Jan. 22, 1924. 1,481,307

H. R. STUART

TEMPERATURE REGULATING MECHANISM FOR INTERNAL COMBUSTION ENGINES

Filed June 14, 1920 2 Sheets-Sheet 1

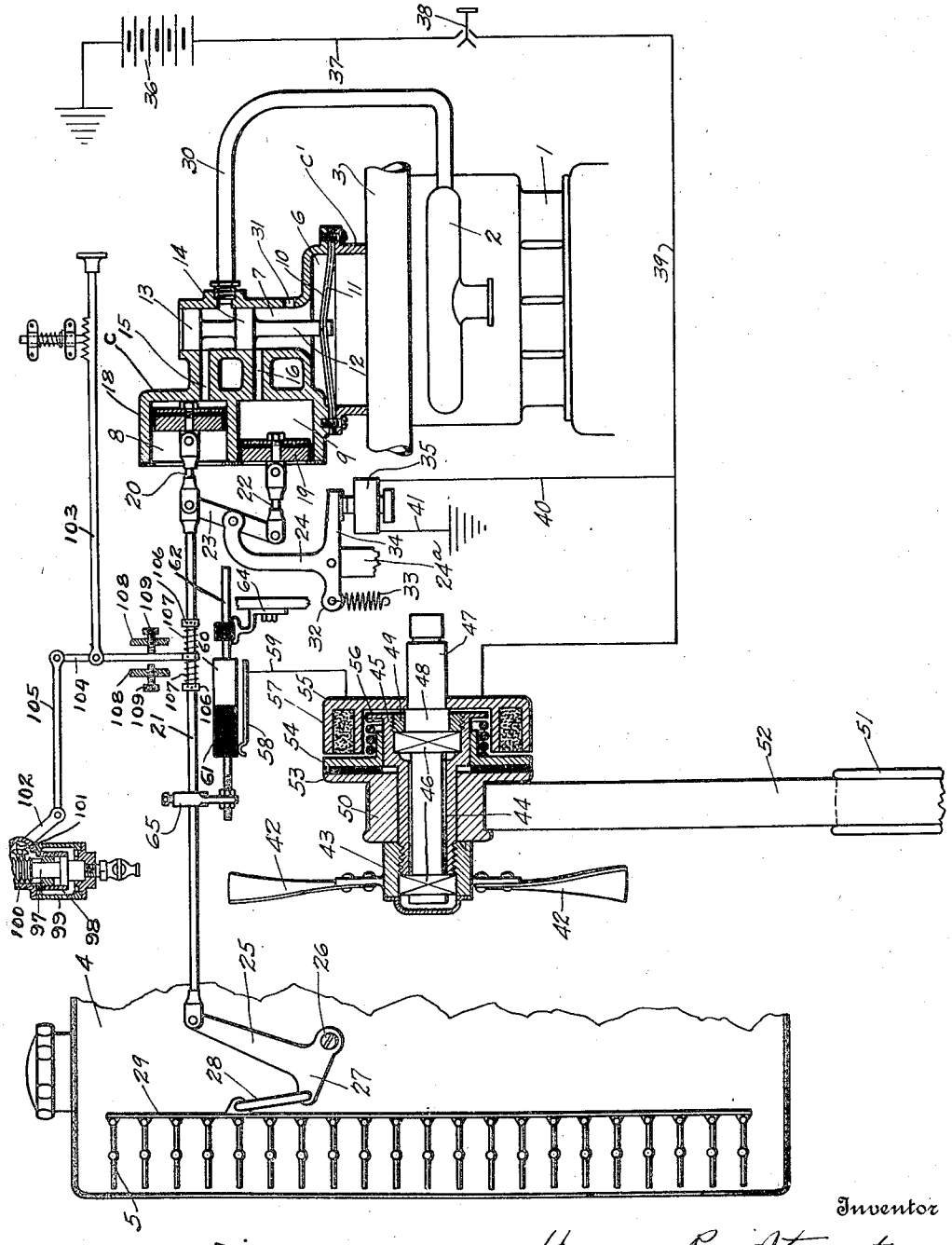


Fig. 1.

Witness

Chas. F. Mich

Inventor

Harre R. Stuart

By Staley & Bowman

Attorneys

Jan. 22, 1924. 1,481,307

H. R. STUART

TEMPERATURE REGULATING MECHANISM FOR INTERNAL COMBUSTION ENGINES

Filed June 14, 1920 2 Sheets-Sheet 2

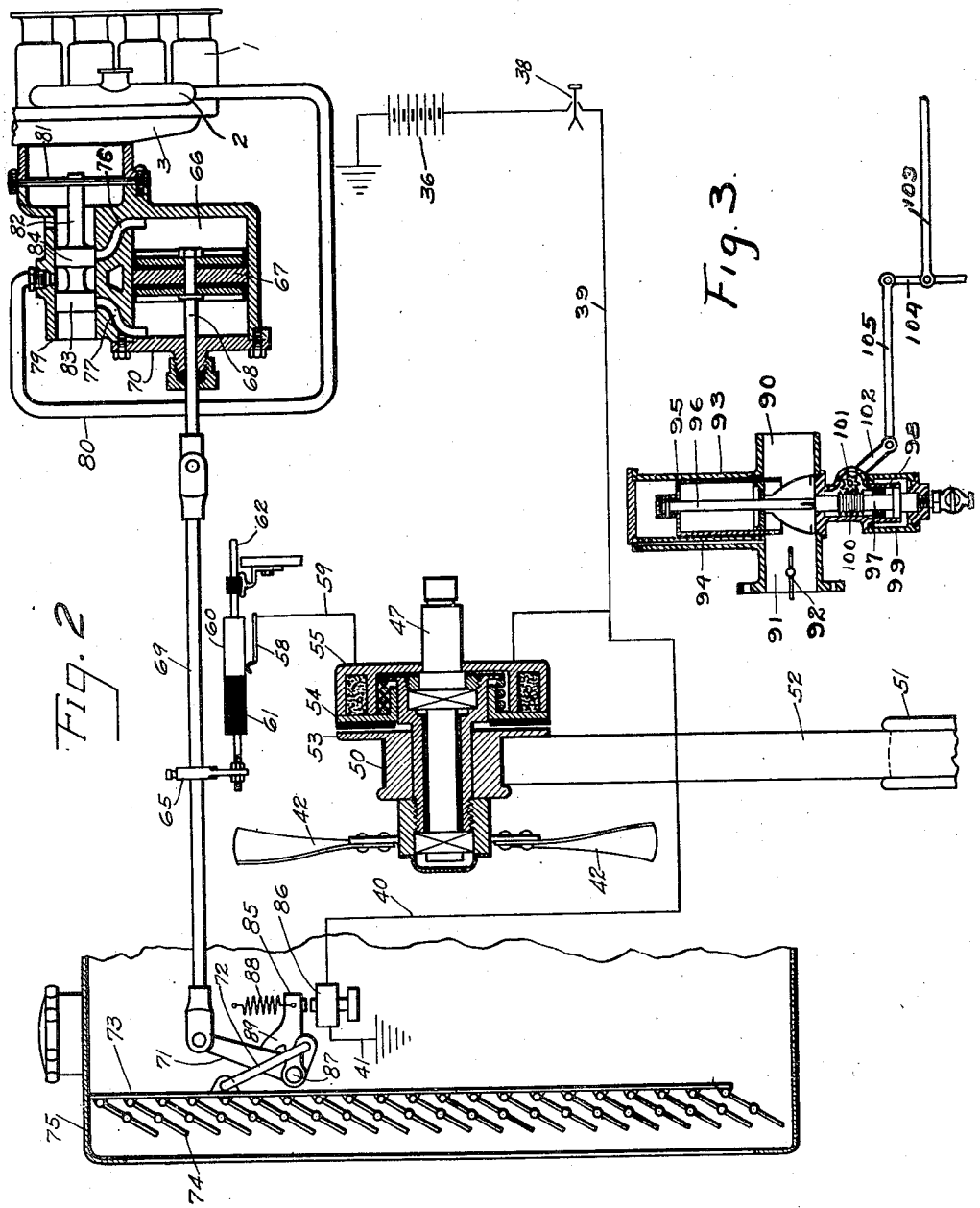


Fig. 2

Fig. 3

Inventor
Harry R. Stuart

Witness
Chas. F. Mech

By Stalup & Borman
Attorneys

Patented Jan. 22, 1924. 1,481,307

UNITED STATES PATENT OFFICE.

HARVE R. STUART, OF SPRINGFIELD, OHIO.

TEMPERATURE-REGULATING MECHANISM FOR INTERNAL-COMBUSTION ENGINES.

Application filed June 14, 1920. Serial No. 388,716.

To all whom it may concern:

Be it known that I, HARVE R. STUART, a citizen of the United States, residing at Springfield, in the county of Clark and State of Ohio, have invented certain new and useful Improvements in Temperature-Regulating Mechanism for Internal-Combustion Engines, of which the following is a specification.

My invention relates to improvements in mechanism for regulating the temperature of internal combustion engines and automatically controlling the fuel supply thereto to accord with the temperature, the improvements being especially intended for automobile gas engines, and being of a character which are fluid operated and thermostatically controlled.

One of the objects of my invention is to improve the controlling mechanism described in my pending application No. 317,822 filed Aug. 15, 1919, by providing for operating the air current interrupters, such as shutters, in both directions by fluid operating means.

A further object of my invention is to also provide for both starting and stopping the action of the air current producer, such as a fan, by the action of such means.

A further object of my invention is to provide regulating mechanism which is operated in both directions by the suction of the engine with which it is associated.

A further object of my invention is to provide means for thermostatically controlling the fuel to furnish a richer mixture when the engine is cold and a leaner mixture when the engine has warmed up; a further, and more specific object in this connection being to provide a fuel controlling means which is operable simultaneously with the devices for regulating the air current interrupters and producers.

A further object of my invention is to simplify and make more effective the operation of mechanism of this character.

In the accompanying drawings:—

Fig. 1 is a diagrammatic view of the mechanism embodying my improvements.

Fig. 2 is also a diagrammatic view showing a modification.

Fig. 3 is a detail section of some of the fuel controlling devices.

In the operation of the mechanism as described in my former application referred to, it has been found that in some cases, for instance where the throttle is being held more or less wide open and the engine turning over comparatively slow, as in climbing a hill, the vacuum in the intake manifold will fall off materially and become inefficient to overcome the action of the spring which closes the shutters and stops the fan, as a consequence of which this spring will act to close the shutters and stop the fan at a time when the temperature of the engine is high enough, thereby causing the engine to overheat. In order to overcome this difficulty, I have devised an arrangement whereby the operation of both opening and closing the shutters and also of both starting and stopping the fan, is performed by the action of the vacuum created in the intake manifold or other source so that in the event the shutters are open and the fan running, the lowering of this vacuum will not effect a change in the position of the operating mechanism for the shutters and fan.

Referring to the drawings, 1 represents a portion of an internal combustion engine, 2 the fuel intake manifold therefor, and 3 a part of the manifold for the cooling medium, which, in the present case, is water. A portion 4 of the frame of the radiator for the cooling medium is shown, equipped with a series of pivoted shutters 5. Mounted upon the manifold 3 is a casting C which is provided with a lower thermostat chamber 6, a valve chamber 7 and a pair of cylinders 8 and 9. The casting preferably has a removable base C′ and clamped between this base and the casting is a thermostat formed of two strips 10 and 11 of metal having different expansible and contractable properties. Mounted in the valve chamber 7 is a valve consisting of a stem 12 and two integrally-formed spaced apart valve heads 13 and 14 which control ports 15 and 16 leading to the respective cylinders 8 and 9. The lower end of the valve stem 12 is connected with the thermostat. Located in the respective cylinders 8 and 9 are pistons 17 and 18 arranged in alternate relation to each other so that when one cylinder moves rearwardly the other one will move forwardly and vice versa. The piston 8 has a direct connection through a pivoted stem 20 with an operating rod 21, while the piston 19 is connected with said rod through a pivoted stem 22 and a rocker arm 23, the rocker arm being pivoted midway its length to a lever 24 pivotally connected with a stationary support 24ª and

hereinafter more fully described. The forward end of the rod 21 is connected to the free end of one arm 25 of a bell-crank lever pivoted to the radiator frame or other suitable point as at 26, the other arm 27 of the lever being connected by a link 28 to a rod 29 which is pivoted to the end of each of the shutters 5. The valve chamber 7 is connected by a pipe 30 with the intake manifold 2 of the engine, or with any other source for creating a vacuum such as the intake port of the water circulating pump.

The result of the construction as thus far described is that as the thermostat is influenced by the temperature of the engine it will move the valve so as to place either one or the other of the cylinders 8 and 9 in communication with the intake manifold 2. In the position of the parts shown in Fig. 1, the temperature of the engine has raised to a point to move the valve so as to connect the cylinder 8 with the intake manifold, creating a vacuum on the rear side of the piston 18 so that atmospheric pressure has forced the piston to the rear end of the cylinder, which, through the connections described, has opened the shutters 5. This movement of the parts has opened the port 16 to the atmosphere through the port 31 in the valve chamber, and moved the piston 19 to the forward end of its cylinder 9. If, now, the temperature should be lowered to an extent to cause thermostat to move the valve to open the port 15 to atmosphere and connect the cylinder 9 through the port 16 with the intake manifold, then the piston 19 will be forced to the rear of its cylinder, thus closing the shutters through the connections described and moving the piston 18 to the forward end of its cylinder.

In order to provide for closing the shutters when the engine is at rest, the lever 24 has two extensions, one of which, 32, is connected to a spring 33 attached to any fixed point, while the other extension, 34, forms the armature of an electromagnet 35, in a circuit from a grounded battery 36, wire 37, switch 38, wire 39, wire 40, magnet coil and wire 41 to ground. The switch 38 may be the usual ignition switch of the electrical system of an automobile. When the engine is running, the electro-magnet 35 pulls down on the armature extension 34 and places the spring 33 under tension. When the engine is at rest, however, and the circuit through the magnet broken by opening the ignition switch, the spring 33 will pull down on the extension 32, swinging the free end of the lever 24 forwardly, and hence, through the link 23, rod 21 and other connections described, close the shutters.

The fan and its controlling devices employed in the present case are substantially like that shown and described in my former application referred to. The blades of the fan are represented by 42 and 43 is the hub. The hub has a threaded connection with a sleeve 44, the rear end of which is enlarged as shown at 45 and is mounted upon ball bearings 46 carried by a stationary forwardly extending supporting spindle 47; the cage for the rear bearings being confined between a collar 48 on the spindle and a shoulder at the inner end of the enlarged portion of the sleeve. A screw threaded ring 49, threaded into the enlarged end of the sleeve against the collar, serves to hold the sleeve in position on the spindle. Rotatably mounted upon the sleeve is a pulley 50, which receives motion from a pulley 51 on the crank shaft through the medium of a belt 52. The inner end of the pulley is provided with a flange 53 which forms one member of a clutch. Slidably mounted upon the enlarged portion of the sleeve is the extended hub of another member 54 of the clutch, preferably faced with leather or other suitable material. A spring 55 about the hub of this clutch member 54, and confined between an extended flange 56 at the inner end of the enlarged portion of the sleeve and the said clutch member 54 normally holds the two clutch members in engaged position. The sleeve is keyed to the hub of the clutch member 54 so as to form a driving connection between the two parts but permit movement of the clutch member to or from engaging position. Mounted upon the spindle 47 is an electro-magnet 57ª arranged in proximity to the clutch member 54 which forms an armature for the magnet so that when the magnet is energized the clutch member will be withdrawn from engaging position against the tension of the spring. The magnet is connected to the battery through the wire 39 and also to a spring contact member 58 through wire 59. The contact member 58 cooperates with a switch consisting of a conducting portion 60 and an insulated portion 61 arranged on a rod 62, one end of which is slidably-supported in a block 63 of insulating material carried by a stationary support 64, and the other end of the rod is connected by a bracket 65 with the rod 21. As a result of this arrangement, when the parts are in the position shown in Fig. 1 and the shutters open, the circuit through the magnet will be broken and the clutch members engaged so that the fan is being operated through the crank shaft. When the mechanism is operated to close the shutters, however, the conducting portion 60 of the switch will ride upon the spring contact 58 to establish a circuit through the magnet and withdraw the clutch member 54 and thereby stop the fan; the circuit being through the shutter connection to the frame.

In Fig. 2 there is shown a modification in which but a single double acting cylin-

der is employed for operating the mechanism. This cylinder is shown as 66 and has therein a piston 67 connected by a stem 68 to the rod 69; the stem being pivotally-connected to the rod and passing through a stuffing box in a removable cylinder head 70. The rod 69 is pivotally-connected to a bell-crank lever 71 which in turn is connected by a link 72 to a rod 73 which has a pivotal connection to each of the shutters 74 pivotally mounted in the radiator frame 75. Ports 76 and 77 form communications between the respective ends of the cylinder and a valve chest 79, open at each end to the atmosphere and having a communication to the intake manifold of the engine through the pipe 80. A thermostat 81 of the kind previously described has a connection to a stem 82 which has two valve heads 83 and 84 arranged to place either one of the ports 77 or 78 into communication with the intake manifold through the pipe 80, leaving the other port open to the atmosphere; when the temperature is high the valve heads would be positioned to form a communication between the intake manifold and the rear end of the cylinder through the port 76, opening the port 77 to atmosphere, thus driving the piston rearwardly and opening the shutters. When the temperature falls below normal, the valve heads move in the opposite direction so as to place the forward end of the cylinder in communication with the intake manifold through the port 77, leaving the port 78 open to the atmosphere, thus driving the piston forwardly and closing the shutters. In this modified construction, the fan is operated in the same manner described in connection with the arrangement shown in Fig. 1.

In this construction shown in Fig. 2, the manner of closing the shutters when the engine is at rest is also modified in that the armature 85 for the magnet 86 is pivoted upon the pin or stud 87 which supports the lever 71 and has connected with the free end thereof a spring 88, which, when the circuit through the magnet is broken, swings the armature upwardly and causes a finger 89 thereon to contact the lever 71 and close the shutters.

There is shown in Figs. 1 and 3 fuel controlling devices, operable by the air current regulating devices, for controlling the fuel so as to provide a rich mixture when the engine is in a cold condition and a lean mixture when the engine has reached the proper running temperature. I have illustrated in these views a portion of a carburetor of a well known type, in which 90 represents the air intake passage, and 91 the outlet thereof which is controlled by the usual butterfly valve 92. An air chamber, closed at the top, is represented by 93, between the upper portion of which and the air passageways is a port 94. A piston 95 is located in this air chamber and has connected therewith a pin 96 provided with tapering grooves which pin extends through a regulating sleeve 97 slidably mounted in a chambered portion 98, surrounded by the cap 99 and to the lower portion of which the fuel is admitted from the float chamber (not shown). This regulating sleeve 97 has thereon an exteriorly arranged worm 100 with which meshes a worm wheel 101 having connected therewith a crank arm 102. Pivotally connected to a rod 103 is a lever 104, the upper end of which is pivotally connected by a link 105 to the crank arm 102. The lower end of the lever 104 is forked and straddles the rod 21. Interposed between the forked end of the lever 104 and collars 106, fixed to the rod 21, are coil springs 107. Arranged in any suitable fixed supports 108 on each side of the lever 104 are adjustable stop screws 109 to limit the movement of the lever 104 in either direction. The position of the rod 103 is adjustable, the rod being slidably mounted in any suitable form of support and provided with a series of ratchet teeth 110 arranged to be engaged by a pin 111, a spring 112 bearing upon a collar on the pin serving to hold it in engagement with the teeth.

In the operation of this device, when the rod 21 has been moved by the devices described to close the shutters and stop the fan, the lever 104 will have been swung thereby so as to move the sleeve 97 through the connections described downwardly relatively to the pin 96 so as to admit a richer supply of fuel when the engine is running. When the engine has heated sufficiently to move the rod 21 to a position to open the shutters and start the fan, the lever 104 will be swung in the opposite direction so as to move the sleeve 97 upwardly relatively to the pin 96 so as to provide for a leaner mixture. The mixture so supplied, whether lean or rich, is regulated by adjusting the rod 103 so as to change the fulcrum of the lever 104. By the arrangement of the stop pins 109, and the manner of connecting the lever 104 to the rod 21 through the springs 107, it will be seen that the lever 104 may be rocked to the proper degree without any nice adjustment of the rod 21, as the springs will allow the rod 21 an additional movement in either direction after the movement of the lever has been arrested.

It will be understood, of course, that the fuel regulating devices thus described may be adapted to any form of carburetor by making suitable connections to the fuel regulating valve or other device of the carburetor. The connection should be made, however, in a manner to prevent interference

with the normal working of the carburetor in the manner shown and described by me. It will be seen that the regulating pin 96 is raised and lowered by the suction of the engine to supply more or less fuel to suit the running conditions, while my thermostatic connections raise or lower the regulating sleeve 97 only so that when this sleeve is adjusted by the thermostatic devices, the carburetor will still function to supply a leaner or richer mixture according to the speed of the engine.

Having thus described my invention, I claim:—

1. In a cooling system for an internal combustion engine, devices for creating a circulation of air, and means, including fluid pressure operated mechanism operated in both directions solely by a vacuum creating source and a thermostat influenced by the temperature of the engine for controlling said mechanism, for throwing said air circulation creating devices into and out of operation.

2. In a cooling system for an internal combustion engine, devices for creating and preventing a circulation of air, fluid pressure operated mechanism operable in both directions solely by the suction of the engine for controlling said devices, and a thermostat influenced by the temperature of said engine for controlling said mechanism.

3. In a cooling system for an internal combustion engine, devices for creating and preventing a circulation of air, a fluid pressure operated mechanism operable in both directions solely by fluid for controlling said devices which includes a connection to a vacuum creating source and a valve, and a thermostat influenced by the temperature of said engine for controlling said valve.

4. In a cooling system for internal combustion engines, the combination of a series of radiator shutters, fluid pressure operated mechanism having an operative connection with said shutters and operable in either direction solely by fluid pressure to open or close said shutters, and a thermostat influenced by the temperature of the engine for controlling said mechanism.

5. In a cooling system for an internal combustion engine, a series of radiator shutters, fluid pressure operated mechanism having an operative connection with said shutters and including a connection to a vacuum creating source and a valve in said connection, and a thermostat influenced by the temperature of said engine for controlling said valve, the construction and arrangement of said mechanism being such as to cause the same to be operable in either direction solely by fluid pressure to open or close said shutters.

6. In a cooling system for an internal combustion engine, the combination of a series of radiator shutters, devices connected with said shutters operable in either direction solely by atmospheric pressure to open or close said shutters, including a connection with a vacuum creating source, and a thermostat influenced by the temperature of said engine for controlling said source.

7. In a cooling system for an internal combustion engine, the combination of a series of radiator shutters, devices having a connection with said shutters and operable solely by atmospheric pressure in either direction to open or close said shutters, including a connection with a vacuum creating source and a valve in said connection, and a thermostat influenced by the temperature of said engine for controlling said valve.

8. In a cooling system for an internal combustion engine, a series of radiator shutters, devices operated solely by atmospheric pressure connected with said shutters and operable in either direction to open or close said shutters including a connection with the intake manifold of said engine and a valve in said connection, and a thermostat influenced by the temperature of the engine for controlling said valve.

9. In a cooling system for an internal combustion engine, a series of radiator shutters, devices connected with said shutters and operable in either direction solely by atmospheric pressure to open or close said shutters, said devices including a cylinder and piston and a connection to a vacuum creating source for creating a vacuum in said cylinder, and a thermostat for controlling said source.

10. In a cooling system for explosive engines, the combination of a cooling member such as a fan, electrically-operated devices for controlling said cooling member, and devices operated in either direction by fluid pressure for controlling said electrically-operated devices, and a thermostat influenced by the temperature of the engine for controlling said fluid devices.

11. In a cooling system of the character described, a series of shutters, thermostatically-controlled mechanism for opening and closing said shutters, means independent of said mechanism for closing said shutters, and electrical means for holding said independent operating means out of commission when the engine is in operation.

12. In a cooling system for an internal combustion engine for motor vehicles, a series of shutters, fluid pressure operated devices operable in either direction to open or close said shutters including a connection with a vacuum creating source associated with said engine when the same is running, a device for closing said shutters independently of said fluid pressure mechanism and electrical means associated with the electrical system of the vehicle for holding said in-

dependent operating device out of commission during the operation of the engine.

13. In a cooling system for an internal combustion engine, cooling means for said engine, fluid pressure operated mechanism for controlling said cooling means and operable in either direction solely by fluid pressure, and a thermostat influenced by the temperature of the engine for controlling said mechanism.

14. In a cooling system for an internal combustion engine, cooling means for the engine, fluid pressure operated mechanism for controlling said cooling means and operable in either direction solely by fluid, the fluid pressure being controlled by the engine, and a thermostat influenced by the temperature of the engine for controlling said mechanism.

15. In a cooling system for an internal combustion engine, cooling means for said engine including an air regulating device, fluid pressure operated mechanism having an operative connection with said regulating device and operable in either direction solely by fluid pressure, and a thermostat influenced by the temperature of the engine for controlling said mechanism.

16. In a cooling system for an internal combustion engine, cooling means for said engine including an air regulating device, fluid pressure operated mechanism having an operative connection with said regulating device and operable in either direction solely by fluid pressure, said fluid being controlled by the engine, and a thermostat influenced by the temperature of the engine for controlling said mechanism.

17. In a cooling system for internal combustion engines, a device to induce a circulation of cooling fluid, adjustable means for obstructing more or less the flow of said cooling fluid, mechanism operated in both directions solely by fluid pressure created by the action of the engine for operating said obstructing means, and a thermostat responsive to engine temperature for controlling said mechanism.

18. The combination, with an internal combustion engine having a water circulation system including a radiator, of a plurality of means, one of which is operable by engine temperature and the other operable in both directions by the suction of the engine, adapted to regulate the flow of air through the radiator.

In testimony whereof, I have hereunto set my hand this 29th day of May, 1920.

HARVE R. STUART.

Witness:
CHAS. I. WELCH.