AIR BLEEDING DEVICE FOR A PRESSURISED LIQUID SUPPLY SYSTEM

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ABSTRACT

An air bleeding device in the fuel supply system of a diesel engine comprises a fuel tank connected between the feed pump and the fuel injection pump, and an air bleed valve in the tank which may be float controlled and which automatically opens when fuel in the tank falls to a predetermined level due to the entry of air into tank.

3 Claims, 1 Drawing Figure
AIR BLEEDING DEVICE FOR A PRESSURISED LIQUID SUPPLY SYSTEM

This invention relates to an air bleeding device for use in a pressurised liquid supply system, especially but not exclusively the fuel supply system of a diesel engine.

According to the present invention there is provided an air bleeding device for use in a pressurised liquid supply system, especially but not exclusively the fuel supply system of a diesel engine, said device comprising a closed tank having a liquid inlet and a liquid outlet adapted for connection respectively to a liquid input pipe and a liquid output pipe, and an air bleed valve in said tank adapted to open when liquid in the tank falls to a predetermined level due to the entry of air into the tank.

An embodiment of the invention will now be described, by way of example, with reference to a fuel supply system for a diesel engine in a vehicle, and with reference to the accompanying diagrammatic drawing, which shows an air bleeding device according to the present invention, in cross section.

An air bleeding device for the fuel supply system of a diesel engine vehicle comprises a closed cylindrical tank 1, into which fuel is fed through an inlet 2 by a feed or lift pump not shown, and from which the fuel passes through an outlet 3 to a fuel injection pump, not shown. The tank has a peripheral wall 1A and is closed by top and bottom walls 1B, 1C. A baffle plate 4 is provided within the tank 1 opposite and adjacent the inlet 2 to restrain the fuel from “scattered” so that the fuel drops to the bottom of the tank, and a similar baffle plate 4A is provided adjacent the outlet 3. The baffle 4A may surround the fuel outlet 3 to prevent water or sludge, which may have inadvertently entered the tank 1 and be lying at the bottom of tank, from entering the outlet. The tank 1 has on its top wall 1B an automatically operating air bleed valve 5 at a sight gauge 6, and a manually operable air bleed valve or cock 7. The movable member 5A of the valve 5 is controlled by an upright float in the form of a cylindrical tube 8 having end caps 8A, 8B, and the indicator 6A of the gauge 6 is controlled by an upright float in the form of a cylindrical tube 8 having end caps 8A, 9A, 9B. The floats 8 and 9 are slidably guided in upper and lower guide tubes 8C, 8D and 9C, 9D respectively secured to the top and bottom walls 1B, 1C.

The tank 1 fills with fuel until the floats 8 and 9 float, and the sight gauge 6 and the air valve 5 become operative. When the float 8 has raised the valve member 5A sufficiently, the valve 5 is closed. This occurs when the fuel is at level B in the drawing.

Pressurised fuel continues to flow into the tank 1 until such time as the pressure inside the tank equals the pressure applied to the fuel being forced into it by the lift pump, and the fuel is above level B in the drawing. At that time, the manually operated valve 7 is opened to allow air at the top of the tank 1 and above the level of the valve 5 to escape, and to allow fuel from the inlet 2, by way of the lift pump, to fill the tank to the bottom of the valve 7. The benefit of this is that tank 1 is now filled to capacity with fuel and little or no air remains inside it, and, unless air is fed into tank 1 with the fuel, the level of fuel in the tank 1 remains constant and at the top of the tank and the sight gauge 6 does not move, and the valve 5 remains closed.

When fuel is allowed to pass from the tank 1 through the outlet 3 to the main or injection fuel pump, it is replaced by pressurised fuel through the inlet 2, and any air entering the tank 1 with the fuel is trapped inside the tank.

When sufficient air has been trapped in the tank 1 to lower the level of the liquid, the float 8 lowers, and consequently the valve member 5A opens and air is allowed to escape through the valve 5 and through the air filter flame trap 11 to the atmosphere, and/or through a piped connection to a conventional excess fuel pipe 13.

Fuel fed through the inlet 2 replaces the air expelled, and again raises the float 8 and the valve member 5A, and so closes the valve 5.

Air entering the tank 1 is therefore constantly and automatically expelled from tank 1, within which, a reasonably constant level of fuel is maintained.

During this time, the float 9 correspondingly moves up and down, starting to move down at level A, so that the presence of air in the tank 1 can be seen from the gauge 6.

In the event of the fuel supply pumping dry at the main tank, the level of the fuel in the tank 1 drops, provided fuel continues to be drawn through the outlet 3.

In this event, the float 9 for the gauge 6 drops below its normal minimum level as the fuel level drops to level C. When this happens, an actuator in the form of a magnet 9E on the end cap 9B of the float 9 actuates an electrical reed switch 10 on the bottom wall 1C which actuates a signal device, not shown, e.g. a buzzer, so that the driver receives a warning, to stop his engine before the fuel in the main fuel pump is aerated.

The float 8 has a magnet 8E on its end cap 8B, and a reed switch 10A is provided on the bottom wall 1C, and the switch 10A is connected to a cut-off device, not shown, for the fuel supply. Thus, if the driver ignores the warning given by the signal device, and the vehicle continues to be driven, the fuel level will continue to fall. When the fuel level falls to the level D in the drawing, the float 8 has lowered sufficiently for the magnet 8E to actuate the switch 10A which effects cutting-off of the fuel supply so that no more fuel is drawn from the tank 1 through the outlet 3.

While the above arrangement is preferred, it would of course be possible to have only one of the reed switches, and, in some circumstances, neither of the switches may be required. Proximity switches may be used in place of reed switches, and, in this case, the magnets would be replaced by some other form of switch actuator.

Various modifications may be made without departing from the scope of the invention, as follows:

A non-return valve may be fitted to the outlet 3, so that fuel will not drain back into the tank when it is not pressurised.

Additional baffles may be fitted inside the box to prevent 'splashing' of the liquid.

The air valve 5 and the sight gauge 6 may be incorporated into one unit for economy in manufacture. A relief valve 12 on the wall 1B may be provided, and this adjusted so as to release excess pressure within the tank 1 in the event of failure of the normal relief valve fitted to the lift pump.

A connection from the sight gauge 6 to the chamber of the safety relief valve 12 and to the manual valve 7 may be made through the conventional excess fuel
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3,888,274 drain pipe 13 to drain away any excess of fuel from these parts. From the above, it will be seen that the device described can save a great deal of time and money which would otherwise be lost by breakdowns caused by diesel engines, especially in commercial vehicles, drawing air into their fuel systems due to slack or faulty couplings, bad gaskets, or cracked pipes, because the air bleeding device described automatically removes air which otherwise would be pumped along the fuel line and into the injector pump and cause the engine to stop.

Moreover, the device can give warning to the driver or operator, that the main fuel supply tank is empty, before the engine actually stops, and, at the same time, it can, if desired, cause the engine to be stopped so that the fuel injector pump does not empty. Thus, the diesel engine and the fuel injector pump are not allowed to run out of fuel, so that the engine may be re-started, after the supply tank has been refilled, without the existing trouble of bleeding the lift pump, the filter, and, the high pressure pump.

The sight gauge is provided so that the driver or operator can check visually whether or not an air leak is present in the fuel system even although the device is actually removing the air at the time and allowing the engine to continue to run.

Thus, an engine which would hitherto have stopped, will continue to run, and, by the advice given to the operator by the sight gauge, the driver or operator can, at a convenient time, take steps to have the fault rectified.

Instead of being controlled by the float 8, opening or closing of the valve member 5A may be effected electrically, for example, by a solenoid valve actuated by a lever switch, and the arrangement may be such that the valve 5 does not open until the fuel reaches level B, in which case, the solenoid valve may be closed by a further lever switch.

As above indicated, the device is not limited to use with diesel engine or a diesel engined vehicle, but can be used, for example, with a fuel injection petrol engine or in any other pressurised liquid system.

In the drawing, 14 indicates a drainage hole which is, of course, provided with a plug, not shown, and which may be used to drain the tank 1, or to remove water or sludge which may have inadvertently entered the fuel system. 15 indicates fuel relief holes in the guide tubes 8D, 9D, and 16 indicates air vents in the guide tubes 8C, 9C. The fuel relief holes 15 are dimensioned so that the fuel filled guide tubes 8D, 9D act as dampers for the floats 8 and 9. The floats 8 and 9 may be spring-urged downwardly.

The guide tubes 8C, 8D and 9C, 9D may in each case be replaced by a single guide tube extending between the top and bottom walls 1B, 1C, and the floats 8 and 9, especially when carrying the magnets 8E, 9E may be held against turning relative to the guide tubes, for example by projections on the floats engaging in grooves in the guide tubes. Also, the valve 5 may be a disc valve having its disc mounted on the float 8 or on a leaf spring attached to the tank 1, and the valve 7 may be arranged so that a spanner or key is required to open it.

What I claim is:

1. An air bleeding device in the fuel supply system of a fuel injection engine, said fuel system including a fuel injection pump, and said air bleeding device comprising a closed tank, side wall means and a top wall and a bottom wall forming said tank, means defining a fuel inlet in said tank, and means defining a fuel outlet in said tank connected to said fuel injection pump, an automatically operating air bleed valve in said top wall of the tank, a float in said tank for controlling operation of said valve and effecting opening of the valve when fuel in the tank, due to the presence of air trapped in the tank, drops below a predetermined level considerably spaced from said top wall, and a manually operable air bleed valve in said top wall opening directly into said tank; whereby, during filling of said tank with fuel, said manually operable bleed valve can be temporarily opened to permit the escape of air from said tank after the fuel has risen to said predetermined level and the automatically operating air bleed valve has closed, and the tank can thus be substantially completely filled with fuel and substantially completely evacuated of air, and said automatically operating air bleed valve remains closed unless an intake of air into the tank eventually forces the fuel to drop below said predetermined level considerably spaced from said top wall, at which time, and at intervals thereafter until the manually operable valve is again opened, the automatically operating air bleed valve opens to permit the escape of air and then closes when incoming fuel raises the level of the fuel in the tank, and said level continues to rise until the pressure inside the tank equals the pressure applied to the fuel entering the tank, so that the automatically opening valve does not hunt, and in which said tank is provided with a switch which is connected to a signal device, and is provided with a second float which has an actuator for actuating said switch and thus the signal device if the fuel falls to a second and lower predetermined level, and said tank is provided with a second switch which is connected to a fuel supply cut-off device for cutting-off the outlet of fuel from the tank, and said first mentioned float is provided with an actuator for actuating said second switch and thus said cut-off device for the fuel supply if the fuel falls to a third and still lower predetermined level.

2. A device as claimed in claim 1, in which each of said floats is slidably guided in upper and lower guide tubes secured respectively to top and bottom walls of said tank, and each lower guide tube is provided with liquid relief holes, which, when said lower guide tubes are filled with liquid, act as dampers for the floats.

3. A device as claimed in claim 2, in which each of said switches is a reed switch, and each of said actuators is a magnet.

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