaining the bar in its rearward position when it is manually moved a sufficient distance to be engaged thereby. A cam shaped end 66 is formed on the forward end of bar 56 in order that the hood may be closed when the depending portion 47 of bar 46 is in its rearward position and upon the closing of the hood, the cam surface engages the depending portion 47 and forces the bar 56 rearwardly for opening the shutters.

A pump shaft 71 journalled in the front end of the engine at 72 has a pump 73 fixed on the inner end thereof by a bolt 74. A pulley 75 also fixed on the pump shaft and driven by a belt 76 is adapted to continuously rotate the pump in proportion to the speed of the engine. Cooperating clutch members 77 and 78 on the pump shaft and on the fan shaft respectively are fixed for rotation with their respective shafts but the member 78 is adapted to move longitudinally of the fan shaft for engagement of its friction surface 79 with the conical surface 81 of the member 77.

A thermostat consisting of a plurality of thermostatic wafers 82 is seated in a thin metal container 83 through which the thermostat is subjected to heat from fluid in the circulating compartment 84 around the engine head. Engaging the forward wafer 82 is a piston rod 85 which has connection with the lower end of a pivoted link 86 by means of a pin 87 passing through the slot 88 in the lower end of the link 86. A spring 89 normally urges the thermostatic elements rearwardly but yields permitting them to move forwardly when heated such that the upper end of link 86 which extends in the channel portion 91 of clutch member 87 forces the clutch member rearwardly for coupling the pump shaft with the fan shaft.

The fan shaft is provided with an enlarged portion 92 which is journalled in an opening 93 in the lower end of arm 34. This arrangement holds the fan shaft in alignment with the pump shaft and prevents longitudinal movement thereof. Link member 86 is pivoted at 94 in the outer end of a forked bracket 95 which forms a part of the plate 96 covering the thermostatic elements.

In the normal operation of my invention the shutters are closed at the time the motor is started. Assuming that the fluid in the radiator and circulating compartment about the engine cylinders is cold, the clutch will be disengaged as shown in Fig. 3. The belt 76 upon starting of the motor continuously rotates the pulley 75 in proportion to the speed of the motor which drives the pump 73 for effecting a continuous circulation of the fluid through the circulating system. As the fluid in the circulating system becomes heated to a predetermined temperature, the thermostatic elements 82 which are in the path of fluid discharged from the pump, become heated and expand so as to force outwardly on the piston rod 85 causing the link 86 to bring the clutch members 77 and 78 into gradual engagement. As the clutch members engage each other, the fan 17 gradually increases in speed and agitates the air within the motor enclosure. When the speed of the fan is increased sufficiently, the centrifugal weights 45 draw the collar 38 forwardly together with the roller 37 on the link 32 whereby the connecting link members through the medium of the bell crank lever 28 and arm 25 cause the shutters on the radiator to open in proportion to the outward extent of the centrifugal weights which is substantially in proportion to the speed of rotation of the fan shaft.

As the link member 31 moves rearwardly it causes cross bar 46 to move rearwardly,

together with its depending ends 47, which by engagement with the bar 56 move it rearwardly, causing the shutters on the sides of the hood 11 to open. Whenever the engine is stopped, even momentarily, the shutters are immediately closed by means of the coil springs 24 and 59, it not being necessary for the clutch members 77 and 78 to become disengaged. If the engine remains stopped for a sufficient period of time for the fluid in the cooling system to become cold, the thermostat recedes to the position shown in Fig. 3 and the fan shaft is uncoupled from the pump shaft, and should the engine again be started it will be necessary for the cooling fluid to be reheated before the fan is again set into operation and before the shutters are again opened.

Having thus described my invention, what I claim is new and desire to secure by Letters Patent of the United States is:

1. In a temperature regulating system for an internal combustion engine, an enclosure for the engine having air passages therethrough, shutters for the air passages, means for circulating fluid through parts of the engine, a speed-responsive device operably connected with said shutters for opening the same, means in the path of fluid passing through said circulating means and responsive to the temperature thereof for controlling the operation of said speed responsive device.

2. In a temperature regulating system for an internal combustion engine, a fluid circulating system for the engine including a radiator, shutters for restricting the passage of air through the radiator, a pump in said circulating system for circulating fluid therethrough, speed responsive means operably connected with said shutters for opening the same, means in the path of fluid circulated by said pump and responsive to the temperature thereof for controlling the operation of said speed responsive means.

3. In a temperature regulating system for an internal combustion engine, a primary temperature regulating medium, a secondary temperature regulating medium, an enclosure for the engine, having passageways for said secondary medium, shutters for said passageways, circulating means for said primary medium, a thermostat in the path of movement of said primary medium from said circulating means, means for circulating said secondary medium, means responsive to the speed of rotation of the last said circulating means adapted to open said shutters and means actuated by said thermostat for simultaneously controlling the operation of said speed responsive means and the secondary medium circulating means.

4. In a temperature circulating device for an internal combustion engine, a liquid circulating system including a radiator, shutters on the radiator, an enclosure for the engine having openings therein, shutters for the openings, a pump for circulating liquid through said system, means for continuously operating said pump in proportion to the speed of the engine, a fan operable to draw air through the radiator, a speed responsive device rotatable with said fan and operable to open said shutters, thermoresponsive means in the path of liquid discharged by said pump, means actuated by said thermoresponsive means for controlling the rotation of said fan and said speed responsive device.

5. In a temperature circulating device for an internal combustion engine, a liquid circulating system including a radiator, shutters on the radiator, an enclosure for the engine having openings therein, shutters for the openings, a pump for circulating liquid through said system, means for continuously operating said pump in proportion to the speed of the engine, a fan operable to draw air through the radiator, a speed responsive device rotatable with said fan and operable to open said shutters, thermoresponsive means in the path of liquid discharged by said pump, means actuated by said thermoresponsive means for controlling the rotation of said fan and said speed responsive device, and means adapted to close said shutters immediately upon stoppage of the engine.

6. In a temperature regulating system for an internal combustion engine, a primary temperature regulating medium, a secondary temperature regulating medium, an enclosure for the engine, having passageways for said secondary medium, shutters for said passageways, circulating means for said primary medium, a thermostat in the path of movement of said primary medium from said circulating means, means for circulating said secondary medium, means responsive to the speed of rotation of the last said circulating means adapted to open said shutters, means actuated by said thermostat for simultaneously controlling the operation of said speed responsive means and the secondary medium circulating means, and means adapted to close said shutters immediately upon stoppage of the engine.

7. In a temperature regulating system for an internal combustion engine, a fluid circulating system for the engine including a radiator, shutters for restricting the passage of air through the radiator, a pump in said circulating system for circulating fluid therethrough, speed responsive means operably connected with said shutters for opening the same, means in the path of fluid circulated by said pump and responsive to the temperature thereof for controlling the operation of said speed responsive device, and means adapted to close said shutters immediately upon stoppage of the engine.

8. In a temperature regulating system for

an internal combustion engine, an enclosure for the engine having air passages therethrough, shutters for the air passages, means for circulating fluid through parts of the engine, a speed responsive device operably connected with said shutters for opening the same, means in the path of fluid passing through said circulating means responsive to the temperature thereof for controlling the operation of said speed responsive device, and means adapted to close said shutters immediately upon stoppage of the engine.

9. In a temperature regulating device for an internal combustion engine, a fluid circulating system including a radiator, a pump for circulating fluid through said system, a pump shaft rotatably supported by said engine and having said pump fixed thereon for rotation therewith, means for continuously rotating said shaft in proportion to the speed of the engine, a fan shaft journalled in alignment with said pump shaft, a fan fixed on said fan shaft for drawing air through said radiator, shutters for restricting the flow of air through said radiator, a speed responsive device rotatable with said fan shaft, means actuated by said speed responsive device for opening said shutters, a thermostat in the path of fluid discharged by said pump and responsive to the temperature thereof, and means actuated by said thermostat for operatively connecting said fan shaft to said pump shaft.

10. In a temperature regulating device for an internal combustion engine, a fluid circulating system including a radiator, a pump for circulating fluid through said system, a pump shaft rotatably supported by said engine and having said pump fixed thereon for rotation therewith, means for continuously rotating said shaft in proportion to the speed of the engine, an arm carried by said engine and having an opening therethrough in alignment with said pump shaft, a fan shaft passing through the opening in said arm and journalled therein, a fan fixed on said fan shaft and adapted to draw air through said radiator, shutters for restricting the flow of air through said radiator, a speed responsive device rotatable with said fan shaft, means pivoted on said arm and actuated by said speed responsive device for opening said shutters, a thermostat in the path of fluid discharged by said pump and responsive to the temperature thereof, and means actuated by said thermostat for operatively coupling said fan shaft and said pump shaft.

11. In a temperature regulating device for an internal combustion engine, a fluid circulating system including a radiator, a pump for circulating fluid through said system, a pump shaft rotatably supported by said engine and having said pump fixed thereon for rotation therewith, means for continuously rotating said shaft in proportion to the speed of the engine, an arm carried by said engine and having an opening therethrough in alignment with said pump shaft, a fan shaft passing through the opening in said arm and journalled therein, a fan fixed on said fan shaft and adapted to draw air through said radiator, shutters for restricting the flow of air through said radiator, a speed responsive device rotatable with said fan shaft, means pivoted on said arm and actuated by said speed responsive device for opening said shutters, a thermostat in the path of fluid discharged by said pump and responsive to the temperature thereof, means actuated by said thermostat for operatively coupling said fan shaft and said pump shaft, and spring means adapted to close said shutters immediately upon the stoppage of the engine.

12. In a temperature regulating device for an internal combustion engine, a fluid circulating system including a radiator, a pump for circulating fluid through said system, a pump shaft rotatably supported by said engine and having said pump fixed thereon for rotation therewith, means for continuously rotating said shaft in proportion to the speed of the engine, a fan shaft journaled in alignment with said pump shaft, a fan fixed on said fan shaft for drawing air through said radiator, shutters for restricting the flow of air through said radiator, a speed responsive device rotatable with said fan shaft, means actuated by said speed responsive device for opening said shutters, a thermostat in the path of fluid discharged by said pump and responsive to the temperature thereof, means actuated by said thermostat for operatively connecting said fan shaft to said pump shaft, and spring means adapted to close said shutters immediately upon the stoppage of the engine.

13. A liquid-cooled internal combustion engine having a fan adapted to draw air through the radiator, a clutch whereby the fan may be operatively connected to the engine to be driven thereby, a thermostat actuated by the temperature of the cooling liquid adapted to control said clutch, shutters adapted to control the flow of air through the radiator, and means associated with the fan adapted to progressively open the shutters as the speed of the fan increases.

14. A liquid-cooled internal combustion engine having a member rotatable independently of the engine, a clutch whereby said member may be operatively connected to the engine to be driven thereby, a thermostat actuated by the temperature of part of the engine adapted to actuate said clutch, shutters adapted to control the flow of air through the radiator, and means connecting said member to said shutters to open same when the engine is running.

15. A liquid-cooled internal combustion engine having a member rotatable independ-

ently of the engine, a clutch whereby said member may be operatively connected to the engine to be driven thereby, a thermostat actuated by the temperature of part of the engine adapted to actuate said clutch, shutters adapted to control the flow of air through the radiator, and a speed responsive device carried by said member operatively connected to the shutters to effect the progressive opening thereof as the speed of the engine increases.

16. A liquid-cooled internal combustion engine having a fan adapted to draw air through the radiator, said air being permitted to escape through openings in the hood, shutters adapted to control the flow of air through the radiator, shutters controlling the flow of air through the openings in the hood, and means for opening and closing said shutters together.

17. A liquid-cooled internal combustion engine having a fan adapted to draw air through the radiator, said air being permitted to escape through openings in the hood, shutters adapted to control the flow of air through the openings on the hood, means associated with the engine adapted to control the first said shutters, and means mounted on the hood adapted to control the opening of the last said shutters and adapted to be actuated by the shutter controlling means associated with the engine so that said shutters are actuated simultaneously.

18. In an automotive engine, in combination, a radiator, a hood, shutters mounted on the radiator, means for actuating said shutters, shutters mounted in openings provided in the hood, and an actuating bar adapted to operate the last said shutters and having a cam shaped end adapted to cooperate with the means for actuating the first said shutters.

19. In an automotive engine, in combination, a radiator, a hood, a fan adapted to draw air through the radiator, a clutch adapted to connect said fan to the engine, a thermostat adapted to control said clutch, shutters mounted on the radiator, means including a speed actuated device carried by the fan for opening the shutters, shutters mounted in openings provided in the hood, and an actuating bar adapted to operate the last said shutters and having a cam shaped end adapted to be actuated from said speed actuated device.

In witness whereof, I hereunto subscribe my name this 21st day of November, 1929.

ALBERT G. McCALEB.