United States Patent

[11] 3,621,907

[72] Inventors **Max Ephraim, Jr.**
Evergreen Park;
Ludvik F. Koci, La Grange Park;
Humberto Suarez, Forest Park, all of Ill.

[21] Appl. No. **33,319**
[22] Filed **Apr. 30, 1970**
[45] Patented **Nov. 23, 1971**

[73] Assignee **General Motors Corporation**
Detroit, Mich.

[54] COOLING SYSTEM FOR LOCOMOTIVE ENGINES AND THE LIKE

6 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** **165/51,** 123/41.14, 123/41.08, 165/71, 165/107, 137/87, 251/14, 251/77

[51] **Int. Cl.** **F01p 11/02**

[50] **Field of Search** ..... 165/71, 107, 51; 123/41.14, 41.08, 41.54; 105/62 A; 180/54 A; 137/87; 251/14, 63.4, 77

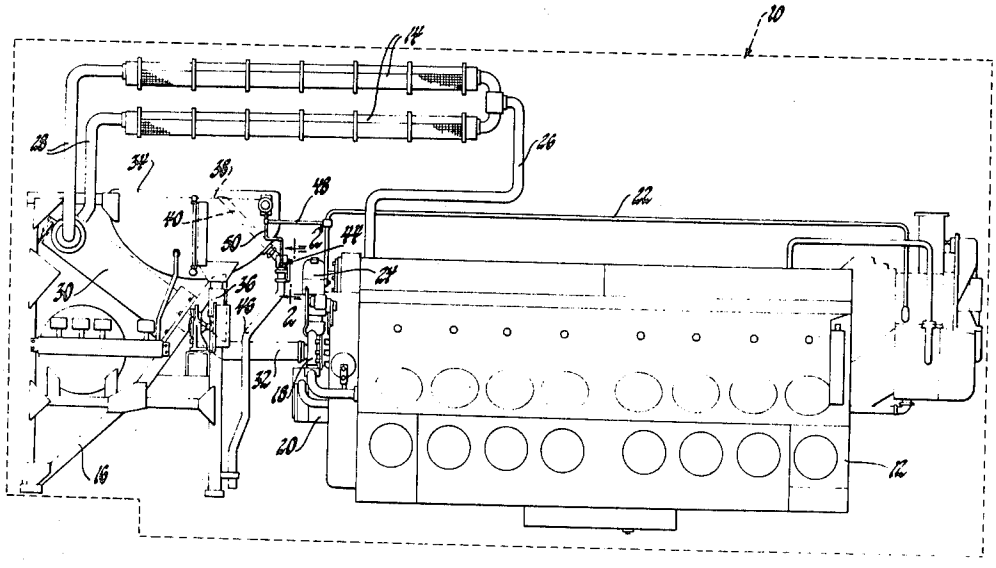
[56] **References Cited**

UNITED STATES PATENTS

2,032,670	3/1936	Simmen	123/41.14
2,857,892	10/1958	Hulsebus	123/41.14 X
1,632,596	6/1927	Grantier	123/41.14

Primary Examiner—Albert W. Davis, Jr.
Attorneys—J. L. Carpenter and Robert J. Outland

ABSTRACT: A locomotive cooling system has radiators mounted above the normal coolant level during engine shutdown in the engine and water tank so as to drain the radiators when the engine stops, to avoid the possibility of freezing the water therein. An automatic pressure relief and overflow valve is provided which is open during engine shutdown to drain excess water from the cooling system so as to prevent the retaining of any coolant in the radiators. When the engine is operating, the valve is normally closed by engine lubricating oil pressure to permit normal pressure buildup in the engine cooling system. However, the valve opens to relieve excess pressure in the cooling system. Manual opening means are also provided to relieve system pressure during engine operation.



PATENTED NOV 23 1971

3,621,907

SHEET 1 OF 2

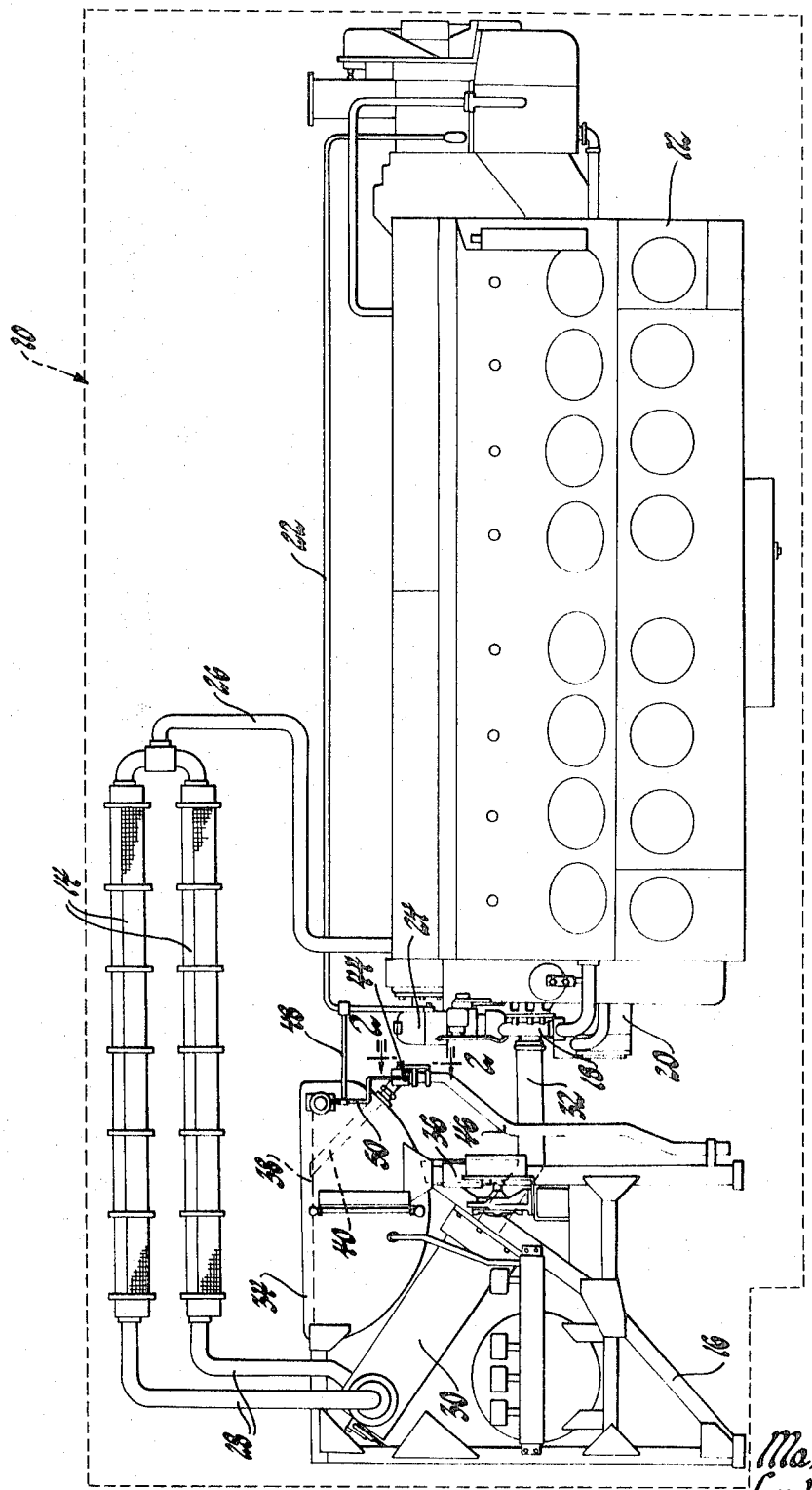


Fig. 1

INVENTORS
Max Ephraim, Jr.
Ludvik F. Koci &
Humberto Suarez

BY
Robert J. Outland
ATTORNEY

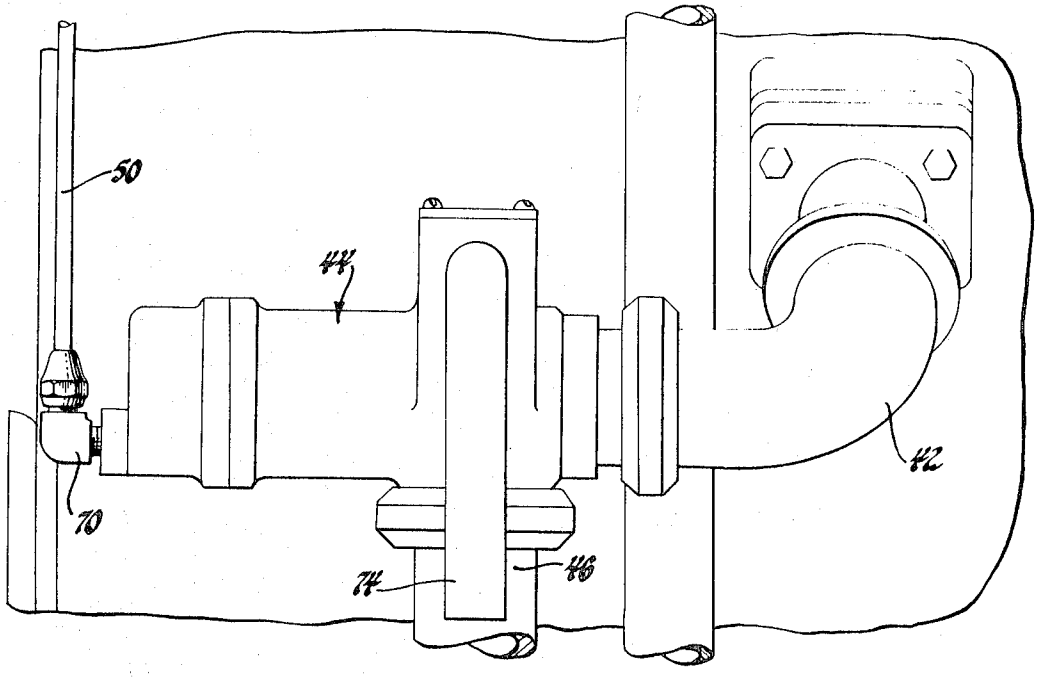


Fig. 2

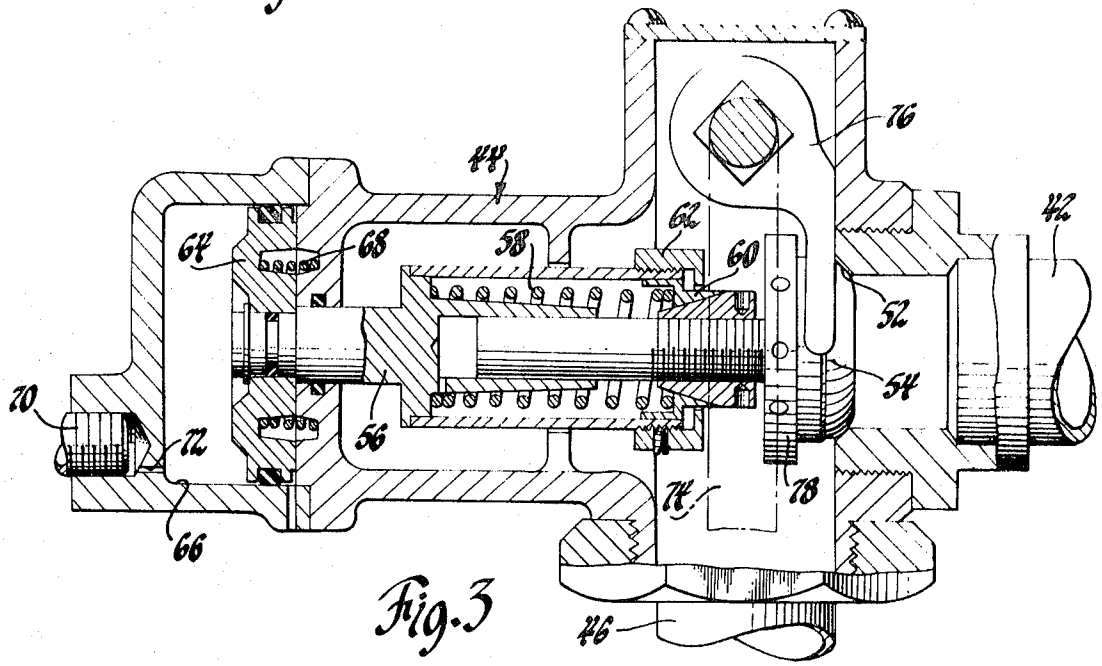


Fig. 3

INVENTORS
Max Ephraim, Jr.,
Ludvik F. Koci &
Humberto Suarez
BY
Robert J. Outland
ATTORNEY

COOLING SYSTEM FOR LOCOMOTIVE ENGINES AND THE LIKE

FIELD OF THE INVENTION

This invention relates to engine cooling systems for locomotives and the like and, more particularly, to an improved cooling system having automatic pressure relief and shutdown level control features.

DESCRIPTION OF THE PRIOR ART

It is known in the art relating to diesel locomotives, power units and other mechanisms utilizing internal combustion engines for exterior use, to provide a water cooling system having radiators mounted above the normal water level in the system when the engine is shut down. This permits the water coolant to drain from the radiators during engine shutdown to avoid the possibility of coolant freezing in the radiator elements, which are generally mounted in a position exposed to air at ambient temperatures.

In such systems, it is normally possible to add cooling water to the tank while the engine is operating, at which time the level in the water tank is lower than when the engine is stopped and the cooling system may, therefore, be inadvertently overfilled. Then when the engine is stopped the water level may be sufficiently high to retain some coolant in the radiators with consequent danger of freezing in cold weather. The problem has been complicated by the recent use of pressure cooling systems, which require relief of the system pressure in order to drain excessive water from the system or to add water or cooling water treatment to the water tank.

SUMMARY OF THE INVENTION

The present invention provides an improved engine cooling system of the above-described type which incorporates an automatic valve having several functions. (1) It opens to relieve excessive pressure in the cooling system. (2) It is normally closed when the engine is running so as to permit normal pressure buildup in the cooling system but it opens when the engine is stopped so as to drain any excess water from the cooling system and thus provide for positive draining of the radiators. (3) It provides for manual pressure relief so as to permit safe removal of the water tank filler cap for filling of the water tank or the addition of water treatment.

Further details and advantages of the cooling system and valve arrangement will be apparent from the following description of a preferred embodiment taken together with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a side view representing, in part diagrammatically, a locomotive engine with attached cooling and lubricating oil system elements;

FIG. 2 is an enlarged view of a portion of FIG. 1 taken generally in the plane indicated by the line 2—2 as viewed in the direction of the arrows; and

FIG. 3 is a cross-sectional view showing the interior construction of the valve as viewed in FIG. 2.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In the drawings, numeral 10 generally indicates the car body of a locomotive in which there is mounted a diesel engine 12 having externally connected radiators 14 (shown diagrammatically) and various lubricating and cooling system elements mounted in a separate plumbing rack 16.

Engine 12 is of a type in current use for diesel locomotives and includes a pair of water pumps 18 (only one being shown) which have outlets connecting with the internal cooling passages (not shown) of the engine. The engine also has a lubricating oil pump 20 which supplies pressure to the engine lubricating oil system whenever the engine is running. A pressure line 22 connects a distant portion of the lubricating oil

system with the engine governor 24 to provide a pressure signal indicating proper operation of the engine.

The engine cooling system passages have an outlet which connects through conduit 26 with the radiators 14. The radiators are, in turn, connected through conduits 28 with an oil cooler 30 mounted in the plumbing rack 16. Oil cooler 30 then connects through dual conduits 32 with the inlets of the water pumps, completing the main cooling water flow circuit.

A water tank 34 is also mounted in plumbing rack 16 below the level of the radiators and is connected through vertical conduits 36, which extend from the lower surface of the tank to the conduits 32 which convey water to the water pump inlets. The water tank is adapted to retain a supply of water and to provide a pressure head on the pump inlets so that water is provided to the pump inlets under all operating conditions.

When the engine is stopped, the cooling water level in the engine cooling system normally extends along a plane 38 slightly below the top of the water tank 34 so that no water remains in the radiators 14. When the engine is running the water level in tank 34 drops, since the engine water pumps maintain a solid flow of water through the main coolant circuit and the water to fill the radiators is supplied by the water tank.

Water tank 34 is provided with an overflow pipe 40 which extends inwardly to the normal shutdown water level and connects outwardly through an elbow 42 with an automatic pressure relief and level control valve 44. Valve 44 is, in turn, connected with a water drain line 46 and, through oil lines 48 and 50, with the oil pressure line 22.

Valve 44 comprises a housing having a valve seat 52 which is engageable by a reciprocable valve element 54 to close the drain passage from the tank. Element 54 is supported by a movable guide member 56, which carries a spring 58. The spring acts against the guide member and a spring seat 60 so as to bias the valve element 54 toward the valve seat 52. Travel of the spring 58 is limited when the valve is open by a cap member 62 that is attached to the guide member 56.

A hydraulic piston 64 acting within a cylinder 66 at one end of the valve member connects with guide member 56 and is acted upon by a second spring 68 which urges the piston in a direction to open valve element 54 by moving the guide member, cap and valve element assembly 56, 62, 54. Provision is made for the introduction of lubricating oil pressure from oil line 50 through an elbow 70 and orifice 72 to the interior of cylinder 66 so as to act against the piston 64. Thus, when the engine is running, the oil pressure forces piston 64 in a valve closing direction so as to compress the spring 68 and permit the valve element 54 to be closed by spring 58.

The valve 44 also includes a manual operating handle 74 connected with a pivotable fork 76. The fork is engageable with a flange 78 of the valve element 54 so that rotation of the handle 74 (in a clockwise direction as shown in FIGS. 1 and 2) is effective to manually open the valve by moving element 54 in a valve-opening direction.

The operation of the above described cooling arrangement is as follows. When the engine is stopped, water and water treatment may be added to the cooling system through a suitable opening (not shown) in the top of the water tank which is normally sealed by a suitable closure. When the proper coolant level is reached, the excess coolant flows into pipe 40 and down through the open valve 44, passing out through drain pipe 46. Since there is no pressure in the engine lubricating oil system at this time, spring 68 holds piston 64 in a leftward position, as shown in FIG. 3, thereby moving the guide member and valve assembly leftwardly so that the valve is open.

When the engine is started, the lubricating oil pressure is transmitted through pressure lines 22, 48 and 50 to the cylinder 66 in the valve body. There the oil pressure forces piston 64 to the right, permitting spring 58 to seat the valve element 54. At the same time, the engine water pumps draw water from the water tank 34 and force it through the engine and into the radiators 14 from whence it passes through the oil cooler and around to the inlet of the water pumps in a continu-

ous circuit. As previously mentioned, the level in the water tank drops during engine operation due to the water taken from it, which is then flowing through the radiators and other parts of the cooling system.

Operation of the engine increases the temperature of the coolant and, since the valve **44** is closed, pressure is developed in the cooling system, which permits operation of the system at high temperatures without boiling. If an excessive pressure is reached, the coolant pressure acting directly on valve member **54**, moves the valve member leftwardly against the bias of spring **58**, opening the valve and relieving the pressure. In this way, valve **44** acts as a pressure relief valve.

If, during engine operation, it is desired to add additional cooling water or cooling water treatment to the cooling system, it is necessary first to relieve the pressure in the system in order to permit the filler cap closure to be safely opened. Such pressure relief may be manually accomplished by rotating the valve operating handle **74** clockwise, as shown in FIGS. **2** and **3**, so that the fork member **76** engages flange **78** of the valve member, moving the valve member in an opening direction and relieving the cooling system pressure.

While the invention has been described by reference to a preferred embodiment selected for purposes of illustration, it should be obvious that numerous modifications of the inventive concepts disclosed could be made within the spirit and scope of the disclosure. Accordingly, the invention is intended to be limited only by the language of the following claims.

We claim:

1. An engine cooling system for a locomotive or the like, said cooling system comprising means defining coolant passages in such engine and a circulating pump having an outlet connected to supply coolant to said passages,

a radiator mounted at a high point in the cooling system, said radiator being connected between the outlet of said engine coolant passages and the inlet of said circulating pump to complete a closed circulation system,

a water tank mounted at a lower level than said radiator but above the inlet to said circulating pump, said tank being connected to said pump inlet and being adapted to maintain a head of water coolant at said pump inlet, and

a drain valve connecting with an upper portion of said water tank, said valve including means responsive to a predetermined condition of engine operation to close the valve during engine operation so as to permit the cooling system to be pressurized and to open the valve when the engine is stopped to drain excess water in the system so as to maintain during engine shutdown, a water level below the radiators to prevent any possibility of the radiators being damaged due to freezing.

2. The cooling system of claim **1** wherein said drain valve is additionally responsive to pressure in the cooling system so as to open to relieve any excessive pressure buildup in said system.

3. The combination of claim **2** wherein said drain valve further includes manual actuating means to permit said valve to be manually opened during engine operation so as to relieve the system pressure.

4. An engine cooling system having a coolant supply tank and a drain valve connecting with an upper portion of said tank, said drain valve being responsive to a predetermined condition of engine operation to close during engine operation so as to permit the cooling system to become pressurized and to open when the engine is stopped to drain excess coolant from the system so as to maintain a predetermined maximum water level during engine shutdown.

5. The cooling system of claim **4** wherein said drain valve is connected to the engine lubricating oil system and is closed by the buildup of pressure in said oil system during engine operation.

6. In a pressurized cooling water system of a diesel engine, the combination with a storage tank and a radiator exposed to ambient air and connected to and positioned above the level of the tank for gravity draining thereinto when the engine is stopped, of a drain port in a side of the tank at a level at which the tank therebelow during running of the engine has sufficient excess water capacity to contain the then water content of the radiator, and an automatic dump valve connected to said dump port for automatically opening said port for and closing said port against dumping respectively on stopping and running of said engine.

* * * * *