DIESEL ENGINE COOLING SYSTEM

Inventor: Virgil L. Frantz, Salem, Va.
Assignee: Graham-White Sales Corporation, Salem, Va.

Filed: Jan. 19, 1970
Appl. No.: 3,786

U.S. Cl. 137/529, 137/522
Int. Cl. F16k 17/02
Field of Search 165/71, 107; 123/41.14, 41.08, 123/41.54; 105/62 A; 180/54 A; 137/87, 469, 522, 523, 529, 528, 536, 538, 543.15; 251/14, 63.4, 77, 82, 83, 62

References Cited

UNITED STATES PATENTS
1,632,596 6/1927 Grantier .................. 123/41.14
2,016,179 10/1935 Rosenqvist .................. 123/41.22 X
2,032,670 3/1936 Simmen .................. 123/41.14
2,244,266 6/1941 Shope .................. 123/41.14 X

2,408,183 9/1946 Wood .................. 123/41.14
28,111 5/1860 Storm .................. 137/529 UX
1,623,431 4/1927 McVoy .................. 137/529 UX
1,402,527 1/1922 Needham .................. 137/493.3
2,086,942 7/1937 Mandeville .................. 137/522
2,829,860 8/1958 Garner et al. .................. 251/129

Primary Examiner—Henry T. Klinksiek
Attorney—Wilmer Mechlin

ABSTRACT

An automatic dump and pressure relief valve for a pressurized engine cooling system in which both automatic dumping and pressure relief are produced by a piston reciprocable in a valve body and having operating and actuating heads responsive to fluid pressure and connected for limited relative axial movement and springs acting on the heads and yieldable to predetermined pressures applied thereto. The valve also has a manual override for enabling it to be opened as needed while the system is pressurized.

8 Claims, 6 Drawing Figures
1

DIESEL ENGINE COOLING SYSTEM

BACKGROUND OF THE INVENTION

Customarily, a diesel engine is cooled by water and where, as in a diesel locomotive, the water in turn is cooled in a radiator exposed to the elements, to prevent freezing in cold weather when the engine is not running, provision is often made for transferring the water automatically from the exposed radiator to a weather-protected, interior storage tank whenever the engine is stopped. However, if the storage tank is accidently overfilled, the transfer cannot be completed and in sub-freezing weather water remaining in the radiator can freeze, with consequent potential damage to the radiator. It is to this problem that the present invention is particularly directed.

SUMMARY OF THE INVENTION

An object of the present invention is to provide for the pressurized cooling water system of a diesel engine having an exposed radiator adapted to drain by gravity into a storage tank when the engine is stopped by an improved automatic dump and pressure relief valve connected to a dump port in a side of the tank and automatically opened and closed, respectively when the engine is stopped and running, for dumping any excess water from the tank when the radiator is draining therein-to, while closing the system for and controlling pressurizing when the engine is running.

Another object of the invention is to provide an improved "automatic dump and pressure relief valve for a pressurized engine cooling system, wherein both automatic dumping and pressure control are provided by a piston having operating and actuating, fluid pressure-responsive heads connected for limited relative axial movement and associated spring means yieldably resisting movement of the heads under pressure."

A further object of the invention is to provide an automatic dump and pressure relief valve for a pressurized engine cooling system, having an override which enables the valve to be opened as desired while the system is pressurized without affecting the action of the valve at other times.

An additional object of the invention is to provide an improved automatic dump and pressure relief valve for a pressurized engine cooling system whereby the operating pressure of the system can be adjusted.

Other objects and advantages of the invention will appear hereinafter in the detailed description, be particularly pointed out in the appended claims and be illustrated in the accompanying drawings, in which:

FIGURE DESCRIPTION

FIG. 1 is a side elevational view of a preferred embodiment of the improved automatic dump and pressure relief valve of the present invention applied to a pressurized cooling system of a diesel engine of a diesel locomotive and connected to a dump port of a storage tank and an engine governor oil line; FIG. 2 is a plan view of the structure of FIG. 1 with part of the tank removed; FIG. 3 is a vertical sectional view taken along lines 3--3 OF FIG. 2, with the valve disconnected from the tank; FIG. 4 is a vertical sectional view taken along lines 4--4 OF FIG. 1; FIG. 5 is a vertical sectional view on the same section as FIG. 3 but on a larger scale and with further parts shown in section to more clearly illustrate certain of the details of construction; and FIG. 6 is a somewhat schematic view of an improved pressurized cooling water system for a diesel locomotive engine incorporating the automatic dump valve of the preceding figures.

DETAILED DESCRIPTION

Referring now in detail to the drawings in which like reference characters designate like parts, the improved auto-
3,651,829

3. Differential piston 16 having mounted on a stem or shank 17 a pair or plurality of axially spaced heads of different presented or effective areas. The smaller of these heads is an inner or operating head or valve element 18 confronting and sealingly seated in the valve seat and riding or moving in a valve chamber 19, and the larger is an outer or actuating head 20 riding and in its case sliding in a pressure chamber 21 separated from the valve chamber by an intervening transverse wall or septum 22 in which the adjoining part of the stem 17 is guiding received. Permissively vertically acting or reciprocating, the differential piston 16, for structural simplicity of the valve, preferably acts or reciprocates horizontally and, along with the main part of the body 12, is horizontally disposed and concentrically or axially aligned with the inlet leg 15. Correspondingly, the valve seat 14 opening onto the valve chamber 19, preferably is formed at the inner end of the inlet leg 15.

Normally or when the engine 2 is stopped or not running, the smaller or operating head 18 is yieldably held retracted away from the seat 14, suitably by a return spring 23 acting between the larger or actuating head 20 and the transverse or dividing wall 22 bounding the inner end of the pressure chamber 21. Conversely, when the engine is running, the operating head 18 is shifted, moved or forced from its normally open position to closed position in the seat 14 by fluid pressure then acting on the actuating head 20 and applying therethrough a force on the differential piston 16 opposing and, by virtue of the different exposed areas of the heads, greater than the force exerted by the return spring 23.

The actuating pressure required for the above purpose is supplied by connecting the pressure chamber 21 at its outer end or otherwise beyond or outwardly of the operating head 20, to a fluid line 24, such as the governor oil line 24 in the locomotive 3, that is pressurized only when the engine 2 is running. The pressure chamber 21 is sealed against leakage of the pressurized fluid, both outside the actuating head 20 and, if that head is releasably connected to the adjoining end of the stem 17, as by a snap ring 25, also through the head and the boundary wall 22 about the stem, by O-rings or like suitable sealing gaskets 26, while back pressure opposing movement of the actuating head under pressure of the actuating fluid is prevented by connecting the inner end of the pressure chamber to atmosphere through atmospheric bleeds 27.

In the illustrated embodiment, the reciprocal or axial movement of the differential piston 16 to open position under force of the return spring 23 and closed position under pressure of the actuating fluid supplied through the line 24, is positively limited by the engagement of the actuating head 20 with the opposite ends or extremities of the pressure chamber 21. To enable the operating head 18 in closed position both to seal the seat 14 against leakage of water from the cooling system 2 and to regulate or control the operating pressure of the system, that head not only mounts the replaceable resilient washer 28 directly engageable with the seat, but is itself mounted for axial movement relative to the actuating head 20 under an adjustable spring force urging it inwardly toward the seat.

For such adjustable mounting of the operating head 18, the stem 17 is divided axially between the inner end wall 22 and the operating head 18 into axially aligned, relatively telescoping parts 29 and 30, mounting, respectively, the operating head and the actuating head 20 and yieldably urged apart by a pressure spring 31. Suitably in the form of a compression coil spring surrounding and extending over both of the parts 29 and 30, the pressure spring 31 preferably is encased or enclosed in a tubular casing 32 carried and fixed at an outer end to the actuating head part 30, as through a radially outstanding annular shoulder 33 integral or rigid therewith, and having thereon its other or inner end a centrally apertured cap 34. The spring 31 acts between the shoulder 33 and an adjusting plug 35 threaded onto the operating head part 29 outwardly of that head and slidably fitting in the confronting inner end of the casing 32.

Seating the adjoining end of the spring 31 in a head portion 36 sliding in the casing 32, the adjusting plug 35 has a reduced neck portion 37 extending through the aperture outer end or wall 38 of the cap 34 and is adjustably limited in outward movement relative to the casing by the radial overlap between its head portion and the cap end, while itself being shiftably axially of the operating head stem part 29 by its threaded engagement therewith for varying the effective length and thus the pressure exertable by the pressure spring. The operating head part 29 is guided in its telescoping movement by being socketed in an adjoining end portion of the actuating part 30 and, desirably, the casing 32 slides in and is guided by an annular guide rib 39 dividing the interior of the body 12 inwardly of the pressure chamber 21 into the valve chamber 19 and a chamber 40 intermediate the valve and pressure chambers. Radial drillings 41 in the peripheries of the operating head 18, cap 34 and adjusting plug 35 for accepting suitable turning tools (not shown), permit an approximate adjustment of the closing force of the pressure spring 31 to be made before insertion of the piston 16 into the body 12 and any further adjustment after assembly can readily be made by like tools inserted through the outlet port 13, using the latter as an access port.

So constructed and connected to the storage tank 6 and actuating fluid line 24, the dump valve 11 will open and close the valve seat 14 under the opposing spring and fluid force supplied to the actuating head. However, when the seat is closed, the pressure of the actuating fluid on the actuating head simply holds the latter at its inner limit of movement against the wall 22 and the force holding the seat closed is the yieldable force exerted by the pressure spring 31 on the operating head 18. Consequently, when the engine is running the heads 18 and 20 and the adjustable pressure spring 31, not only controls or regulates the operating pressure of the system 1, but, as opposed to a pressure cap, enables that pressure to be adjusted at will. Conversely, when the engine is stopped, the removal of the closing pressure from the actuating head 20 will enable the return spring 23 to shift the piston to open position and, by unseating the operating head 18 from the seat 14, open the dump port 10 in the side of the storage tank to the outlet port 13 of the dump valve 11. Not only does this ensure that all of the water contained in the radiator 4 during running of the engine will flow by gravity into the storage tank 6 and eliminate any possible damage to the radiator under sub-freezing weather conditions, but, since the dump port 10 in the storage tank will always be open when the engine is not running and it is then that the storage tank will be filled by removing the fill cap 8, the limit to which the storage tank can be filled is the level of the dump port, and here can be no accidental overfilling.

While the automatic action of the dump valve 11 in opening and closing the dump port 10 will suit most conditions encountered in service, at times it will be desirable to remove the fill cap 8 while the engine is running, as for the introduction of a water treating agent. For such eventualities, the preferred dump valve 1 is made overrideable in its automatic closing action. Although this is accomplishable by valving the actuating fluid line 24 for bypassing the pressure chamber 21 and thus temporarily relieving the pressure on the actuating head 20, the preferred means is a manually actuated mechanical override 42 forming part of the dump valve. In the preferred override 42, a yoke 43 straddling or embracing and engageable with but normally disengaged from the operating head 18, within a normally closed upper leg 44 "of the body 12 mounted against relative rotation," on an operating shaft 45. Journalled in the upper leg 44, the operating shaft 45 projects at one end thereby and bears against relative rotation at that end an operating handle 46.

Embracing the operating head 18 between a radially outstanding annular flange 47 thereon and the adjoining end of the inlet leg 15 and normally yieldably held against the latter, suitably by a torsion spring 48 acting between the body's
upper leg 44 and the handle 46, and with the operating shaft 45 disposed above and substantially normal or at right angles to the piston stem 17, the yoke 43, while normally removed from and no affecting movements of the operating head 18, on swinging of the handle against the spring, will be swung outwardly from the valve seat 14 against the head flange 47 and, by applying force thereto, unseat the operating head. The consequent relief of the pressure in the pressurized cooling water system 1 through the dump port 10 in the storage tank 6, will permit the fill cap 8 to be removed without danger for introducing a treating agent or other additive into the tank and, thereafter, replacement of the cap and release of the handle will restore the normally closed and pressurized running or operating condition of the cooling system.

From the above detailed description it will be apparent that there has been provided an improved automatic dump and pressure relief valve for use in a pressurized engine cooling system, which, when applied to a cooling system of an engine of a diesel locomotive, by automatically closing and opening a dump port in the system's storage tank in response to running and stopping of the engine, prevents overfilling of the tank and ensures emptying of the system's radiator thereinto whenever the engine is stopped. It should be understood that the described and disclosed embodiment is merely exemplary of the invention and that all modifications are intended to be included that do not depart from the spirit of the invention and the scope of the appended claims.

Having now described my invention, I claim:

1. An automatic dump and pressure relief valve for pressurized engine cooling system, comprising a valve body having inlet and outlet ports and a valve seat therebetween, a piston reciprocable in said body and having axially spaced operating and actuating heads respectively for closing said seat and for moving said operating head into and out of seat-closing position, a piston stem connecting and having relatively telescopic parts each mounting one of said heads for limited relative axial movement therebetween, said operating head being exposed through said seat and inlet port to operating pressure in said cooling system, said actuating head in response to actuating pressure applied thereto moving said operating head to close said seat, first compression spring means acting on said actuating head for unseating said operating head in the absence of said actuating pressure, and second compression spring means acting between said parts and therethrough on said operating head in the seat-closing position thereof and yieldable under a predetermined operating pressure in said system for therebelow holding said operating head in said seat.

2. A valve according to claim 1, including means for adjusting the force exerted by the second spring means and therethrough the operating pressure in the system.

3. A valve according to claim 2, including a casing on one of the stem parts for receiving the second spring means.

4. A valve according to claim 3, wherein the adjusting means is on the other stem part and extends into an adjoining end of the casing.

5. A valve according to claim 4, including stop means on the casing and adjusting means for limiting the relative outward axial movement of the heads.

A valve according to claim 1, including override means normally operatively disconnected from the piston and actable thereon for unseating the operating head from the seat while actuating pressure is applied to the actuating head without otherwise affecting operation of the piston.

7. A valve according to claim 6, wherein the override means is manually operable and mounted in the body and acts directly on the operating head.

8. A valve according to claim 7, wherein the override means includes a pivoted yoke loosely embracing the operating head inwardly of abutment means thereon and on outward pivoting engageable with said means for unseating said head, an operating shaft journaled in the body and pivotally mounting said yoke against relative rotation, handle means on said shaft outside the body, and spring means acting between the body and said handle means for normally holding said yoke in inoperative position against the body and disengaged from the operating head.

* * * * *