DIESEL EXHAUST DOSING VALVE

Dosing structure 30 is provided for supplying diesel fuel to an exhaust passage 12 of a diesel system. The dosing structure includes an electrically operated control valve 31 constructed and arranged to receive a supply of diesel fuel. A dosing valve 32 is constructed and arranged to receive fuel from the control valve and deliver the fuel to the exhaust passage. An extension tube 48 is fluidly coupled between the control valve and the dosing valve to space the control valve from the dosing valve and to permit fuel to be delivered from the control valve, through the extension tube, and to the dosing valve.
DIESEL EXHAUST DOSING VALVE

[0001] This application claims the benefit of the earlier filing date of U.S. Provisional Application No. 60/783,558, filed on Mar. 17, 2006, which is incorporated by reference herein in its entirety.

FIELD OF THE INVENTION

[0002] This invention relates to reducing and trapping particulates of a diesel engine for vehicles.

BACKGROUND OF THE INVENTION

[0003] Federal and state governments have imposed increasingly strict regulations over the years governing the levels of hydrocarbon (HC), carbon monoxide (CO) and nitrogen oxide (NOx) pollutants that a motor vehicle may emit to the atmosphere.

[0004] In diesel engine systems, a diesel particulate filter (DPF) is provided to trap the particulate matter in the exhaust passage of the diesel engine. Conventionally, a dosing valve is mounted into the exhaust manifold of a diesel system to inject diesel fuel into the exhaust to reduce the particulate matter and thus reduce NOx emissions. Since the temperature of the exhaust manifold can reach 600°C, water cooling is required to ensure that the valve survives.

[0005] Thus, there is a need to eliminate water cooling of an exhaust dosing valve.

SUMMARY OF THE INVENTION

[0006] An object of the invention is to fulfill the need referred to above. In accordance with the principles of the present invention, this objective is achieved by providing dosing structure for supplying diesel fuel to an exhaust passage of a diesel system. The dosing structure includes an electrically operated control valve constructed and arranged to receive a supply of diesel fuel. A dosing valve is constructed and arranged to receive fuel from the control valve and to deliver the fuel to the exhaust passage. An extension tube is fluidly coupled between the control valve and the dosing valve to space the control valve from the dosing valve and to permit fuel to be delivered from the control valve through the extension tube, and to the dosing valve.

[0007] In accordance with another aspect of the invention, a method is provided for supplying diesel fuel to an exhaust passage of a diesel system to reduce particulates in the exhaust passage. The method provides a dosing valve coupled to an exhaust passage of a diesel system. An electrically operated control valve is associated with the dosing valve to supply diesel fuel to the dosing valve. The method spaces the control valve from the dosing valve such that heat generated in the exhaust passage is less at the control valve than at the dosing valve. The control valve is operated to supply diesel fuel to the dosing valve with the dosing valve injecting diesel fuel into the exhaust passage.

[0008] Other objects, features and characteristics of the present invention, as well as methods of operation and the functions of the related elements of the structure, the combination of parts and economies of manufacture will become more apparent upon consideration of the following detailed description and appended claims with reference to the accompanying drawings, all of which form a part of this specification.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The invention will be better understood from the following detailed description of the preferred embodiments thereof, taken in conjunction with the accompanying drawings, wherein like reference numerals refer to like parts, in which:

[0010] FIG. 1 is a schematic diagram of an exhaust gas purifying system including a diesel dosing structure in accordance with an embodiment of the present invention.

[0011] FIG. 2 is a view of the diesel dosing structure of FIG. 1.

[0012] FIG. 3 is an enlarged view of a dosing valve of the dosing structure of FIG. 2.

[0013] FIG. 4 is a block diagram of a dosing system including the dosing structure.

DETAILED DESCRIPTION OF THE EXEMPLARY EMBODIMENT

[0014] Referring to FIG. 1 of the drawings, a multi-cylinder diesel engine, generally indicated at 10, for vehicles is provided with an exhaust passage 12 and intake passage 13. The intake passage 13 is distributes intake air to each cylinder. The exhaust passage 12 and the intake passage 13 are connected by an exhaust gas recirculation (EGR) passage 14 in the conventional manner.

[0015] The engine 10 is provided with a common rail fuel injection device, generally indicated at 16. The fuel injection device 16 is provided with a supply pump 18, common rail 20 and an injector 22 provided for every cylinder. Fuel pressurized by the supply pump 18 is distributed to each injector 22 via the common rail 20.

[0016] A variable capacity turbocharger 24 is provided in the exhaust passage 12 downstream of the EGR passage 14. Compressor 26, installed in the intake passage 13, can be considered to be part of the turbocharger 24. A turbine (not shown) of the turbocharger 24 transforms the energy of the flow of exhaust gas into rotational energy, and can drive the compressor 26 using this rotational energy.

[0017] A diesel particulate filter (DPF) 28 which traps particulate matter in the exhaust gas is installed in the exhaust passage 12 downstream of the turbine 24. Diesel fuel burns off the particulates trapped in the filter, thus regenerating particulate storage capacity.

[0018] As shown in FIG. 1, a dosing structure, generally indicated at 30, is provided in the exhaust passage 12 upstream of the filter 28. With reference to FIG. 2, the dosing structure 30 includes a control valve 31, a dosing valve 32 and an extension tube 48 there-between. The dosing valve 32 is preferably in the form of a poppet valve. As shown in FIG. 3, the poppet valve 32 has a valve member 34 that extends outwardly from a body 36 of the valve 31 when in the opened position, permitting fuel to flow into the exhaust line 12. End 38 is inserted (e.g., threaded) into the exhaust manifold 40 (see FIG. 2). The poppet valve 32 preferably has all metal construction (e.g., stainless steel), capable of withstanding the high temperature of the manifold 40. The poppet valve 32 is constructed and arranged to create a particular spray configuration into the exhaust passage.
The control valve 31 is preferably a gasoline, electrically operated fuel injector without a precision orifice. Since there is no need for special spray patterns from the injector, a simple pencil stream is sufficient. A suitable injector can be of the type disclosed in U.S. Pat. No. 6,685,112, the content of which is hereby incorporated by reference into this specification. The control valve 31 has a fuel inlet 42 and a fuel outlet 44. The inlet 42 receives diesel fuel from the tank 46 (FIG. 1). The fuel outlet 44 is connected with one end of the extension tube 48, with another end of the extension tube being connected with an inlet 50 of the dosing valve 32. The control valve 31 controls the flow rate to the dosing valve 32 and also shuts-off the flow.

The extension tube 48 is of sufficient length to place the control valve 31 away from the heat of the manifold 40. The extension tube 48 can be a metal tube or can be a flexible tube such as a fiberglass braided Teflon hose, capable of withstanding 230°C. Utilization of the flexible extension tube allows for mounting the control valve 31 on a chassis and the dosing valve 32 on the exhaust. This configuration accommodates large amounts of displacement. In other applications, the control valve and the dosing valve are mounted on the engine, thus a metal extension tube can be used. All connections between the tube 48 and the valves 31 and 32 are preferably welded.

FIG. 3 show a block diagram of a dosing system, generally indicated at 53, employing the dosing structure 30. Electrical connections are shown in dashed lines. Thus, an Electronic Control Unit (ECU) 54 can periodically control a fuel pump 56 to deliver diesel fuel from tank 28 to the control valve 31. The ECU also controls the control valve 31 to send fuel through the extension tube 48 to the dosing valve 32 and into the exhaust line 12 to reduce particulates and possibly reduce NOx emissions. It can be appreciated that instead of the ECU 54 controlling the fuel injector 31, a separate controller can control the fuel injector 31.

The dosing structure 30 also reduces oil dilution. In addition, system cost is reduced since a smaller particulate trap can be used, the water cooled system is eliminated, O-rings and polymers are eliminated in high temperature locations, and the structure 30 uses exiting technologies.

The foregoing preferred embodiments have been shown and described for the purposes of illustrating the structural and functional principles of the present invention, as well as illustrating the methods of employing the preferred embodiments and are subject to change without departing from such principles.

Therefore, this invention includes all modifications encompassed within the spirit of the following claims.

What is claimed is:

1. A dosing structure for supplying diesel fuel to an exhaust passage of a diesel engine, the dosing structure comprising:
   - an electrically operated control valve constructed and arranged to receive a supply of diesel fuel,
   - a dosing valve constructed and arranged to receive fuel from the control valve and deliver the fuel to the exhaust passage, and
   - an extension tube fluidly coupled between the control valve and the dosing valve to space the control valve from the dosing valve and to permit fuel to be delivered from the control valve, through the extension tube, and to the dosing valve.
2. The structure of claim 1, wherein the control valve is a fuel injector.
3. The structure of claim 1, wherein the dosing valve is a poppet valve.
4. The structure of claim 3, wherein the poppet valve is composed entirely of metal.
5. The structure of claim 4, wherein the poppet valve is constructed and arranged to be coupled to an exhaust manifold.
6. The structure of claim 5, wherein the poppet valve includes threads for engaging the manifold.
7. The structure of claim 1, wherein the extension tube is a metal tube.
8. The structure of claim 1, wherein the extension tube is a flexible tube.
9. The structure of claim 8, wherein the flexible tube is fiberglass braided Teflon hose.
10. The structure of claim 1, in combination with a control unit electronically controlling operation of the control valve.
11. The structure of claim 3, wherein the poppet valve has a valve member constructed and arranged, when in an opened position, to extend outwardly from a body of the poppet valve.
12. A dosing structure for supplying diesel fuel to an exhaust passage of a diesel engine, the dosing structure comprising:
   - a dosing valve constructed and arranged to deliver the fuel to the exhaust passage,
   - means for controlling a supply of fuel to the dosing valve, and
   - means, fluidly coupled between the dosing valve and the means for controlling, for spacing the control valve from the means for controlling and to permit fuel to be delivered from the means for controlling, through the means for spacing, and to the dosing valve.
13. The structure of claim 12, wherein the means for controlling is an electrically operated fuel injector.
14. The structure of claim 12, wherein the dosing valve is a poppet valve.
15. The structure of claim 14, wherein the poppet valve is composed entirely of metal.
16. The structure of claim 15, wherein the poppet valve is constructed and arranged to be coupled to an exhaust manifold.
17. The structure of claim 16, wherein the poppet valve includes threads for engaging the manifold.
18. The structure of claim 12, wherein the means for spacing is a metal tube.
19. The structure of claim 12, wherein the means for spacing is a flexible tube.
20. The structure of claim 19, wherein the flexible tube is fiberglass braided Teflon hose.
21. The structure of claim 13, in combination with a control unit electronically controlling operation of the fuel injector.
22. The structure of claim 14, wherein the poppet valve has a valve member constructed and arranged, when in an opened position, to extend outwardly from a body of the poppet valve.
24. A method of supplying diesel fuel to an exhaust passage of a diesel system to reduce particulates in the exhaust passage, the method including the steps of:

providing a dosing valve coupled to an exhaust passage of a diesel system,

providing an electrically operated control valve associated with the dosing valve to supply diesel fuel to the dosing valve,

spacing the control valve from the dosing valve such that heat generated in the exhaust passage is less at the control valve than at the dosing valve, and

operating the control valve to supply diesel fuel to the dosing valve with the dosing valve injecting diesel fuel into the exhaust passage.

25. The method of claim 24, wherein the step of providing the dosing valve includes providing a poppet valve as the dosing valve.

26. The method of claim 24, wherein the step of providing the control valve includes providing a fuel injector as the control valve.

27. The method of claim 24, wherein the step of spacing includes providing an extension tube fluidly coupled between the dosing valve and the control valve.

* * * * *