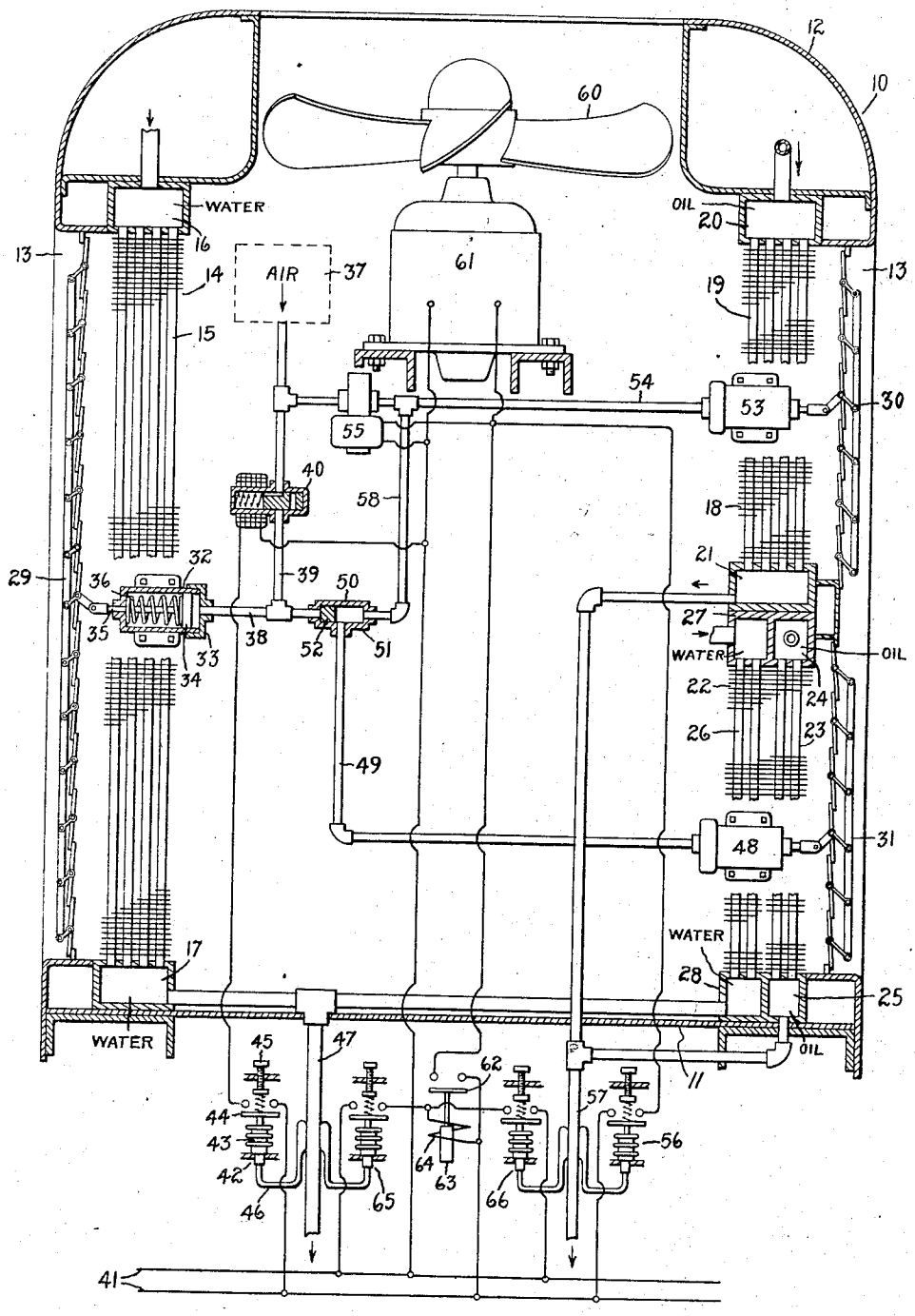
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RADIATOR ARRANGEMENT

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## RADIATOR ARRANGEMENT

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The present invention relates to radiator arrangements including at least two radiators or surface type heat exchangers for cooling or temperature conditioning two different fluids as are used for example on Diesel locomotives in which both the oil for lubricating the Diesel engine and the water circulated through a cooling jacket of the engine are circulated through separate coolers or heat exchangers during operation. More specifically the invention relates to the type of radiator arrangements which include fan means for forcing air across the coolers or radiators and louvers for controlling the flow of air through the cooling passages of the radiators.

The object of my invention is to provide an improved construction of radiator arrangements of the type above specified and a control mechanism for independently controlling the flow of cooling air through the radiators by a single fan means or blower.

For a consideration of what I believe to be novel and my invention, attention is directed to the following description and the claims appended thereto in connection with the accompanying drawing.

The single figure of the drawing illustrates a radiator arrangement embodying my invention.

In the example illustrated in the drawing the radiator arrangement forms part of a Diesel locomotive for cooling water and oil or like operating medium for Diesel engines.

The arrangement comprises a cab 10 which may form part of the Diesel locomotive having a bottom 11, a top 12 and side walls forming openings 13. A plurality of radiators or surface type heat exchangers are arranged on the cab to receive cooling air conducted through the openings 13. In the present example I have shown a radiator 14 on the lefthand side of the cab including a plurality of vertically arranged, finned tubes 15 having upper ends connected to an inlet header 16 for receiving water to be cooled, and lower ends connected to an outlet header 17 for discharging cooled water. On the righthand side of the cab three other radiators are provided. A radiator 18 for cooling oil is located in the upper portion and includes a plurality of vertical cooling tubes 19 with upper ends connected to an inlet header 20 for receiving oil to be cooled and lower ends connected to discharge cooled oil into a lower header 21. A third radiator 22 is located in the lower portion of the righthand side of the cab. This radiator consists of two sections, an outer section with a plurality of tubes 23 with upper ends connected to an upper header or header section 24 for receiving oil to be cooled and connected at their lower ends to a lower header or header section 25 for discharging cooled oil. The radiator 22 has an inner section with vertical tubes 26 connected to an upper header 27 for receiving water to be cooled and to a lower header or header section 28 for discharging cooled water.

Thus, the arrangement as a whole includes two water-cooling radiators and two oil-cooling radiators. One of the water-cooling radiators and one of the oil-cooling radiators are combined with their air passages connected in series as regards the flow of cooling air therethrough.

A plurality of separate louvers are provided to control the flow of air through the passages of the radiator. These louvers include a first louver 29 associated with the radiator 14, a second louver 30 associated with the radiator 18 and a third louver or louver arrangement 31 associated with the third radiator 22. According to my invention, means are provided for automatically actuating the louvers in response to predetermined temperature conditions of the cooled mediums and other means including a fan are provided for forcing cooling medium, in the present instance air, across the radiators upon the temperature of the discharged cooled medium reaching a predetermined high value.

Referring more specifically to the drawing, the louver 29 may be opened or closed by means of an air-operated servomotor 32 having a cylinder 33 with a piston 34 slidably disposed therein and secured to a stem 35 which at its lefthand end is linked to the louver 29. The piston 34 is biased towards the right, that is, into closed position of the louver by means of a spring 36. The righthand end of the cylinder 33 is connected to a source of operating medium, in the present instance a source of compressed air 37, by means of a conduit 38 and a conduit 39 including a known type of solenoid-operated valve 40. The solenoid-operated valve 40 has an electric circuit connected to an electric source 41 through a temperature-responsive device 42 including a bellows 43 with a contact-making member 44 biased by an adjustable spring 45. The bellows is connected to a pipe 46 which has a closed end portion in heat-exchange relationship with a conduit 47 connected to the water outlet header 17 of the radiator 15 and the sectional outlet header 28 of the radiator 22.

During operation, upon rise in temperature of the water discharged through the conduit 47 to a predetermined value, the temperature-respon-

sive device 42 causes closing of the circuit for the solenoid-operated valve 40 whereby the valve member is moved into its lefthand end position and air is s pplied from the source 37 through conduits 39, 38, to the servomotor 32, thus causing the piston 34 of the latter to move into its lefthand end position to open the louver 29. Simultaneously with the opening of the louver 29 the louver 31 is opened. The latter is actuated by a servomotor 48 corresponding to the servomotor 32 and connected to receive air from the conduit 39 through a conduit 49 including a shuttle valve 50. The latter in the present example comprises a cylinder 51 and a piston 52 movably disposed therein. The conduit 49 is connected to a central portion of the cylinder 51. The supply of air under pressure through the conduit 39 into the lefthand end of the cylinder 51 forces the piston 52 into its righthand end position, thus permitting the flow of air under pressure through the conduit 49 into the servomotor 48.

The louver 30 is actuated by a third servomotor 53 similar to the servomotors 32 and 48. The motor 53 is connected to the source of air 37 by a conduit 54 including a solenoid-operated valve 55 similar to the valve 40. The valve 55 has an electric circuit connected to the electric source 41 through a temperature-responsive device 56 similar to the device 42 and associated with a conduit 57 connected to receive cooled oil discharged from the lower headers 21 and 25 of the oil-cooling radiators. As the temperature of the oil discharged through the conduit 57 reaches a predetermined value the device 56 closes the electric circuit for the solenoid-operated valve 55 whereby the latter reverses its position to permit the flow of air under pressure from the source 37 through the conduit 54 to the servomotor 53. Simultaneously, air is supplied through a conduit 58 connected between the conduit 54 and the valve 50 to the servomotor 48 to open the louver 31. In case the piston 52 of the valve 50 is not in its lefthand end position the force of the air pressure through the conduit 58 forces the piston 52 in this position to establish connection of the conduit 49 with the source of air under pressure.

Thus, both louvers 30 and 31 are opened when the oil temperature rises to a certain value and, vice-versa, the louvers are closed as the oil temperature drops below such value. In case opening of the louvers does not suffice to pass sufficient air through the radiators, to bring the temperatures of the mediums to be cooled to the desired value an additional draft is produced by the provision of a single fan 60 driven by a power agency, in the present instance an electric motor 61 having an electric circuit connected to the source 41 by a contactor 62. The latter is connected to a relay 63 with an operating coil 64. The circuit for the operating coil is connected to the source 41 and includes a temperature-responsive device 65 associated with the conduit 47 for discharging cooled water and another temperature-responsive device 66 associated with the conduit 57 for discharging cooled oil. Each of the devices 65, 66 may close the circuit for the coil 64 and the devices 65 and 66 are set for temperatures higher than the temperatures for which the devices 42 and 56 respectively are set.

As described above, as the temperature of the water rises to a certain value, the temperature-responsive device 42 is actuated and causes closing of the circuit of the solenoid-operated valve 40 to admit air under pressure to the servomotors 32 and 48. This causes opening of the louvers 29 and 31 to admit cooling air to the passages of the radiators 15 and 22 respectively. If this flow of air is not sufficient to effect the desired reduction in temperature of the water and if the temperature of the water rises further, the water temperature-responsive device 65 causes closing of the circuit of the operating coil 64 for the contactor relay 63, resulting in closing of the circuit for the motor 61 and operation of the fan 60. The fan 60 continues to operate until the water temperature has dropped to permit the device 65 to open the circuit for the motor 61.

Similarly, as the temperature of the cooled coil rises to a predetermined value, the device 56 closes the electric circuit for the solenoid-operated valve 55 to admit air under pressure to the servomotors 53 and 48 and to open the louvers 30 and 31. If thereupon a further rise of the oil temperature takes place, the temperature-responsive device 66 closes the circuit for the coil 63 to effect operation of the fan 60. In case the fan 60 is already operating, the device 66 will keep the circuit closed until the oil temperature has dropped to the desired value.

If both motors 48 and 53 are connected to the source of air under pressure 37 and if thereupon the servomotor 32 is also connected to the source of air under pressure, the valve 50 remains in the position indicated because both sides of the piston 52 are subjected to the same pressure.

Thus, with my invention I have accomplished an improved construction and arrangement of radiators for temperature-conditioning several different fluids. An arrangement according to my invention is particularly efficient and economical when used in connection with Diesel locomotives for cooling several operating mediums such as water and oil for Diesel engines.

Having described the method of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof, I desire to have it understood that the apparatus shown is only illustrative and that the invention may be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. Radiator cooling arrangement for locomotives comprising a cab having open side walls and an open top, a water cooling radiator and a first louver arranged along one of the side walls, an oil cooling radiator and a second louver arranged along the opposite side wall, combined water and oil cooling radiators and a third louver arranged along said opposite side wall, means for actuating the first and third louvers in response to predetermined temperature conditions of the cooled water discharged from the first and third radiator, means including temperature responsive devices for controlling the second and third louvers in response to certain temperature conditions of the cooled oil, and means including a single fan for inducing the flow of cooling medium through one of the radiators in response to a certain temperature rise therein.

2. Radiator cooling arrangement for locomotives comprising a cab having open side walls and an open top, a water cooling radiator and a first louver arranged along one of the side walls, an oil cooling radiator and a second louver arranged along the opposite side wall, combined water and oil cooling radiators and a third louver arranged along said opposite side wall, first, second and

third hydraulic motors for actuating the respective louvers, means including a first valve for controlling the flow of operating fluid to the first and third motors, means including a second valve for controlling the flow of operating fluid to the second and third motors, means for actuating the first valve in response to a predetermined temperature of the cooled water discharged from the first and third radiators, means for operating the second valve in response to a predetermined temperature of the cooled oil discharged from the second and third radiators, and means including a single fan for inducing the flow of cooling air through any radiator when open and separate means responsive to the temperature of the cooled water and the cooled oil respectively discharged from the respective radiators for starting the fan.

3. Radiator cooling arrangement for locomotives comprising a cab having open side walls and an open top, a water cooling radiator and a first louver arranged along one of the side walls, an oil cooling radiator and a second louver arranged along the opposite side wall, combined water and oil cooling radiators and a third louver arranged along said opposite side wall, first, second and third hydraulic motors for actuating the respective louvers, means including a first valve for controlling the flow of operating fluid to the first and third motors, means including a second valve for controlling the flow of operating fluid to the second and third motors, means for actuating the first valve in response to a predetermined temperature of the cooled water discharged from the first and third radiators, means for operating the second valve in response to a predetermined temperature of the cooled oil discharged from the second and third radiators, and means including a single fan for inducing the flow of cooling air through the open radiators and other separate means responsive to the temperature of the cooled water and the cooled oil respectively discharged from the radiators for starting the fan, said other temperature responsive means being set to operate at a temperature above that of the first mentioned temperature responsive means to effect starting of the fan only subsequent to the opening of at least one of the louvers.

4. Radiator cooling arrangement for locomotives comprising a water cooling radiator, an oil cooling radiator, a combined water and oil cooling radiator, a first, a second, and a third louver for the water cooling radiator, the oil cooling radiator, and the combined water and oil cooling radiator respectively, a first, a second, and a third hydraulic motor for operating the respective louvers, a conduit including a valve for conducting operating fluid to the first motor, another conduit including a valve for conducting operating fluid to the second motor, separate devices responsive to the temperature of the cooled water and the cooled oil respectively for operating the first and second valves respectively, and a conduit including a shuttle valve connecting the third motor to the first and second conduits behind the valves therein as regards the direction of flow of operating fluid therethrough automatically to supply operating fluid to the third motor upon fluid flow to one of the first and second motors.

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