APPARATUS FOR ADJUSTING THE TEMPERATURE OF EXHAUST GASES

Inventors: Carl-Johan Karlsson, Goteborg (SE); Paulina Tengstrom, Askim (SE)

Correspondence Address:
NOVAK BRUCE & QUIGG, LLP
1300 EYE STREET NW
400 EAST TOWER
WASHINGTON, DC 20005 (US)

Assignee: VOLVO LASTVAGNAR AB, Goteborg (SE)

Appl. No.: 11/306,147
Filed: Dec. 16, 2005

Related U.S. Application Data
Continuation of application No. PCT/SE04/00937, filed on Jun. 14, 2004.

ABSTRACT

Apparatus for adjusting the temperature of exhaust gases passing through an exhaust system of a vehicle having an internal combustion engine. The exhaust system is provided with an active regeneration filter for collecting particles from the exhaust gas stream. The apparatus includes a heat exchanger that has a first flow passage for an exhaust gas stream from the exhaust manifold of the engine to the particle filter and a second flow passage for an exhaust gas stream from the particle filter to the outlet pipe of the exhaust system.
APPARATUS FOR ADJUSTING THE TEMPERATURE OF EXHAUST GASES

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application is a continuation patent application of International Application No. PCT/SE2004/000097 filed 14 Jun. 2004 which is published in English pursuant to Article 21(2) of the Patent Cooperation Treaty, and which claims priority to Swedish Application No. 0301799-3 filed 18 Jun. 2003. Said applications are expressly incorporated herein by reference in their entireties.

TECHNICAL FIELD OF THE INVENTION

[0002] The present invention relates to an apparatus for adjusting the temperature of exhaust gases passing through an exhaust system of a vehicle that has an internal combustion engine. Furthermore, the exhaust system is provided with an active regeneration filter for collecting particles from the exhaust gas stream and which apparatus comprises a heat exchanger.

BACKGROUND OF THE INVENTION

[0003] Active regeneration particle filters can be used for the after-treatment of exhaust gases from diesel engines for catching soot and ash particles instead of allowing them to be dispersed into the surrounding environment. By active regeneration it is meant that the temperature of the exhaust is intermittently increased upstream of the filter to such an extent that the particles can be burnt off. Further, an oxidation catalyst can be integrated with the filter for the increase in temperature.

[0004] The oxidation catalyst uses unburned fuel in the exhaust gas stream to create the preconditions for regeneration. This unburned fuel can be fed to the exhaust gas stream, for example, through the normal injection system of the engine and is commonly termed post-injection.

[0005] The effect of the high temperatures generated in active regeneration (oxygen-based) is that the temperature of gases discharged from a vehicle through the exhaust pipe can be extremely high (around 600 degrees Celsius). This can cause a fire risk and create danger for other road-users, for example pedestrians. One way of cooling the exhaust gases can be, for example, to pass the exhaust gases through a cooler that uses ambient air as a cooling medium. This type of cooler is usually provided with a fan so as to provide cooling air when the vehicle is stationary or traveling at low speed, which expediently is the state in which the vehicle finds itself during regeneration of its particle filter. A drawback, however, with these types of exhaust coolers with a fan is that they are both bulky and expensive.

SUMMARY OF THE INVENTION

[0006] One object of the present invention is therefore to produce a cost-effective and space-saving apparatus for reducing the temperature of the exhaust gas stream leaving a vehicle having a diesel engine with an active regeneration particle filter.

[0007] In at least one embodiment, the invention takes the form of a purpose-built apparatus for adjusting the temperature of exhaust gases passing through an exhaust system of a vehicle that has an internal combustion engine. The exhaust system is provided with an active regeneration filter for collecting particles from the exhaust gas stream and which comprises (includes, but is not limited to) a heat exchanger that, according to the invention, has a first flow passage for an exhaust gas stream from the exhaust manifold of the engine to the particle filter and a second flow passage for an exhaust gas stream from the particle filter to the outlet pipe of the exhaust system. By virtue of this configuration of the apparatus, the temperature of the exhaust gas stream leaving the vehicle can be lowered at the same time as the thermal energy can be utilized to heat up the gas flow into the particle filter. This also means that less fuel is needed for the active regeneration.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] The invention will be described in greater detail below with reference to an illustrative embodiment shown in the accompanying drawing that diagrammatically represents an internal combustion engine arrangement configured according to the teachings of the present invention.

DETAILED DESCRIPTION

[0009] FIG. 1 diagrammatically illustrates a diesel engine 10 installed in a vehicle, for example a truck or a bus, and which is provided with an exhaust system comprising an exhaust manifold 11 connected to a heat exchanger 12. A silencer having an oxidation catalyst 13 and a particle filter 14 is connected to the heat exchanger 12 by, on the one hand, an inlet pipeline 15 and, on the other hand, an outlet pipeline 16.

[0010] A first flow passage through the heat exchanger 12 extends vertically in the figure and allows an exhaust gas stream from the exhaust manifold 11 of the engine, via the inlet pipeline 15, to the particle filter 14. A second flow passage through the heat exchanger 12 extends horizontally in the figure and conveys an exhaust gas stream from the particle filter 14, via the outlet pipeline 16, to the outlet pipe 17 of the exhaust system.

[0011] Through active regeneration, using oxygen as the oxidant, soot particles can be automatically removed from the particle filter, whereby servicing and maintenance requirements are reduced. Regeneration can take place at an appropriate time, when the vehicle has traveled a certain distance or when the engine has operated at a certain load for a certain period of time.

[0012] In order to activate the regeneration of the particle filter, the injectors of the engine are exemplarily equipped with means for injecting fuel into the exhaust gases for so-called post-injection. Alternatively, an extra injector can be placed in the exhaust system upstream of the particle filter to inject fuel into the exhaust gases.

[0013] The exhaust gas temperature upon exit from the engine via the exhaust manifold 11 can measure around 200 degrees Celsius under low load. When an active regeneration is initiated, the temperature of the exhaust gas flow exiting the silencer will initially increase owing to combustion of hydrocarbons in the oxidation catalyst belonging to the system. Gradually, the soot combustion in the particle filter begins, whereupon temperatures in excess of 1000
degrees Celsius can be generated and occur locally. The gas flow from the silencer to the heat exchanger via the outlet pipe 16 therefore has a temperature not less than around 600 degrees Celsius. This hot gas stream is cooled during its passage through the heat exchanger 12 and leaves the vehicle via the outlet pipe 17 at a temperature of, for example, around 400 degrees Celsius (at 50% heat exchanger efficiency). The thermal energy from the hot gas stream is used to heat the gas stream emanating from the exhaust manifold, in which case a substantially smaller quantity of fuel is needed to initiate the active regeneration.

The invention shall not be deemed to be limited to the illustrative embodiments described above. Instead, a number of further variants and modifications are conceivable and within the scope of the patent claims.

What is claimed is:

1. An apparatus for adjusting the temperature of exhaust gas passing through an exhaust system (11-17) of a vehicle having an internal combustion engine (10), which exhaust system is provided with an active regeneration filter (14) for collecting particles from the exhaust gas stream, and which apparatus comprises a heat exchanger (12), which has a first flow passage for an exhaust gas stream from the exhaust manifold (11) of the engine to the particle filter (14) and a second flow passage for an exhaust gas stream from the particle filter (14) to the outlet pipe (17) of the exhaust system, and characterized in that the particle filter (14) is provided with an oxidation catalyst (13) for intermittent combustion of accumulated soot.

2. The apparatus as recited in claim 1, further characterized in that the combustion chamber of the engine (10) is provided with an injector for injecting fuel into the exhaust gases.

3. The apparatus as recited in claim 1, further characterized in that an injector is placed in the exhaust system upstream of the particle filter (14), for injecting fuel into the exhaust gases.

4. An apparatus for adjusting the temperature of an exhaust gas stream emanating from an internal combustion engine of a vehicle and passing through an exhaust system thereof, said exhaust system comprising:

   - an active regeneration filter for collecting particles from the exhaust gas stream;
   - a heat exchanger having a first flow passage for an exhaust gas stream from the exhaust manifold of the engine to the particle filter and a second flow passage for an exhaust gas stream from the particle filter to an outlet pipe of the exhaust system; and
   - said particle filter being provided with an oxidation catalyst for intermittent combustion of accumulated soot.

5. The apparatus as recited in claim 4, further comprising said internal combustion engine having an injector that injects fuel into the exhaust gases.

6. The apparatus as recited in claim 4, further comprising an injector located in the exhaust system upstream of the particle filter which injects fuel into the exhaust gases.

* * * * *