

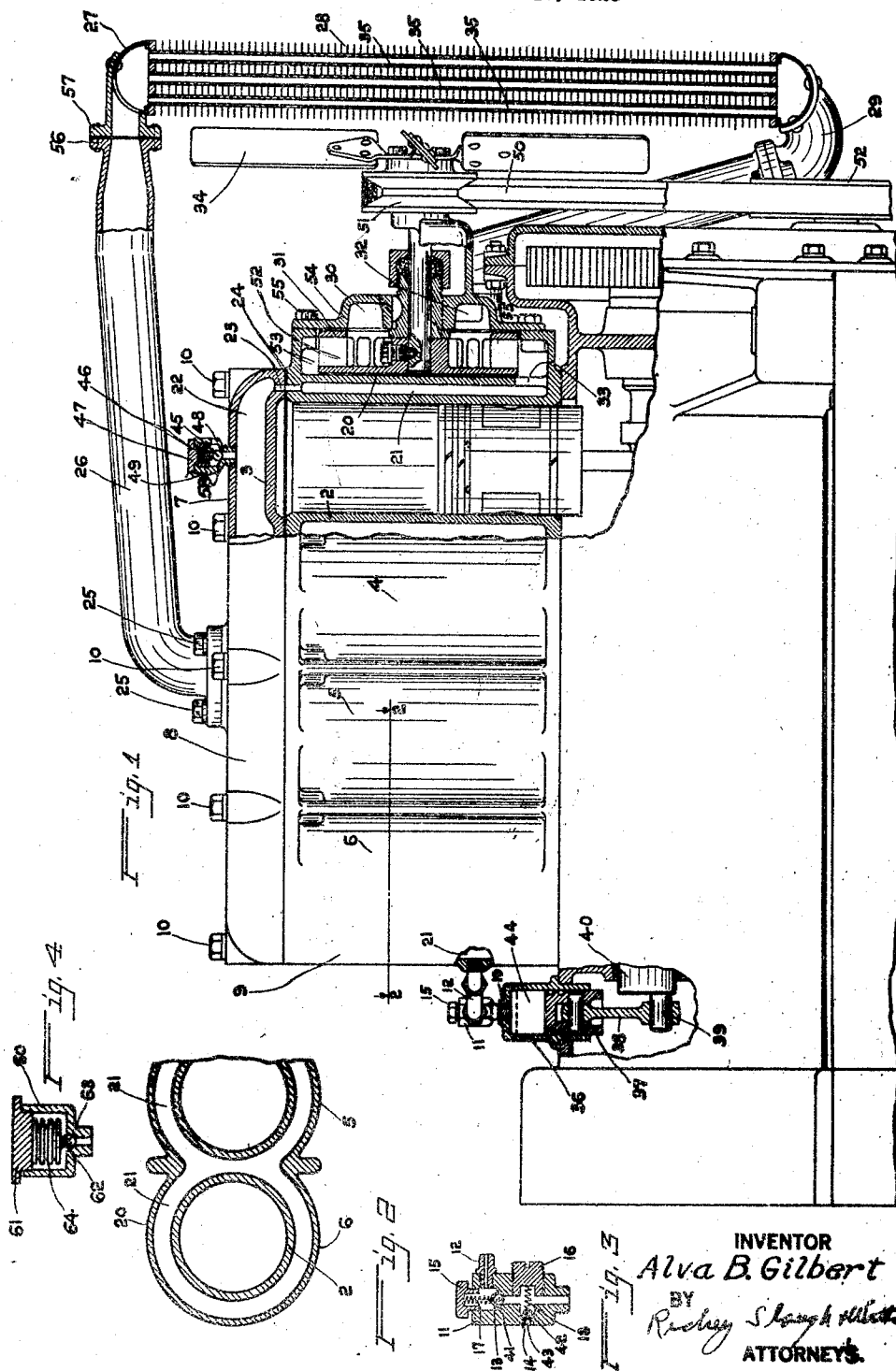
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ENGINE COOLING SYSTEM

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ENGINE-COOLING SYSTEM.

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To all whom it may concern:

Be it known that I, ALVA B. GILBERT, a citizen of the United States, residing at Elyria, in the county of Lorain and State of Ohio, have invented certain new and useful Improvements in Engine-Cooling Systems, of which the following is a specification.

My invention relates to engine cooling systems, and is applicable to engines of many different types. It is particularly applicable to engines of the explosive type as used in automotive vehicles of various kinds such as automobiles and air-craft.

It is a particular object of my invention to provide a cooling system applicable to automotive vehicles wherein the cooling medium shall be a gas, and preferably air instead of a liquid such as water as now commonly employed.

Another object of my invention is to provide an air or gas cooled engine wherein the heat conveying properties of the air are increased.

Another object of my invention is to provide a cooling system for engines involving the use of a gas as a cooling medium, the gas being maintained under a relatively high pressure and caused to circulate at and through the system past the heated portions of the engine and therefrom through a cooling apparatus.

Another object of my invention is to provide such a system wherein the cooling gas will be maintained above a certain pressure and will be circulated at a rate depending upon the speed of the engine.

Other objects of my invention and the invention itself will be disclosed in the accompanying description of an embodiment of my invention, and in which description reference will be had to the accompanying drawings illustrating an embodiment of my invention applied to an automotive engine of the explosive type.

Referring to the drawings:—

Fig. 1 shows a side elevational view, partly in longitudinal, medial, cross-section of an engine embodying my invention;

Fig. 2 shows a transverse section taken on the line 2—2 of Fig. 1;

Fig. 3 shows a longitudinal, medial, vertical section of valve controlling means which I preferably employ in connection with such an embodiment of my invention as is herein illustrated and described.

Fig. 4 is a medial vertical section of a thermostatic control device for maintaining a higher pressure in the cooling jacket.

Referring now to the different figures of the drawing and in all of which like parts are designated by like reference characters, at 1 I show the cylindrical side walls of the engine cylinder, an end wall therefor being shown at 3, the other cylinders of the engine illustrated being disposed to the rear of the first cylinder at 4, 5 and 6. The end wall 3 is a part of a casing forming the head of the engine 8 secured to the block 9 by bolts 10, the block 9 comprising the walls 2 of each of the cylinders and cooling medium jacket walls 20, there being provided between the jacket walls 20 and the cylinder walls 2 an intermediate air space 21. This air space is continuous throughout the engine block and surrounds all of the cylindrical walls 2 of all of the cylinders. The cooling jacket comprises the walls 7 of the head and the walls 20 of the block in close cooling spaces such as the space 21 for the block and the space 22 for the head, and these spaces are in free communication the one with the other in the usual manner for water-cooled automobile engines, there being openings provided through the adjoining walls of the head and the block, such as the aligned openings 23 and 24 shown forwardly of the front cylinder and adjacent the top thereof, such openings being provided all around the top walls of each of the cylinders. In other words, the contacting faces of the head and the block have aligned perforations through them adapted to communicate the cooling medium from the cooling space 21 in the block to the cooling space 22 in the head. Leading from the space 22 in the head and secured to the block by bolts 25, I provide a cooling medium outlet pipe 26 and which leads to the top 27 of a radiator 28 disposed preferably at the front of the vehicle in the usual manner for water cooling radiators, but which may be of any suitable form and disposition. A return pipe 29 leads from the bottom of the radiator 28 to a space 30 in front of a circulating fan 31 disposed preferably forwardly of the foremost cylinder, the ends of the pipe 29 opening at 32 into the space 30. The circulating fan 31 then forces the air returning by the pipe 29 from the radiator 28 through a

port 33 leading to the interior of the cooling jacket and to the space 21 therein. So far as described, the arrangement does not differ greatly from the usual arrangement in water cooling systems for automobile engines, although where it is usual to employ conduits 26 and 29 comprising sections made of rubber or like material where water is used, in my invention I preferably make these conduits of such a material as will adapt them to withstand high fluid pressures exerted from within the conduits, since it is my intention to employ a cooling gaseous fluid passing through these conduits and the radiator 28 under a very high pressure, the pressure depending upon the heat developed by the engine cylinders per unit of radiating surface. I expect often to employ pressures in excess of one hundred pounds per square inch, and to maintain air under such pressures circulating through the passages and conduits and radiator described.

The fan or pump is intended to function primarily as a circulating pump, that is, it pushes the compressed air contained in the cooling circulating system through the system, and has little or nothing to do with the securing of the air pressure.

My invention contemplates employing a common mechanism for maintaining the pressure of the air and for circulating the air, but I preferably employ, as illustrated, separate devices for accomplishing these dual purposes.

I preferably employ also a fan 34 disposed to the rear of the radiator 28 in the usual manner for drawing cooling air from the atmosphere in front of the radiator through apertures in the radiator between the radiator ducts 35 for the purpose of bringing air having a relatively low temperature into contact with the more highly heated air passing through the radiator. The radiator and the fan 34 and the speed of the fan will be proportioned according to well known engineering principles so as to bring sufficient cooling air at the proper rate into contact with the radiator cooling surfaces. It is a mere matter of making the radiator large enough and the fan powerful enough to sufficiently cool the heated air passing through the radiator before such heated air is discharged at the bottom of the radiator into the conduit 29.

At 36 I show a compression pump adapted to compress the air employed to cool the engine, the pump comprising a reciprocating piston 37 adapted to be reciprocated by a crank 38 driven by an eccentrically disposed reduced end 39 on the engine crank shaft 40, or driven in any suitable manner by the engine or appurtenances thereto. A conduit 12 leads from the pump 36 to the interior of the walls 20 of the block, and is adapted

to convey air compressed by the pump 36 to the space 21 of the cooling system. A valve unit 11 is screw-threaded at 19 into the head of the compression pump cylinder and carries a pair of valves 13 and 14, each being pressed by spring 17 and 18 respectively against valve seats 41 and 42. The valve 14 closes an opening 43 leading from the exterior of the valve member and the purpose of the opening 43 is to admit air drawn past the valve 14 on the suction stroke of the piston 37 into the space 44 above the head of the piston, and the valve 14 will be seated closing the opening 43 on the compression stroke of the piston. Upon the compression stroke of the piston, however, the valve 13 will be forced from its seat by the excess of pressure acting on its underside over the pressure exerted above it by its spring 17 and the pressure of the air contained in the jacket space 21.

The force of the springs 17 and 18 can be adjusted by their respective adjusting screws 15 and 16 and the maximum pressure which the pump 36 can deliver thus controlled.

The valve arrangement just described is one commonly used in varying forms for compression pumps and the arrangement is such that when the one valve is closed the other is open and conversely dependent upon whether the piston 37 is on its compression or suction stroke, there being perhaps intermediate moments when both valves are closed.

A blow-off valve 45 spring pressed with a spring 46 against a seat 58, the tension of the spring being adjusted by a cap screw 47 is provided as shown and is adapted to be opened to permit compressed air to escape through a port 48 to atmosphere from the compressed air space 22 whenever the pressure of the air in such space exceeds a predetermined pressure.

The cap 47 may be employed as an adjustment to permit the valve 45 to withstand varying high pressures depending upon the varying degree to which the adjusting screw 47 is turned. A spring 49 secured to the side of the valve casing presses against a roughened side of a screw 47 so as to maintain it in any given adjusted position. This arrangement is but one of a number of arrangements for blow-out valves which are well known and which any one of a number of forms of which could be employed.

It will be seen from the above description that the pump 36 is constantly operated during the operation of the engine to compress the air and force it into the cooling medium passages and the pressure of the air in the cooling system will rise until it has reached the maximum pressure that the pump is designed and adjusted to supply, which

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pressure is preferably slightly lower than the pressure necessary to force the valve 45 from its seat.

In Fig. 4 I have shown a sectional view of a thermostatic regulator which may be used in place of the blow-off valve 45. This regulator consists of a casing 60 having an apertured screw-threaded neck which is adapted to communicate and to be screwed into the cylinder head similar to the spring controlled blow-off valve shown in Fig. 1. This casing is provided with a screw threaded cover 61 and a valve seat 62 which seats a valve 63. A thermostat device of any desired type may be used, but I prefer to employ one of the bellows type as shown at 64. The lower end of the thermostat is provided with a seat which engages the ball valve 63 and exerts a pressure thereagainst while the upper portion of the thermostat abuts the cover 61 which may be screwed down against the thermostat to exert varying pressure thereon, thus determining the pressure at which the valve will open.

From this arrangement it will be seen that as the engine speeds up and consequently heats up to a greater degree, the pump builds up a greater pressure on the cooling fluid which will be maintained within the cooling jacket due to the increased pressure of the thermostat against the valve 63 to keep the same seated. It will be noted that the thermostat is mounted on the engine head so that it will be acted upon directly by the heat from the engine as the latter is speeded up.

It will be understood that the pressure regulating device may be controlled to maintain the pressure on the cooling fluid at a substantially constant value even when the engine is running at a comparatively slow speed. As the engine increases its speed it increases the temperature of the block and head, and it is the purpose of the thermostat element when actuated by this increased temperature to maintain the valve 63 in seated position so that a higher air pressure may be had within the cooling jacket to more effectively reduce the increased temperature thereabout. It will be seen therefore that this device operates to automatically maintain an increased air pressure as the speed and temperature of the engine increase.

At 50 I show a fan belt passing over pulleys 51 and 52, the latter being driven by the crank shaft 40, the pulleys and belt being provided to maintain the fan 34 in operation during the operation of the engine. The circulating fan 31 has a rotor 52, a volute 53 and an inlet 30. The front plate 54 of the fan casing is bolted to the engine block by bolts 55. Suitable fluid-tight gaskets will be employed between the plate 54 and the block adjacent surfaces and

between the adjacent surfaces of the head 8 and the block 9 of the engine and between any adjoined fluid communicating surfaces such as the ends of the flanges 56 and 57 contained in the conduit 26.

In operation air is circulated by the fan or pump 52 through the cooling system as previously described and maintained up to a pre-determined high pressure by the co-operative action of the pump 36 and the blow-off valve 45 and the compressed air passing over the heated surfaces of the engine cylinder walls will carry heat away from said surfaces at a rate greatly in excess of what might be accomplished by air at substantially atmospheric pressure or at a relatively low pressure, and will carry the heat away through the conduit 26 to the radiator 28 where the air is cooled in any suitable way but as illustrated by the passage of cooling air through the interstices of the radiator.

Having thus described my invention as embodied in a particular type of automotive engine, I am aware that numerous and extensive departures may be made from the embodiment of my invention herein illustrated and described, but without departing from the spirit of my invention.

I claim:—

1. In an automotive engine, a cooling system therefor comprising a radiator, a cooling jacket surrounding the engine and spaced from the heated walls thereof, conduits leading from opposite ends of the radiator to opposite portions of the space provided between the cooling jacket and the heated engine walls, means to circulate a gas through the jacket space, conduits and radiator continuously, and compressing means adapted to force air under compression into the fluid circulating system.

2. In an automotive engine, a cooling system therefor comprising a radiator, a cooling jacket surrounding the engine and spaced from the heated walls thereof, conduits leading from opposite ends of the radiator to opposite portions of the space provided between the cooling jacket and the heated engine walls, means to circulate a gas through the jacket space, conduits and radiator continuously, and compressing means adapted to force air under compression into the fluid circulating system, and a valve for limiting the pressure of fluid in the circulating system.

3. In an automotive engine, a cooling system therefor comprising a radiator, a cooling jacket surrounding the engine and spaced from the heated walls thereof, conduits leading from opposite ends of the radiator to opposite portions of the space provided between the cooling jacket and the heated engine walls, means to circulate a gas through the jacket space, conduits and

radiator continuously, and compressing means adapted to force air under compression into the fluid circulating system, and a valve for limiting the pressure of fluid in the circulating system, said circulating pump and compressing means being continuously operated by the engine.

4. In an automotive engine, a cooling system therefor comprising a radiator, a cooling jacket surrounding the engine and spaced from the heated walls thereof, conduits leading from opposite ends of the radiator to opposite portions of the space provided between the cooling jacket and the heated engine walls, means to circulate a gas through the jacket space, conduits and radiator, and compressing means adapted to force air under compression into the fluid circulating system, and a valve for limiting the pressure of fluid in the circulating system, said circulating pump and compressing means being continuously operable by the engine and a fan driven by the engine for effecting a flow of cooling air over the radiator surfaces.

5. In an automotive engine, a cooling system therefor comprising a radiator, a cooling jacket surrounding the engine and spaced from the heated walls thereof, conduits leading from opposite ends of the

radiator to opposite portions of the space provided between the cooling jacket and the heated engine walls, means to circulate a gas through the jacket space, conduits and radiator continuously, and compressing means adapted to force air under compression into the fluid circulating system, and a thermostatically controlled valve for automatically maintaining a greater pressure in the circulating system upon an increase in engine speed.

6. In an automotive engine, a cooling system therefor comprising a radiator, a cooling jacket surrounding the engine and spaced from the heated walls thereof, conduits leading from opposite ends of the radiator to opposite portions of the space provided between the cooling jacket and the heated engine walls, means to circulate a gas through the jacket space, conduits and radiator continuously, and compressing means adapted to force air under compression into the fluid circulating system, and automatic means for maintaining a greater pressure in the circulating system upon an increase in engine speed.

In testimony whereof I hereunto affix my signature this 7th day of March, 1925.

ALVA B. GILBERT.