

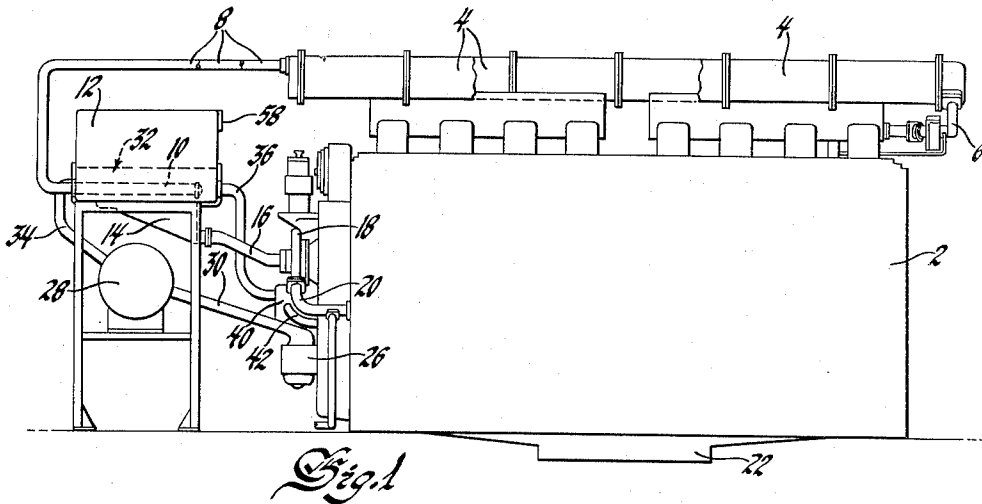
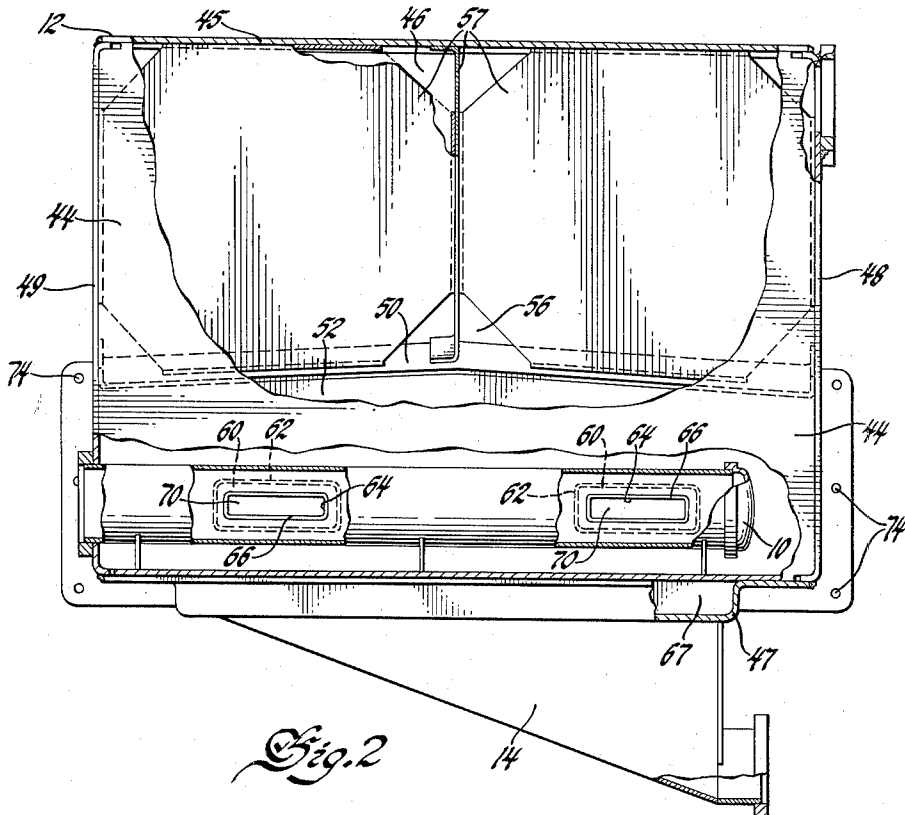
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FLUID CIRCULATING SYSTEM

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2 Sheets-Sheet 1



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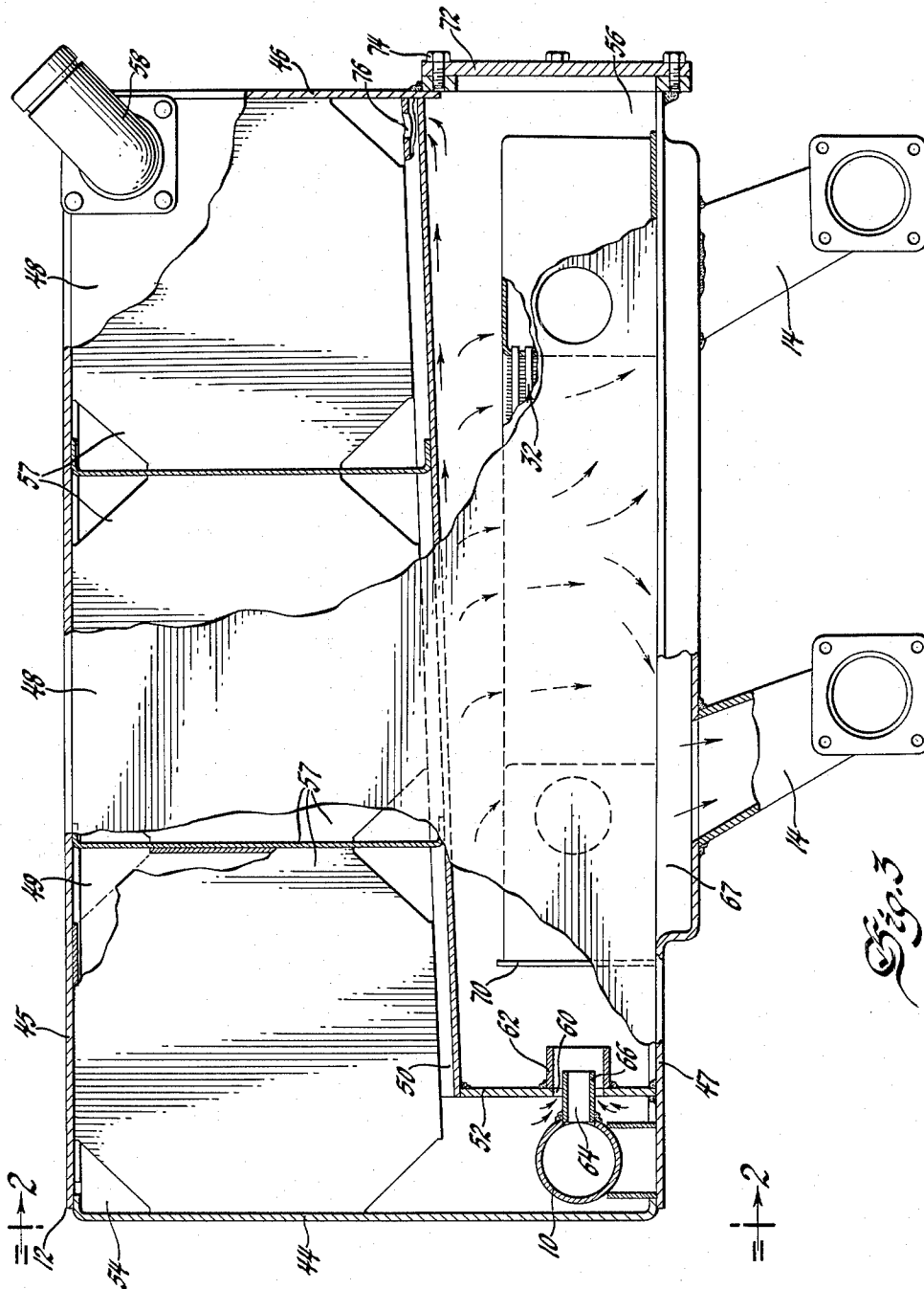


Fig. 3

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FLUID CIRCULATING SYSTEM

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6 Claims. (Cl. 123—41.44)

This invention relates generally to liquid circulating systems and more particularly to the liquid cooling systems for diesel engines as used in diesel electric locomotives.

In liquid cooling systems for internal combustion engines which use a circulating pump driven by the engine, a variety of circulating coolant characteristics are usually encountered. For example, at high engine speeds and temperatures the coolant is circulated at a high rate which along with the increased temperatures tend to entrain additional amounts of vapor in the coolant. This high vapor content coupled with the high circulating rate due to high pump speed may cause or increase cavitation at the inlet or suction side of the pump. Since it is well known that cavitation at the inlet of the pump decreases pump efficiency and the effectiveness of the cooling system, several means have been devised in an attempt to improve pump operation at high temperatures and speeds.

Most of these means are based on the well-established principle that pump performance in liquid circulating systems can be improved by causing the circulating liquid to exert more positive pressure on the inlet side of the pump. These means are, however, subject to one or more disadvantages which it is the purpose of this invention to overcome.

In other words it is an object of this invention to provide a new and improved means for increasing the positive pressure on the inlet side of a pump used to transfer liquid in a liquid circulating system to thereby improve pump performance. It is also an object of this invention to provide an expansion or make-up cooling water tank in immediate communication with the suction side of a water circulating pump which will increase the positive pressure on the suction side of the pump and thereby improve pump operation.

It is a further object of this invention to utilize new improved pressure increasing means in an engine cooling water expansion tank which has the oil cooling radiator of an engine lubricating oil circulating system positioned therein for more efficient lube oil cooling, the new improved means acting to increase the performance of a pump used to circulate the water through the engine water cooling system by increasing the water pressure on the suction side of the pump.

In the drawings:

Fig. 1 is a side view of an internal combustion engine including a cooling radiator, a circulating water pump and the new make-up tank. Also shown in Fig. 1 is an engine oil cooling system for the engine lubricating oil comprising the usual pumps, filters and oil cooler.

Fig. 2 is an enlarged side view of the new expansion or make-up tank with parts broken away and in section.

Fig. 3 is an enlarged end view of the new cooling tank with walls partially broken away to show the position of the engine lube oil cooler and the manner in which the cooling water is discharged into the lower portion of the tank against the oil cooler and an upwardly sloping baffle

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to increase the positive pressure on the inlet side of the water circulating pumps.

Referring now to Fig. 1, a diesel engine 2 is shown having a pair of radiators 4 positioned thereover which receive cooling water from the engine jacket by means of the piping 6. The left-hand ends of the cooling radiators 4 have coolant conducting piping 8 communicating therewith which terminates in the inlet of a manifold 10 supported in the new cooling tank 12. Leading from the bottom of the tank 12 are a pair of tank outlets 14 to which are fastened the piping 16 leading to and communicating with the inlet sides of a pair of water cooling pumps 18. The pumps 18 create the usual pressure head which forces cooling water through the piping 20 back into the cooling jacket of the engine 2 from where it is again conducted through radiators 4 and tank 12.

The engine lubricating oil circulating system is also shown in Fig. 1 and comprises a lubricating oil engine sump 22 which communicates with the inlet side of a scavenging oil pump 26. The discharge side of the scavenging pump 26 communicates with a lube oil filter 28 by means of piping 30. After passing through the filter 28 the lubricating oil may enter the oil cooler 32 by means of piping 34 passing through the left end wall of the cooling tank 12. The cooled oil is then discharged from the opposite end of the oil cooler 32 by means of piping 36 which leads through the right end wall of the cooling tank 12 to the inlet side of a lubricating oil circulating pump 40. The lubricating oil is then discharged from the pump 40 by means of piping 42 which leads into the diesel engine 2 where the oil is fed to the parts to be lubricated after which it again returns to the sump 22.

Referring now to Figs. 2 and 3, the details of the new cooling tank will be described. The exterior of the tank 12 is made up of a plurality of flat plates 44, 45, 46, 47, 48 and 49 which are suitably fastened by welding, etc. Welded or otherwise suitably fastened to and extending between tank walls 48 and 49 is a creased plate 50 which has a downward pitch from the transverse center line thereof toward each of the walls 48 and 49. The plate 50 is also fastened to the end wall 46 so that its transverse centerline slopes downwardly toward the opposite end wall 44 to a vertical longitudinally extending plate 52 to which the lower edge of plate 50 is welded. Vertical plate 52 extends between and is welded to end plates 48 and 49 and bottom plate 47 to form in combination with the sloping plate 50 an upper chamber 54 and a lower chamber 56. The upper chamber 54 is compartmented by a series of longitudinally and transversely extending vertical rectangular plates 57 having diagonally clipped corners to control the change in the free surface of the cooling liquid in upper chamber 54 when the locomotive is subjected to sway or other motions which might affect the free surface of the contained coolant.

The upper chamber 54 is also provided with a water tank filler pipe and cap and air vent 58, which allows the tank to be filled with water and vents the upper chamber 54 to atmosphere.

The vertical longitudinally extending interior wall 52 is provided with a pair of horizontally spaced openings 60 to which are welded flat rectangular rings 62 extending inwardly into the lower chamber 56. In the downwardly extended portion of upper chamber 54 is positioned the water manifold 10 communicating with the discharge side of the radiators 4. The manifold 10 is provided with a pair of horizontally spaced openings 64 in which are fastened rectangularly shaped elongated nozzle discharge means 66. The nozzle discharge means 66 extend through the openings 60 in the vertical wall 54 and are encircled by the rectangular rings 62. It will be noted that the rectangular nozzle discharge means 66 are substantially smaller in cross section than the openings 60

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and the rectangular rings 62, thereby providing a substantial amount of clearance therebetween. This clearance allows water to flow between the upper chamber 54 and the lower chamber 56 of tank 12. Also allowing communication between upper chamber 54 and lower chamber 56 is an opening 76 located along the crease of sloping plate 50 near side wall 46.

The oil cooler 32 is shown in Figs. 2 and 3 as being positioned in the lower chamber 56 directly over the water tank sump 67 and the flanged lower water outlets 14 which, as described, communicate directly with the inlet sides of the water circulating pumps 18 by means of piping 16. The oil cooler 32 is of typical construction including the usual oppositely disposed headers having conventional piping and cooling fins extending therebetween. In addition to the usual structure, however, the oil cooler is provided with a vertical baffle 70 at one end thereof toward which the nozzle discharge means 66 and rectangular rings 62 are directed. The oil cooler 32 may be placed in and removed from the lower chamber 56 by means of the removable plate 72 suitably fastened by means of bolt assemblies 74 to side and bottom plates 46 and 47.

The operation of this new cooling tank is as follows: When the pump 18 is being driven by the engine 2 to cause circulation of water through the cooling system, water flows from the discharge side of the radiators 4 into the intake manifold 10. As the water enters the manifold 10, it is discharged therefrom at high velocity by means of the nozzles 66 toward the vertical deflecting plate 70. This forces the water to flow upwardly against the sloping baffle 50 and the high velocity head is partially converted into pressure head which results in a positive pressure in the oil cooler section of the tank. Since the oil cooler section of the tank is in direct communication with the inlets of pumps 18 this positive pressure on the suction side of the pumps decreases the pumps' tendency to cavitate and improves pump performance especially with hot inlet water. The pressure existing below the sloping creased plate 50 also causes a coolant flow out of the oil cooler section of the tank (chamber 56) into the expansion or make-up portion of the tank (chamber 54). This flow, occurring along the underside of the sloped plate 50 toward the opening 76, carries air and vapor which has separated from the water in the oil cooler section of the tank into the make-up section of the tank, which being quite placid readily allows the air to settle out of the water so it can be vented to atmosphere. The water which flows from the oil cooler section of the tank into the make-up section may re-enter the oil cooler section by means of the openings 60 where the pressure is low due to the high velocity of the water being discharged by the nozzles 66. The removal of entrained air and vapor from the circulating coolant by the method described also tends to decrease cavitation and improve pump operation.

I claim:

1. In a liquid circulating system, a pump, and means to conduct the output of said pump to the suction side of said pump comprising a liquid storage chamber having an outlet in communication with the suction side of said pump, an upwardly sloped baffle in said chamber below the level of liquid contained therein, an air vent leading to atmosphere in communication with said storage chamber above said baffle, nozzle means dischargeable into said chamber below said baffle in the direction of upward slope of said baffle, and conducting means in communication with the outlet of said pump and said nozzle means for conducting the output of said pump to said nozzle means to be discharged therefrom.

2. In a circulating cooling system including a cooling radiator, a circulating pump, and an engine to be cooled; a tank between said radiator and said pump in communication with the low side of said pump, a partition in said tank dividing said tank into an upper chamber and a lower chamber and including an upwardly sloping section, an air vent leading to atmosphere in communication with

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said upper chamber, said partition having a communicating opening therein in said sloping section leading from said lower chamber to said upper chamber, and nozzle means communicating with the outlet of said radiator and discharging into said tank below said partition in the direction of upward slope of said section and toward said opening, said partition having a second opening immediately adjacent said nozzle means leading from said upper chamber to said lower chamber to allow circulation of coolant through said upper and lower chambers.

3. In a liquid cooling system for an internal combustion engine including an engine jacket, a cooling radiator, and a circulating pump; a tank between said radiator and said pump in communication with the inlet side of said pump, a lower chamber in said tank, said lower chamber having an upwardly sloping top wall with an opening therein above the lowest portion of said wall, an upper chamber in said tank above said lower chamber in communication with said lower chamber by means of said opening, an air vent leading to atmosphere in communication with said upper chamber, and nozzle means communicating with the outlet of said radiator and discharging into said tank below said wall in the general direction of upward slope of said wall and toward said opening.

4. In a liquid circulating system, a pump and means to conduct substantially the entire liquid output of said pump to the suction side of said pump, said means comprising a tank having a discharge pipe in communication with the suction side of said pump, a sloped partition in said tank dividing said tank into an upper and a lower chamber, said partition having a communicating opening therein located along the slope of said partition and leading from said lower chamber to said upper chamber, an air vent leading to atmosphere in communication with said upper chamber, nozzle means dischargeable into said lower chamber below said partition in the direction of upward slope of said partition and toward said opening, and conducting means in communication with the outlet of said pump for conducting substantially the entire output of said pump to said nozzle means to be discharged therefrom.

5. In a liquid cooling system for an internal combustion engine including an engine jacket, a water cooling radiator, and a water circulating pump; a tank between said radiator and said pump, a lower chamber in said tank in communication with the inlet side of said pump, said lower chamber having an upwardly sloping top wall with an opening therein above the lowest portion of said wall, an upper chamber in said tank above said lower chamber and in communication with said lower chamber by means of said opening, an air vent leading to atmosphere in communication with said upper chamber, an oil cooling radiator supported in said lower chamber below said upwardly sloping top wall, an oil pump having an inlet in communication with said oil radiator, oil conducting means for conducting oil from the outlet of said oil pump to said oil radiator, a vertically positioned baffle adjacent one side of said oil cooling radiator in said lower chamber, and nozzle means communicating with the outlet of said water cooling radiator and dischargeable into said tank below said wall and directed toward said baffle in the general direction of upward slope of said wall and toward said opening, said wall directing at least a part of the water in said liquid cooling system discharged by said nozzles through said oil radiator toward the inlet side of said water pump.

6. In a liquid circulating system, a liquid pump and means to conduct substantially the entire liquid output of said pump to the suction side of said pump, said means comprising a tank, partitions in said tank forming a lower chamber and an upper chamber in said tank, said lower chamber having a discharge pipe in communication with the suction side of said pump, said upper chamber having an air vent leading to atmosphere in communication therewith, said partitions including a first vertically extending

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partition in said tank forming a vertical wall at one end of the lower chamber in said tank and a second partition in said tank fastened to an edge of said vertical partition and forming an upwardly sloping top wall for said lower chamber, said vertical wall having horizontally spaced openings extending therethrough placing said upper and lower chambers in direct communication with each other, an oil cooling radiator positioned in said lower chamber, an oil circulating pump having an inlet in communication with said oil radiator, conducting means in communication with the outlet of said oil pump and said oil radiator for conducting the output of said oil pump to said oil radiator, a vertically extending baffle forming an exterior wall of said oil radiator, flow directors extending from the horizontally spaced openings in said vertical wall and directed toward

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said baffle, said sloping partition having a communicating opening therein located along the slope of said second partition and leading from said lower chamber to said upper chamber, and nozzles extending into said flow directors and dischargeable therethrough into said lower chamber below said upwardly sloping top wall on and toward said vertical baffle and along the upward slope of said top wall on toward said opening, and conducting means in communication with the outlet of said liquid pump for conducting substantially the entire output of said liquid pump to said nozzles to be discharged therefrom.

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