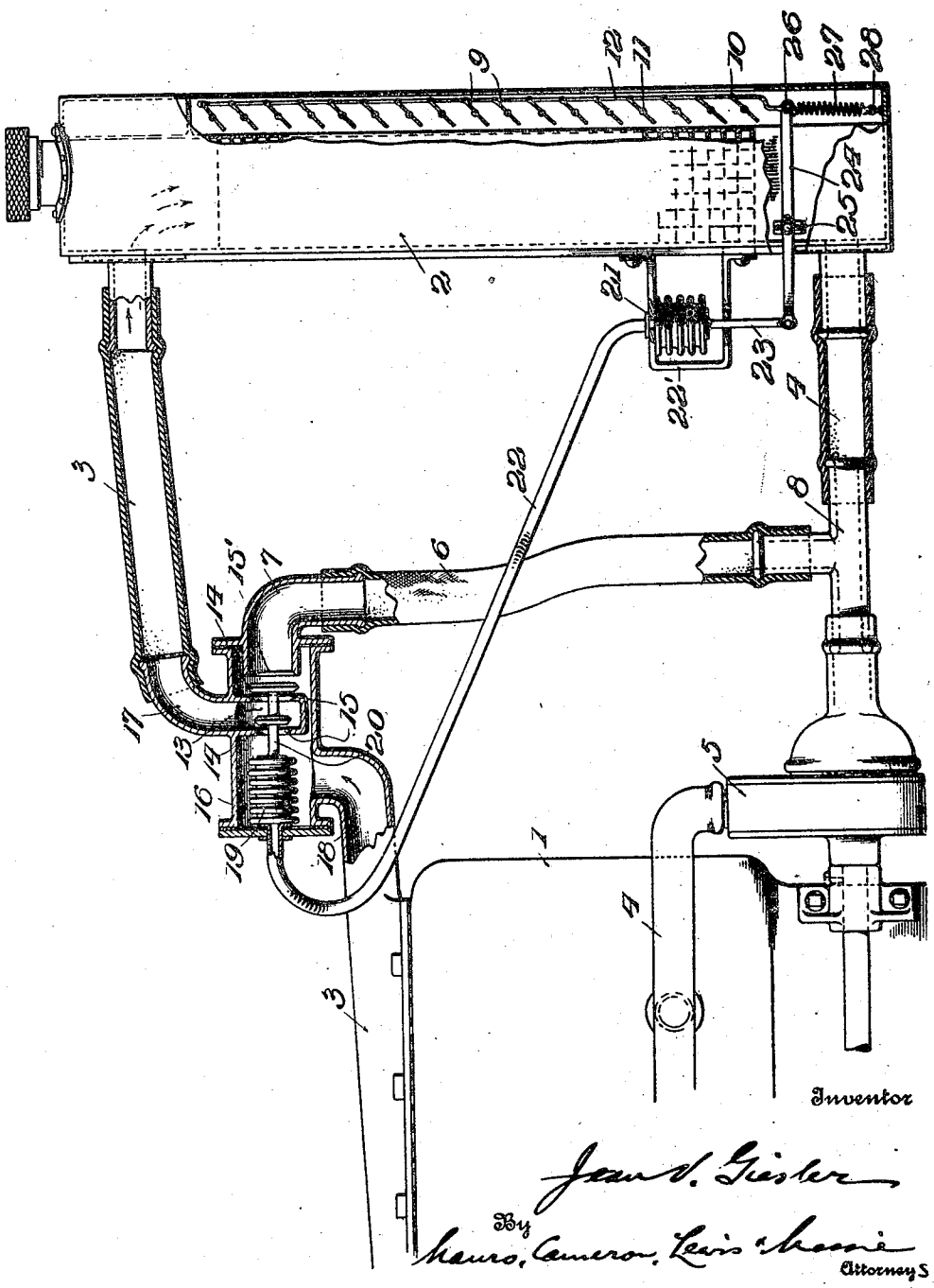
J. V. GIESLER.

COOLING SYSTEM FOR INTERNAL COMBUSTION ENGINES.

APPLICATION FILED APR. 23, 1917.

1,286,993. Patented Dec. 10, 1918.



Inventor

Jean V. Giesler

By Mauro, Cameron, Lewis & Hassie

Attorneys

UNITED STATES PATENT OFFICE.

JEAN V. GIESLER, OF KNOXVILLE, TENNESSEE, ASSIGNOR TO THE FULTON COMPANY, OF KNOXVILLE, TENNESSEE, A CORPORATION OF MAINE.

COOLING SYSTEM FOR INTERNAL-COMBUSTION ENGINES.

1,286,993. Specification of Letters Patent. Patented Dec. 10, 1918.

Application filed April 23, 1917. Serial No. 163,959.

To all whom it may concern:

Be it known that I, JEAN V. GIESLER, a citizen of the United States of America, and a resident of Knoxville, Tennessee, have invented a new and useful Improvement in Cooling Systems for Internal-Combustion Engines, which invention is fully set forth in the following specification.

This invention relates to cooling systems for internal combustion engines and, while capable of use in connection with a wide variety of engines of this type, has particular utility when applied to the engines of automobiles.

It is an object of this invention to provide a cooling system for internal combustion engines which enables the engine to be brought quickly to that temperature at which it operates most efficiently, which maintains the engine at such temperature even under widely varying and adverse temperature conditions exterior thereto, and which retains the engine at such temperature for a considerable time after the engine is stopped to avoid the necessity of bringing it back to its proper temperature after each short period that the engine is not in operation, which periods frequently occur in the running of an automobile.

It has heretofore been proposed to provide an internal combustion engine with a jacket, a radiator in connection with said jacket, and thermosensitive means for regulating the circulation of cooling medium through said jacket and radiator, both with and without the provision of a by-pass around the radiator. While possessing many advantages, such systems have also serious inherent defects, among the more notable of which may be mentioned the likelihood of freezing of the stationary body of water in the radiator under extreme temperature conditions; the adverse cooling effects produced by the circulation of air around the engine parts under conditions of low external temperature; the loss of efficiency, under such conditions, arising from the supply of air at too low a temperature to the carbureter and from condensation in the intake manifold; and the rapid cooling of the system and engine when the latter is stopped even for a short period.

It has also been proposed to provide an internal combustion engine with a jacket, a radiator connected therewith and a curtain, damper or shutters for regulating the flow of air through the radiator, such curtain, damper or shutters in some instances being controlled by thermosensitive means so as to vary the admission of air to the radiator in accordance with the temperature variations of the cooling system. While possessing certain advantages, these systems also have certain serious inherent defects, among the more notable of which may be mentioned the slowness with which the engine is brought to its proper temperature because of the large body of cooling medium that must first be raised to such temperature, and the difficulty of bringing the engine and system to such temperature because of the air leakage that inevitably occurs around devices of the type referred to.

It is an object of this invention to combine, in a cooling system for internal combustion engines, the two types of temperature-regulating means above referred to under such conditions and by the use of such instrumentalities as will secure the advantages arising from the use of either, while avoiding the defects inherent in both, and furthermore obtaining benefits heretofore unobtainable by the use of the known systems.

Other objects of this invention relate to the provision of a cooling system for internal combustion engines which is simple in construction, efficient in operation, and inexpensive to manufacture and install.

Stated broadly, the invention consists of a cooling system for internal combustion engines comprising a jacket for the engine cylinder or cylinders, a radiator, connections between said radiator and jacket, and, by preference, a by-pass around said radiator, together with mechanism for regulating the

flow of air through the radiator, valve mechanism for regulating the flow of cooling medium through the system, and means for controlling said mechanisms, preferably in the form of thermosensitive means, desirably subjected to the temperature of the cooling medium flowing through the system, and, by preference, so constructed and controlled that the first-named mechanism is not operated to admit the flow of air through the radiator until after the valve mechanism has assumed a predetermined position permitting the flow of the cooling medium through the radiator. Said thermosensitive means may be, and in practice preferably are, so constructed that, upon the occurrence of a leak therein rendering the regulating mechanisms unresponsive to temperature variations, said mechanisms assume a position of safety admitting the maximum circulation of cooling medium and the maximum flow of air through said radiator.

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

Said drawing illustrates in elevation, somewhat diagrammatically, a cooling system for an internal combustion engine embodying the present invention, certain parts being shown in section.

Referring in detail to said drawing, 1 represents the cylinder or cylinders of an internal combustion engine, the same being provided with a jacket through which it is designed that a cooling medium shall be circulated as is well known in the art. 2 designates a radiator of any suitable construction, 3 the upper water line connecting the engine jacket with the radiator, 4 the lower water line connecting the radiator with the engine jacket, and 5 any suitable pump for maintaining a circulation through the system thus provided. Obviously, if desired, the thermo-siphon system of maintaining a circulation through the engine jacket and radiator could be employed in place of the forced system of circulation. In the preferred arrangement, a by-pass 6 is provided around the radiator, the same being shown as connected at its opposite ends with the upper and lower water lines intermediate the engine jacket and the radiator, and conveniently taking the form of a tube of flexible material, such as rubber, connected at its opposite ends to pipe connections 7 and 8 suitably connected into the upper and lower water lines.

In accordance with the present invention, the radiator is provided in any suitable way with a damper mechanism for regulating the flow of the air through the radiator, such mechanism being illustrated as consisting of a series of shutters 9 pivoted to a suitable frame or housing at 10 and connected at joints 11 to an operating bar or link 12.

Also in accordance with the present invention, means are provided for regulating the flow of the cooling medium through the system, such means taking the form of a valve mechanism 13 shown as consisting of a pair of seating valves 14 coacting with ports 15 provided in walls positioned interiorly of a housing 16, to which is connected, either integrally or separately, said pipe connection 7 and pipe connections 17 and 18 communicating respectively, in the form shown, with the portions of the upper water line leading to the radiator and from the engine jacket. The valve mechanism, however, could obviously be interposed in the lower water-line if desired. Said valve mechanism also regulates the flow of the cooling medium through the by-pass, proportionately closing the by-pass as the main water line from the water jacket to the radiator is opened, and to this end pipe connection 7 is shown as extended interiorly of the housing 16 to provide a port 15′ with which the outer valve 14 coöperates and which it closes when the ports 15 have been opened wide. Obviously any other suitable form of valve mechanism may be employed if desired.

Means are provided for controlling the aforesaid damper mechanism and valve mechanism, such preferably taking the form of thermosensitive means. While separate thermostats operatively connected to said damper mechanism and said valve mechanism, respectively, may be employed if desired, the preferred embodiment of the invention comprises communicating thermostatic vessels respectively connected to said mechanisms and one only of said vessels being subjected to the temperature-controlling medium, preferably the cooling medium flowing through the cooling system. In the form shown, an expansible and collapsible corrugated resilient vessel 19 is positioned within said housing 16 in the path of the cooling medium flowing from the engine jacket, one wall of said vessel being maintained stationary while the opposite and movable wall of said vessel is connected to said valves 14 by a stem 20. A second expansible and collapsible corrugated resilient vessel 21 is in communication with the aforesaid vessel 19 through a pipe 22 and has one end wall maintained stationary by a suitable framework 22′ while its opposite and movable end wall is connected by a stem

23 to a lever 24 pivoted at 25 and operatively connected at 26 to the shutter-operating bar 12.

Means are provided to prevent the operation of the shutters until said valve mechanism has operated to close the by-pass and open the water line between the engine jacket and the radiator. While a wide variety of means may be employed to accomplish this end, the illustrated construction comprises a spring 27 secured at 28 to a relatively stationary part of the system as, for example, the framework supporting the shutters, and connected at its opposite end to lever 24 to oppose movement of said lever in a direction opening the shutters.

Preferably, the thermosensitive means is so constructed that, upon the occurence of a leak, the damper mechanism and valve mechanism will assume positions of safety, *i. e.*, positions wherein the maximum flow of air is admitted to the radiator and the maximum circulation of cooling medium is maintained through the radiator to the exclusion of the by-pass. To this end, vessels 19 and 21 are made collapsible against an elastic force, preferably inherent in the walls of said vessel by constructing the same of resilient material, and said vessels are charged with a thermosensitive fluid at a pressure below that to which the same are exteriorly subjected, the connections of said vessels to said damper mechanism and valve mechanism, respectively, being such that, upon expansion of said vessels, said damper mechanism is opened wide and said valve mechanism is operated to close the by-pass and open the water line. Where a spring is used, as shown at 27, the elastic force against which vessel 21 is collapsed must be sufficient to overcome said spring as well as to operate the shutter mechanism upon equalization of the interior and exterior pressures acting on said vessel.

Upon starting the engine, the cooling medium in the system is cold, vessels 19 and 21 are collapsed, valves 14 close ports 15, and shutters 9 close the air passage through the radiator. The circulation of cooling medium as maintained by the pump 5 is now from engine jacket 1 through valve housing 16, by-pass 6 and back to the engine jacket. Owing to the relatively small body of water now in circulation, the engine quickly reaches the temperature at which it operates most efficiently. A further increase in temperature of the cooling medium produces an expansion of vessel 19 with a corresponding opening of ports 15 and a proportionate closing of port 15′. Further increases in temperature produce further opening of the ports 15 until the outer valve 14 comes into engagement with and closes port 15′. The circulation of cooling medium as maintained by the pump 5 is now through the upper water line 3, radiator 2, lower water line 4 and back to the engine jacket. During all of this time, spring 27 has opposed any tendency to expansion of vessel 21 and has maintained the shutters closed. Upon a further increase in temperature of the cooling medium after outer valve 14 has engaged port 15′, the increase in pressure of the thermosensitive fluid within vessels 19 and 21 and connecting pipe 22 is exerted solely to cause an expansion of vessel 21, since vessel 19 can expand no further owing to the positive stop provided by port 15′ when in engagement with the outer valve 14. Expansion of vessel 21 produces an operation of lever 24 against the tension of spring 27 to gradually open shutters 9 until such quantity of air is permitted to flow through the radiator as will maintain the cooling medium in the system at its proper temperature. Upon a drop in temperature of the cooling medium, the first effect of the decrease in pressure exerted by the thermosensitive fluid is to permit spring 27 to close shutters 9 with a corresponding collapsing of the vessel 21. When vessel 21 is again fully collapsed, a further decrease in temperature, with a corresponding decrease in the pressure exerted by the thermosensitive fluid, permits a collapsing of vessel 19 with a corresponding closing of ports 15 and proportionate opening of port 15′.

Should a leak occur in either of vessels 19 or 21, or in pipe 22, the equalization of the internal and external pressures acting upon said vessels will permit the unbalanced elastic forces against which said vessels are normally collapsed to expand said vessels, moving valves 14 to open ports 15 and close port 15′ and moving the shutters 9 against the tension of spring 27 to admit the maximum flow of air through the radiator.

From the above, it will be seen that, upon starting the engine, only a small body of cooling medium needs to be heated before the engine is brought to its proper temperature. Therefore, the engine will heat up quickly. Thereafter the proportion of cooling medium flowing through the radiator is automatically varied, and eventually the admission of air to the radiator is automatically varied, to maintain said cooling medium at said proper temperature. Upon stopping of the engine, the first effect of a decrease in temperature of the cooling medium is to close the shutters 9, preventing the admission of air, retarding the cooling of the parts, and maintaining them for a long period of time at such proper temperature. Furthermore, when the engine is running under adverse temperature conditions, the stationary body of water in the radiator is not likely to freeze as in systems here-

tofore proposed wherein a thermostatically controlled by-pass is provided about the radiator; there is no circulation of air about the engine parts to cool them below their proper temperature or to produce condensation of the explosive mixture in the intake manifold; the air drawn into the carbureter is taken from the body of heated air surrounding the engine and the efficiency of the engine is maintained; and, owing to the provision of the by-pass and its thermostatic control, such leakage as occurs about the shutters 9 is insufficient to produce an improper drop in temperature of the cooling medium. It will therefore be perceived that a cooling system has been provided wherein the cooling medium is brought to its proper temperature within a minimum time, wherein the cooling medium is maintained at such temperature under the most adverse temperature conditions, and wherein, upon stopping of the engine, the parts are maintained at their proper temperature for a long period of time, so that, after a short stop, the engine may be started without loss of efficiency, a consideration of great importance in the operation of automobile engines.

While the particular embodiment illustrated on the drawing has been described with considerable detail, it is to be expressly understood that the invention is not to be restricted to the form there shown, for it is capable of receiving a variety of mechanical expressions, some of which will readily suggest themselves to those skilled in the art, while certain features thereof are capable of use without other features thereof. Reference is therefore to be had to the appended claims for a definition of the limits of the invention.

What is claimed is:—

1. A cooling system for internal combustion engines comprising an engine jacket, a radiator connected therewith, a by-pass around said radiator, mechanism for regulating the flow of air through said radiator, and valve mechanism for regulating the flow of the cooling medium through said radiator and by-pass.

2. A cooling system for internal combustion engines comprising an engine jacket, a radiator connected therewith, a by-pass around said radiator, mechanism for regulating the flow of air through said radiator, valve mechanism for regulating the flow of the cooling medium through said radiator and by-pass, and thermosensitive means for controlling said mechanisms.

3. A cooling system for internal combustion engines comprising an engine jacket, a radiator connected therewith, a by-pass around said radiator, mechanism for regulating the flow of air through said radiator, valve mechanism for regulating the flow of the cooling medium through said radiator and by-pass, and means controlled by the temperature of the cooling medium for operating said mechanisms.

4. A cooling system for internal combustion engines comprising an engine jacket, a radiator connected therewith, a by-pass around said radiator, mechanism for regulating the flow of air through said radiator, valve mechanism for regulating the flow of the cooling medium through said radiator and by-pass, and thermosensitive means for operating said mechanisms in succession.

5. A cooling system for internal combustion engines comprising an engine jacket, a radiator connected therewith, a by-pass around said radiator, mechanism for regulating the flow of air through said radiator, valve mechanism for regulating the flow of the cooling medium through said radiator and by-pass, and means controlled by the temperature of the cooling medium for operating said mechanisms in succession.

6. A cooling system for internal combustion engines comprising an engine jacket, a radiator connected therewith, a by-pass around said radiator, a damper for regulating the flow of air through said radiator, a valve mechanism for regulating the flow of the cooling medium through said radiator and by-pass, thermosensitive means for operating said valve mechanism and damper, and means to prevent opening of said damper before said valve mechanism has assumed a predetermined position.

7. A cooling system for internal combustion engines comprising an engine jacket, a radiator connected therewith, a by-pass around said radiator, a damper for regulating the flow of air through said radiator, a valve mechanism for regulating the flow of the cooling medium through said radiator and by-pass, means controlled by the temperature of the cooling medium for operating said valve mechanism and damper, and means to prevent opening of said damper before said valve mechanism has assumed a predetermined position.

8. A cooling system for internal combustion engines comprising an engine jacket, a radiator, connections between said jacket and radiator, a by-pass around said radiator, a damper for regulating the flow of air through said radiator, a valve mechanism for regulating the flow of the cooling medium through said radiator and by-pass, and thermosensitive means operatively connected to said damper and valve mechanism to first close said by-pass and open a passage communicating with said radiator and to thereafter open said damper.

9. A cooling system for internal combustion engines comprising an engine jacket, a

radiator, connections between said jacket and radiator, a by-pass around said radiator, a damper for regulating the flow of air through said radiator, a valve mechanism for regulating the flow of the cooling medium through said radiator and by-pass, and thermosensitive means subjected to the cooling medium flowing through said system and operatively connected to said damper and valve mechanism to first close said by-pass and open a passage communicating with said radiator and to thereafter open said damper.

10. A cooling system for internal combustion engines comprising an engine jacket, a radiator, connections between said radiator and jacket, mechanism for regulating the flow of air through said radiator, valve mechanism for regulating the flow of the cooling medium through said radiator, and means controlled by the temperature of the cooling medium for operating said mechanisms in succession.

11. A cooling system for internal combustion engines comprising an engine jacket, a radiator, connections between said radiator and jacket, mechanism for regulating the flow of air through said radiator, valve mechanism for regulating the flow of the cooling medium through said radiator, and thermosensitive means for operating said mechanisms in succession.

12. A cooling system for internal combustion engines comprising an engine jacket, a radiator, connections between said radiator and jacket, a damper for regulating the flow of air through said radiator, valve mechanism for regulating the flow of the cooling medium through said radiator, and thermosensitive means operatively connected to said damper and valve mechanism to first open a radiator connection and to thereafter open said damper.

13. A cooling system for internal combustion engines comprising an engine jacket, a radiator, connections between said radiator and jacket, a damper for regulating the flow of air through said radiator, valve mechanism for regulating the flow of the cooling medium through said radiator, and thermosensitive means subjected to the cooling medium flowing through said system and operatively connected to said damper and valve mechanism to first open a radiator connection and to thereafter open said damper.

14. A cooling system for internal combustion engines comprising an engine jacket, a radiator, connections between said radiator and jacket, a damper for regulating the flow of air through said radiator, valve mechanism for regulating the flow of the cooling medium through said radiator, thermosensitive means operatively connected to said damper and valve mechanism, and means to prevent the opening of said damper before said valve mechanism has operated to permit the flow of the cooling medium through said radiator.

15. A cooling system for internal combustion engines comprising an engine jacket, a radiator, connections between said radiator and jacket, a damper for regulating the flow of air through said radiator, valve mechanism for regulating the flow of the cooling medium through said radiator, thermosensitive means subjected to the cooling medium flowing through said system and operatively connected to said damper and valve mechanism, and means to prevent the opening of said damper before said valve mechanism has operated to permit the flow of the cooling medium through said radiator.

16. A cooling system for internal combustion engines comprising an engine jacket, a radiator, connections between said radiator and jacket, a damper for regulating the flow of air through said radiator, a valve mechanism for regulating the flow of the cooling medium through said radiator, and expansible and collapsible vessels charged with thermosensitive fluid and respectively connected to said damper and said valve mechanism.

17. A cooling system for internal combustion engines comprising an engine jacket, a radiator, connections between said radiator and jacket, a damper for regulating the flow of air through said radiator, a valve mechanism for regulating the flow of the cooling medium through said radiator, and communicating expansible and collapsible vessels charged with thermosensitive fluid and respectively connected to said damper and said valve mechanism.

18. A cooling system for internal combustion engines comprising an engine jacket, a radiator, connections between said radiator and jacket, a damper for regulating the flow of air through said radiator, a valve mechanism for regulating the flow of the cooling medium through said radiator, expansible and collapsible vessels charged with a thermosensitive fluid and respectively connected to said damper and said valve mechanism, and means to prevent the expansion of the vessel connected to said damper before said valve mechanism has assumed a predetermined position.

19. A cooling system for internal combustion engines comprising an engine jacket, a radiator, connections between said radiator and jacket, a damper for regulating the flow of air through said radiator, a valve mechanism for regulating the flow of the cooling medium through said radiator, communicating expansible and collapsible vessels charged with a thermosensitive fluid and respectively connected to said damper and

said valve mechanism, and means limiting the expansion of said vessel connected to said valve mechanism whereby further increase of pressure of said thermosensitive fluid effects expansion only of the vessel connected to said damper.

20. A cooling system for internal combustion engines comprising an engine jacket, a radiator, connections between said radiator and jacket, a damper for regulating the flow of air through said radiator, a valve mechanism for regulating the flow of the cooling medium through said radiator, communicating expansible and collapsible vessels charged with a thermosensitive fluid and respectively connected to said damper and said valve mechanism, means preventing expansion of the vessel connected to said damper before said valve mechanism has assumed a predetermined position, and means preventing expansion of the vessel connected to said valve mechanism after the latter has assumed said predetermined position whereby further increase of pressure of said thermosensitive fluid effects expansion only of said first-mentioned vessel.

21. A cooling system for internal combustion engines comprising an engine jacket, a radiator, connections between said radiator and jacket, a damper for regulating the flow of air through said radiator, a valve mechanism for regulating the flow of the cooling medium through said radiator, and expansible and collapsible vessels collapsible against an elastic force, charged with thermosensitive fluid at a pressure below that of the surrounding medium, and so connected to said damper and said valve mechanism respectively as to move the same to positions of safety upon the occurrence of a leak in said vessels.

22. A cooling system for internal combustion engines comprising an engine jacket, a radiator, connections between said radiator and jacket, a damper for regulating the flow of air through said radiator, a valve mechanism for regulating the flow of the cooling medium through said radiator, and communicating expansible and collapsible vessels collapsible against an elastic force, charged with thermosensitive fluid at a pressure below that of the surrounding medium, and so connected to said damper and said valve mechanism respectively as to move the same to positions of safety upon the occurrence of a leak in either of said vessels.

23. A cooling system for internal combustion engines comprising an engine jacket, a radiator connected therewith, a by-pass around said radiator, a damper for regulating the flow of air through said radiator, a valve mechanism for regulating the flow of the cooling medium through said radiator and by-pass, and expansible and collapsible vessels charged with thermosensitive fluid and respectively connected to said damper and said valve mechanism.

24. A cooling system for internal combustion engines comprising an engine jacket, a radiator connected therewith, a by-pass around said radiator, a damper for regulating the flow of air through said radiator, a valve mechanism for regulating the flow of the cooling medium through said radiator and by-pass, and communicating expansible and collapsible vessels charged with thermosensitive fluid and respectively connected to said damper and said valve mechanism.

25. A cooling system for internal combustion engines comprising an engine jacket, a radiator connected therewith, a by-pass around said radiator, a damper for regulating the flow of air through said radiator, a valve mechanism for regulating the flow of the cooling medium through said radiator and by-pass, expansible and collapsible vessels charged with thermosensitive fluid and respectively connected to said damper and said valve mechanism, and means to prevent the expansion of the vessel connected to said damper before said valve mechanism has assumed a predetermined position.

26. A cooling system for internal combustion engines comprising an engine jacket, a radiator connected therewith, a by-pass around said radiator, a damper for regulating the flow of air through said radiator, a valve mechanism for regulating the flow of the cooling medium through said radiator and by-pass, and expansible and collapsible vessels collapsible against an elastic force, charged with thermosensitive fluid at a pressure below that of the surrounding medium, and so connected to said damper and said valve mechanism respectively as to move the same to positions of safety upon the occurrence of a leak in said vessels.

27. A cooling system for internal combustion engines comprising an engine jacket, a radiator, connections between said radiator and jacket, mechanism for regulating the flow of air through said radiator, valve mechanism for regulating the flow of the cooling medium through said radiator, and thermosensitive means for controlling said mechanisms, said thermosensitive means being so constructed as to move said mechanisms to their positions of safety upon failure of the temperature control.

28. A cooling system for internal combustion engines comprising an engine jacket, a radiator, connections between said radiator and jacket, a by-pass around said radiator, mechanism for regulating the flow of air through said radiator, valve mechanism for regulating the flow of the cooling medium through said radiator and by-pass, and ther-

mosensitive means for controlling said mechanisms, said thermosensitive means being so constructed as to move said mechanisms to their positions of safety upon failure of the temperature control.

29. A cooling system for internal combustion engines comprising an engine jacket, a radiator, connections between said radiator and jacket, mechanism for regulating the flow of air through said radiator, valve mechanism for regulating the flow of the cooling medium through said radiator, and means subjected to the temperature of the cooling medium flowing through said system for controlling said mechanisms, said thermosensitive means being so constructed as to move said mechanisms to their positions of safety upon failure of the temperature control.

In testimony whereof I have signed this specification.

JEAN V. GIESLER.