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(54) **DIESEL ENGINE EXHAUST PURIFIER**

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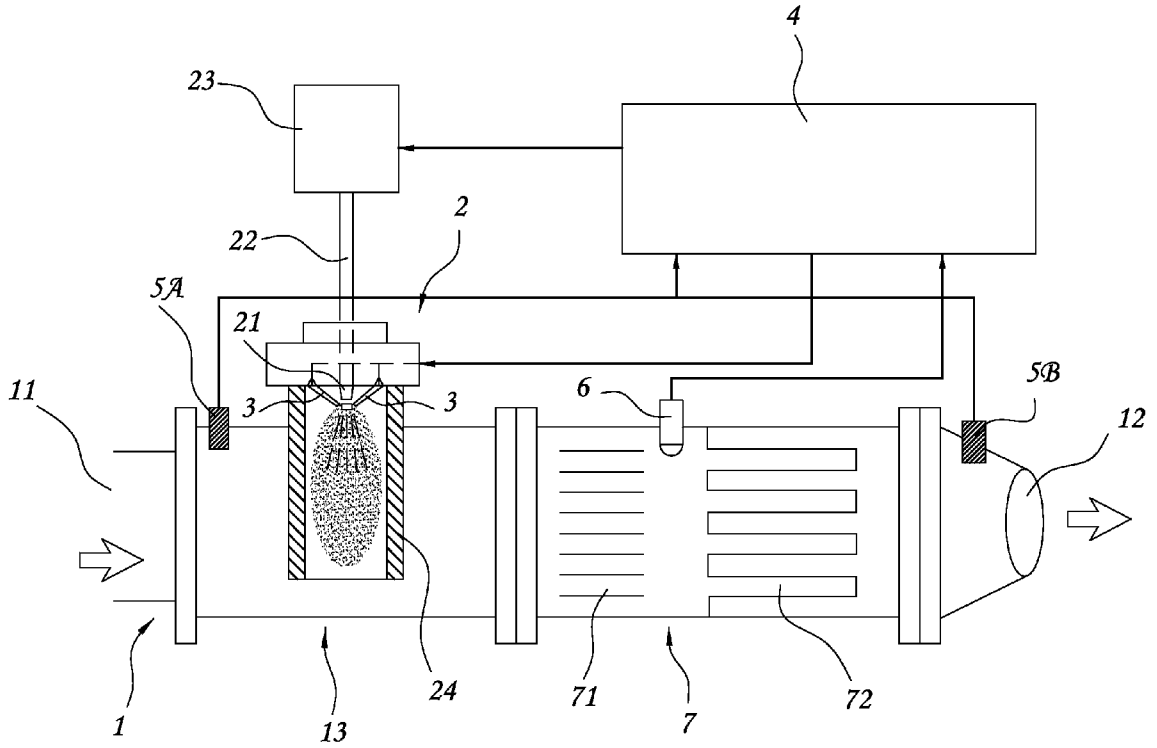
(57) **ABSTRACT**

A diesel engine exhaust purifier includes a burner system having a metal barrel mounted in the exhaust pipe of a diesel vehicle and a flame thrower mounted in the metal barrel, pressure sensors mounted in the front and rear ends of the metal barrel, a precious metal catalyzer converter type filter system mounted in the metal barrel for removing solid matters from engine exhaust gas and a microcontroller electrically connected to the power supply system of the diesel vehicle for driving the pump-operated fuel tank of the flame thrower to deliver forced fuel out of a fuel nozzle and an auto igniter to ignite the mist of fuel discharged out of the fuel nozzle for burning out cumulated carbon subject to the detection of the pressure sensors.



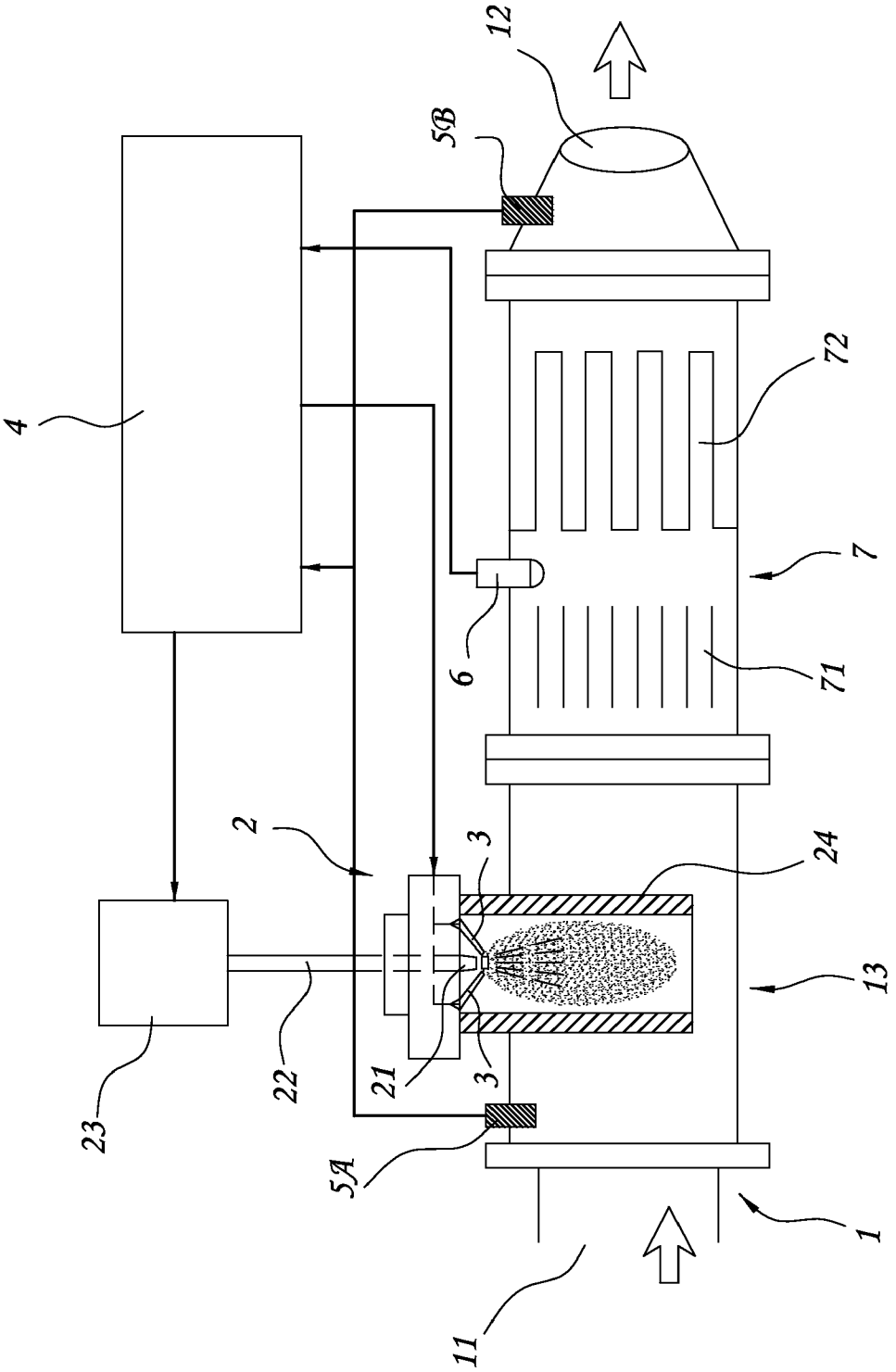


FIG. 1

DIESEL ENGINE EXHAUST PURIFIER

BACKGROUND OF THE INVENTION

[0001] (a) Technical Field of the Invention

[0002] The present invention relates to a carbon deposition elimination technology and more particularly, to a diesel engine exhaust purifier that effectively eliminates cumulated carbon from the exhaust pipe of a diesel vehicle.

[0003] (b) Description of the Prior Art

[0004] A diesel vehicle uses compression ignition to burn fuel oil or substitute fuel, performing the diesel cycle to convert chemical energy into thermal energy and power output. During combustion, pollutants including PM (particulate matter), smoke, NO_x (mono-nitrogen oxides), CO (carbon monoxide), SO_x (sodium oxides), CO_2 (carbon dioxide), HC (hydrocarbon) and other waste matters are produced and discharged out of the exhaust pipe into the atmosphere, causing damage to the ozone layer, occurrence of acidic rain and rise in greenhouse effect. In case PM (particulate matter) in exhausted waste gas contain polycyclic aromatic hydrocarbons or metal oxides, breathing in such exhausted waste gas may cause lung, bronchi or breathing passage diseases. According to a local air pollution source investigation, 46% of particulate matter and 51% of NO_x of mobile source of air pollution came from diesel vehicles. Most big public transportation vehicles are of diesel vehicles. To control discharge of diesel engine waste gas is an important measure to improve air quality.

[0005] The automotive industry has been continuously proposing new measures to reduce the exhaust amount of waste gas. One of the best ways to reduce the exhaust amount of waste gas from the diesel engine of a diesel vehicle is to install an exhaust gas purifier in the exhaust pipe. However, carbon will deposit in the filter element of the exhaust gas purifier to block the passage after a long period of work, thereby affecting exhausting effect and normal functioning of the diesel engine.

[0006] When a certain amount of carbon is cumulated in the filter element of the exhaust gas purifier of the exhaust pipe of a diesel vehicle, the passage of the exhaust gas purifier will be partially blocked, causing a rise in pressure (back pressure) in the exhaust pipe. Therefore, a backpressure sensor may be installed in the exhaust pipe of a diesel engine to detect the pressure level of the waste gas in the filter element of the exhaust gas purifier, monitoring the status of deposition of carbon. When the deposition of carbon in the inside wall of the exhaust pipe reaches a certain thickness, the backpressure sensor will detect a high level of back pressure, and the engine management system will give a signal to increase the working temperature of the diesel engine, thereby burning out cumulated carbon. However, when a vehicle stops frequently due to a poor traffic condition or frequently runs at idle speed due to driver's personal driving habit, the low engine speed cannot raise the engine working temperature for enabling the cumulated carbon to be burned out. When an excessive amount of carbon is cumulated in the exhaust gas purifier of the exhaust pipe, the driver may have to send the vehicle to an auto repair and service center, asking a mechanic to clean the exhaust pipe and to remove deposition of carbon from the exhaust gas purifier. This manner is inconvenience and time-wasting.

[0007] To meet new vehicle exhaust emission standards, electronic direct ignition system may be used with a nested ceramic filter element to filtrate carbon dioxide, hydrocarbon, mono-nitrogen oxides, sodium oxides and black ash particles. When the back pressure surpasses a predetermined value, diesel oil is added to the engine valve outlet to increase the combustion temperature, or added to the inside of the exhaust pipe near the filter element to increase the temperature of the filter element, causing cumulated carbon in the filter elements to be burned out. However, installation of the electronic direct ignition system and the nested ceramic filter element in an existing diesel vehicle is complicated. A modification of the original electronic structure of the diesel vehicle is necessary. This modification complicates further maintenance of the diesel vehicle.

[0008] Therefore, it is desirable to provide a diesel engine exhaust purifier that eliminates the aforesaid problems.

SUMMARY OF THE INVENTION

[0009] The primary purpose of the present invention is to provide a diesel engine exhaust purifier, which eliminates the drawback of conventional diesel engine exhaust purifiers that cause the working temperature of the diesel engine unable to be effectively increased due to utilization of the working temperature of the engine for burning cumulated carbon.

[0010] It is another object of the present invention to provide a diesel engine exhaust purifier, which fits any of a variety of existing diesel vehicles without any modification of the electronic structure of the diesel vehicle, saving much the installation cost and facilitating vehicle maintenance.

[0011] Technically, the invention has a burner system and a filter system connected in series and installed in the exhaust pipe of a diesel vehicle. When a certain amount of carbon is cumulated in the exhaust pipe, the back pressure will be relatively increased. When the back pressure surpasses a predetermined value, a microcontroller drives an indicator light to flash and enables engine exhaust gas to be directly discharged into a combustion chamber in a burner system for burning at about 400° C., so that cumulated carbon is completely burned out within 20 minutes, cleaning the filter system in the rear side of the exhaust pipe.

[0012] The filter system uses precious metal ceramic filter elements to remove solid matters from exhaust gas. The precious metal ceramic filter elements are prepared from magnesium oxide, aluminum oxide, silicon oxide or the like through a sintering process, having 100 meshes per square inch. Each mesh has one end opened and the other end closed. Thus, exhaust gas cannot pass through the meshes directly and must move along the wall of the exhaust gas passage. The porosity is about 7~13μ. Therefore, about 99% of black ash particles can be caught. The precious metal ceramic filter elements have a precious metal coating (platinum, palladium, rhodium or titanium coating) that oxidizes toxic gas or causes toxic gas to be converted into nontoxic gas for exhaust. The filter system eliminates 90% and up HC (hydrocarbon) and CO (carbon monoxide), and 20% up NOx (mono-nitrogen oxides) from exhaust gas.

[0013] According to the technical features of the present invention, the burner system is installed in the exhaust pipe in front of the filter system and adjacent to the exhaust port of the diesel engine. The burner system comprises a stainless steel barrel, and a flame thrower connected to a middle part of the stainless steel barrel. The flame thrower is controlled by a microcontroller. When the working time of the diesel engine surpasses 50 hours (this is adjustable subject to the type of the diesel vehicle) or when the back pressure reaches 6 kpa, a corresponding indication signal is produced, and the driver can directly switch on the control button to turn on the igniter

of the burner system and then to turn on the motor pump of the pump-operated fuel tank of the burner system. If the temperature rise does not reach 20° C. within 60 seconds, ignition is started again. If burning is not initiated twice, failure indicator light is turned on. At this time, a troubleshooting is necessary. When fuel sensor means detected fuel low, the burner system is turned off. The burner system is started again when a new supply of fuel is added. The burning process is completed when the set burning time period of 20 minutes is up. Thus, cumulated carbon is effectively eliminated.

[0014] The foregoing object and summary provide only a brief introduction to the present invention. To fully appreciate these and other objects of the present invention as well as the invention itself, all of which will become apparent to those skilled in the art, the following detailed description of the invention and the claims should be read in conjunction with the accompanying drawings. Throughout the specification and drawings identical reference numerals refer to identical or similar parts.

[0015] Many other advantages and features of the present invention will become manifest to those versed in the art upon making reference to the detailed description and the accompanying sheets of drawings in which a preferred structural embodiment incorporating the principles of the present invention is shown by way of illustrative example.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] FIG. **1** is a schematic plain view of a diesel engine exhaust purifier in accordance with the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0017] The following descriptions are of exemplary embodiments only, and are not intended to limit the scope, applicability or configuration of the invention in any way. Rather, the following description provides a convenient illustration for implementing exemplary embodiments of the invention. Various changes to the described embodiments may be made in the function and arrangement of the elements described without departing from the scope of the invention as set forth in the appended claims.

[0018] Referring to FIG. **1**, a diesel engine exhaust purifier for use in a diesel vehicle in accordance with the present invention comprises a burner system **13** and a filter system **7** arranged in an exhaust pipe **1** between an input end **11** and an output end **12** of the exhaust pipe **1**. The burner system **13** comprises a stainless steel barrel **24**, a flame thrower **2** mounted in the stainless steel barrel **24**, and an auto igniter **3**. The flame thrower **2** comprises a pump-operated fuel tank **23**, a nozzle **21**, and a fuel pipe **22** connected between the pump-operated fuel tank **23** and the fuel nozzle **21** for guiding fuel from the pump-operated fuel tank **23** to the fuel nozzle **21** that sprays fuel into a mist. The auto igniter **3** is disposed adjacent to the fuel nozzle **21**, and electrically connected to the DC power supply circuit of the diesel vehicle. When electrically connected, the auto igniter **3** discharges sparks to burn the mist of fuel being discharged out of the fuel nozzle **21**. A first pressure sensor **5**A is disposed in front of the flame thrower **2** and adapted to detect back pressure. The first pressure sensor **5**A is mounted in one sidewall of the burner system **13** at a suitable location and electrically connected to the control system of the diesel vehicle. According to the present preferred embodiment, the first pressure sensor **5**A is electrically connected with the pump-operated fuel tank **23** to a microcontroller **4**. The filter system **7** is a precious metal catalyzer converter installed in the output end **12** of the exhaust pipe **1**, comprising a straight through precious metal catalyzer type ceramic filter element **71** and a nested metal catalyzer type ceramic filter element **72**. A temperature sensor **6** is installed in one side of the filter system **7**. A second pressure sensor **5**B is installed in the output end **12** of the exhaust pipe **1**. The temperature sensor **6** and the second pressure sensor **5**B are electrically connected to the microcontroller **4**.

[0019] The burner system **13** of the exhaust pipe purifier does no work under a normal working status of the diesel vehicle, and exhaust gas of the diesel engine is directly discharged through the burner system **13** and the filter system **7**. When exhaust gas is flowing through the filter system **7**, the straight through precious metal catalyzer type ceramic filter element **71** and the nested metal catalyzer type ceramic filter element **72** remove solid matters from exhaust gas. When gas discharge is smooth, the back pressure detected by the first pressure sensor **5**A is under a predetermined value, at this time, the flame thrower **2** is not started. If a certain amount of carbon is cumulated in the filter system **7** after a long use, the exhaust back pressure will be increased. When the back pressure detected by the second pressure sensor **5**B surpasses the predetermined value, the second pressure sensor **5**B provides a signal to the microcontroller **4**, causing the microcontroller **4** to start up the pump (not shown) of the pump-operated fuel tank **23**. Thus, the pump-operated fuel tank **23** supplies forced fuel through the fuel pipe **22** to the fuel nozzle **21** for burning. At the same time, the microcontroller **4** drives the igniter **3** to discharge sparks, causing the mist of fuel being discharged out of the fuel nozzle **21** to be burned. When the discharging mist of fuel is burned, the temperature will be as high as about 400° C. This high temperature is transferred to the straight through precious metal catalyzer type ceramic filter element **71** and the nested metal catalyzer type ceramic filter element **72** of the filter system **7**, causing cumulated carbon to be burned out. After removal of cumulated carbon, the filter system **7** resumes to function smoothly. At this time, the back pressure detected by the first pressure sensor **5**A dropped below the predetermined value, and the first pressure sensor **5**A gives a signal to the microcontroller **4** to turn off the flame thrower **2**, allowing engine exhaust gas to be directly discharged through the filter system **7**. This operation procedure is repeated again and again, effectively eliminating cumulated carbon.

[0020] It will be understood that each of the elements described above, or two or more together may also find a useful application in other types of methods differing from the type described above.

[0021] While certain novel features of this invention have been shown and described and are pointed out in the annexed claim, it is not intended to be limited to the details above, since it will be understood that various omissions, modifications, substitutions and changes in the forms and details of the device illustrated and in its operation can be made by those skilled in the art without departing in any way from the spirit of the present invention.

I claim:

1. An exhaust pipe purifier installed in the exhaust pipe of a diesel vehicle to eliminate cumulated carbon from the exhaust pipe, comprising:

a burner system, said burner system comprising a metal barrel mounted in said exhaust pipe, a flame thrower

mounted in said metal barrel, said flame thrower comprising a pump-operated fuel tank, a fuel nozzle adapted to spray a fuel into a mist, a fuel pipe adapted to guide a fuel from said pump-operated fuel tank to said fuel nozzle for spraying into a mist, and an auto igniter adapted to discharge sparks for burning the mist of fuel discharged out of said fuel nozzle,

a first pressure sensor mounted in said metal barrel near a front end thereof;

a second pressure sensor mounted in said metal barrel near a rear end thereof;

a filter system mounted in said metal barrel between said burner system and said second pressure sensor and adapted to remove solid matters from engine exhaust gas; and

a microcontroller electrically connected to the power supply system of the diesel vehicle and electrically connected to said first pressure sensor and said second pressure sensor and said burner system and adapted to control the operation of said pump-operated fuel tank and said auto igniter subject to pressure detection of said first pressure sensor and said second pressure sensor.

2. The exhaust pipe purifier as claimed in claim **1**, wherein said filter system comprises a straight through precious metal catalyzer type ceramic filter element and a nested precious metal catalyzer type ceramic filter connected in series.

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