EXHAUST GAS APPARATUS AND METHOD FOR THE REGENERATION OF A NOX TRAP AND A PARTICLE FILTER

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Abstract

Exhaust gas apparatus for the cleaning of exhaust gas where the exhaust gas apparatus comprises an exhaust conduit section which is formed with at least two separate flow paths. Each flow path is provided with a particle filter for the removal of particulate matter from the exhaust gas, an NOx trap for the removal of NOx from the exhaust gas. The exhaust gas apparatus further comprises at least one cold flame vaporizer in which fuel is partially oxidized in preheated air to form a cold flame gas where the cold flame vaporizer is arranged in fluid communication with each of the flow paths in the exhaust conduit section such that the cold flame gas can flow through the particle filter and the NOx trap, and valve means for controlling the flow of cold flame gas from the cold flame vaporizer to each flow path in the exhaust conduit section. Thereby, both the particle filter and the NOx trap in at least one of the flow paths can be regenerated in a single operation. There is also provided a method for regenerating cleaning means for exhaust gas where the cleaning means comprises an NOx trap and possibly a particle filter.
EXHAUST GAS APPARATUS AND METHOD FOR THE REGENERATION OF A NOX TRAP AND A PARTICLE FILTER

[0001] The present invention relates to apparatus for regenerating a NOx trap and the regeneration of a particle filter and a NOx trap in a single operation. The invention is also related to a method for the regeneration of a NOx trap and a method for regenerating a particle filter and a NOx trap in a single operation. The invention further relates to the use of the apparatus and the methods with a compression ignition engine, i.e. what is often called a diesel engine.

[0002] The cold flame is a phenomenon which has so far not received much attention. In a cold flame the fuel is partially oxidized in preheated air and the temperature is kept constant at about 450°C, and it is independent of air/fuel ratio and residence time. In the cold flame process, only 2-20% of the calorific value of the fuel is released, and this heat is used to evaporate the fuel, giving a homogenous gaseous fuel. During developmental work, it has been observed that the gas was able to remove carbon deposits from the reactor walls. The reason for this has not been established yet, but is thought to be due to free radicals that are present in the cold flame gas, i.e. the partially oxidized, gaseous fuel.

[0003] A more complete description of the cold flame gas phenomenon can be found in the American patent, U.S. Pat. No. 6,795,693.

[0004] Exhaust from compression ignition engines (often inaccurately called diesel engines), which operate on excess air, contains mainly particulates, NOx and incomplete combustion products (HC and CO). Particulates can be removed using a filter downstream from the engine. After a while, the filter will be blocked and need to be regenerated. This is done by increasing the temperature in the exhaust gas to above 600°C under oxidizing conditions and thereby burning away the carbon deposits. In order to allow for continuous operation, it is common to have two filters in parallel and a valve which sends the majority of the exhaust to one of the filters while the other is being regenerated.

[0005] Incomplete combustion products (HC and CO) can be removed by an oxidation catalyst.

[0006] NOx, on the other hand, can only be removed catalytically if the exhaust gas is slightly reducing (as in an Otto engine). This is not normally the case in a compression ignition engine. Since the regeneration of the particle requires an oxidizing environment while the regeneration of the NOx trap requires a slightly reducing environment, there has not been available a method for regenerating the particle filter and the NOx trap in a single operation.

[0007] One way to reduce NOx emissions in a diesel engine is to recirculate some of the exhaust back into the engine (EGR).

[0008] While the above method reduces the NOx formation, it is also possible to remove NOx by inserting an NOx absorvent, as described in several patent documents, for instance U.S. Pat. No. 5,974,791. An NOx absorvent can be made from barium carbonate. During absorption, the absorvent is converted to barium nitrate and releases CO2 at the same time. When the absorvent is saturated, it can be regenerated using CO in that the barium nitrate is converted back to barium carbonate and release N2 gas.

[0009] For a complete treatment of the exhaust gas, a particle filter and an NOx absorvent (NOx trap) and an oxidation catalyst is used. The problem is, as already mentioned, that the particle filter has to be regenerated under high temperature (600°C) in an oxidizing environment while the NOx absorvent is regenerated at lower temperatures in a reducing environment (500°C with CO gas). This means that two process operations are needed in order to clean both the particle filter and the NOx trap, as described in the American patent U.S. Pat. No. 6,955,042.

[0010] There is therefore an objective of the present invention to find a new way to regenerate an NOX trap.

[0011] A more general objective of the present invention has been to find a way to regenerate the particle filter and the NOx trap in a single operation.

[0012] These objectives are achieved by the present invention as described in the independent claims. Further embodiments of the invention are described in the dependent claims.

[0013] There is provided an exhaust gas cleaning apparatus for the cleaning of exhaust gas flowing in an exhaust gas conduit. The exhaust cleaning apparatus comprises at least one NOx trap arranged in the exhaust gas conduit such that the NOx trap at least partially removes NOx from the exhaust gas flowing through the exhaust gas conduit. The exhaust gas cleaning apparatus further comprises a cold flame vaporizer wherein fuel is partially oxidized in preheated air to form a cold flame gas. The cold flame vaporizer is arranged in fluid communication with the exhaust gas conduit such that the cold flame gas can flow through the NOX trap in the exhaust gas conduit, thereby regenerating the NOx trap.

[0014] The cold flame vaporizer is a standard cold flame vaporizer in which the fuel can be partially oxidized in preheated air. In the cold flame vaporizer air and fuel is mixed in a proportion of typically 0.3-1.0 (1.0 is stoichiometric air/fuel ratio), but only a small fraction of the air is used in the cold flame reaction.

[0015] The exhaust gas conduit may be a pipe or similar of any cross sectional shape, or the exhaust gas conduit may be formed as internal conduits in a larger body.

[0016] The means for preheating the air may be a heat exchanger in which the heat of the exhaust gas warms up the air. It would also be possible to use other means for preheating the, for instance electrical heating means.

[0017] The cold flame vaporizer may be arranged outside the exhaust gas conduit and, if necessary, connected to the exhaust gas conduit with fluid lines. If the cold flame vaporizer is mounted to the exhaust gas conduit, then there may only be necessary to provide openings into the exhaust gas conduit, while if the cold flame vaporizer is arranged separate from the exhaust gas conduit, fluid lines will be provided connecting the cold flame vaporizer and the exhaust gas conduit.

[0018] In an embodiment of the invention, the cold flame vaporizer can also be arranged inside the exhaust gas conduit. In that case, there is no need for fluid lines as the cold flame vaporizer may just release the cold flame gas into the exhaust gas conduit through openings including said valve means.

[0019] The exhaust gas cleaning apparatus further comprises valve means controlling the flow of cold flame gas from the cold flame vaporizer into the exhaust gas conduit.

[0020] The exhaust gas cleaning apparatus is further provided with one or more valve means which controls the flow of exhaust gas through the exhaust gas conduit. When regenerating the NOX trap in the exhaust gas conduit, the flow of exhaust gas can therefore at least partially be shut off.
[0021] These valve means may be controlled such that the NOx trap is regenerated, for instance, at specific time intervals, or when the pressure drop across NOx trap reaches a predetermined level indicating that the NOx trap needs to be regenerated.

[0022] Furthermore, the exhaust gas cleaning apparatus comprises a fuel supply which is arranged in fluid communication with the cold flame vaporizer. The exhaust gas cleaning apparatus also comprises an air supply and means for preheating the air, the air supply being in fluid communication with the cold flame vaporizer. In order to control the flow of fuel and preheated air into the cold flame vaporizer, the exhaust gas apparatus comprises one or more valve means controlling the flow of fuel and preheated air to said cold flame vaporizer.

[0023] There is also provided an exhaust gas apparatus for the cleaning of exhaust gas, the exhaust gas apparatus comprising an exhaust conduit section which is formed with at least two separate flow paths. Each flow path is provided with a particle filter for the removal of particulate matter from the exhaust gas and an NOx trap for the removal of NOx from the exhaust gas. The exhaust gas apparatus further comprises at least one cold flame vaporizer in which fuel is partially oxidized in preheated air to form a cold flame gas. The cold flame vaporizer is arranged in fluid communication with each of the flow paths in the exhaust conduit section such that the cold flame gas can flow through the particle filter and the NOx trap. There is further provided valve means for controlling the flow of cold flame gas from the cold flame vaporizer to each flow path in the exhaust conduit section, whereby both the particle filter and the NOx trap in at least one of the flow paths can be regenerated in a single operation.

[0024] The cold flame vaporizer is a standard cold flame vaporizer in which the fuel can be partially oxidized in preheated air. In the cold flame vaporizer air and fuel is mixed in a proportion of typically 0.3-1.0 (1.0 is stoichiometric air/fuel ratio), but only a small fraction of the air is used in the cold flame reaction.

[0025] The exhaust gas conduit may be a pipe or similar of any cross sectional shape, or the exhaust gas conduit may be formed as internal conduits in a larger body.

[0026] The means for preheating the air may be a heat exchanger in which the heat of the exhaust gas warms up the air. It would also be possible to use other means for preheating the air, for instance electrical heating means.

[0027] The flow paths may be formed by providing the exhaust gas return conduit, at least along a part of its length, with one or more partitions such that two or more separate flow paths for the exhaust gas are formed in the exhaust conduit section. These partitions may be one or more plates dividing the exhaust gas return conduit in two or more flow paths. Alternatively, the flow paths may be formed by providing the exhaust gas return conduit with at least two separate conduits through which the exhaust gas can flow.

[0028] The cold flame vaporizer may be arranged outside the exhaust conduit section and, if necessary, connected to the exhaust conduit section with fluid lines. If the cold flame vaporizer is mounted to the exhaust conduit section, then there may only be necessary to provide openings into the exhaust conduit section, while if the cold flame vaporizer is arranged separate from the exhaust conduit section, fluid lines will be provided connecting the cold flame vaporizer and the exhaust conduit section.

[0029] In an embodiment of the invention, the at least one cold flame vaporizer can also be arranged inside the exhaust conduit section. In that case, there is no need for fluid lines as the cold flame vaporizer may just release the cold flame gas into the exhaust gas conduit through openings including said valve means.

[0030] The exhaust gas apparatus is preferably provided with one or more valve means which controls the flow of exhaust gas through the flow paths of the exhaust conduit section. The valve means may close off one or more flow paths for the flow of exhaust gas. The exhaust gas apparatus is preferably also provided with one or more valve means controlling the flow of cold flame gas from the at least one cold flame vaporizer to the flow paths of exhaust conduit section and the particle filters and NOx traps in the flow paths. These valve means may be controlled such that the particle filters and NOx traps are regenerated, for instance, at specific time intervals, or when the pressure drop across a particle filter and/or NOx trap reaches a predetermined level indicating that the particle filter and the NOx trap needs to be regenerated.

[0031] The exhaust gas apparatus further comprises a fuel supply which is arranged in fluid communication with the at least one cold flame vaporizer. Preferably, there is also provided valve means controlling the flow of fuel to the at least one cold flame vaporizer.

[0032] The exhaust gas apparatus also comprises an air supply and, as mentioned above, means for preheating the air, the air supply being arranged in fluid communication with the at least one cold flame vaporizer. Preferably, there is also provided valve means controlling the flow of preheated air to the at least one cold flame vaporizer.

[0033] In each flow path, the NOx trap is preferably arranged downstream of the particle filter so that particulate matter in the exhaust gas can be removed before reaching the NOx trap.

[0034] Preferably, the exhaust gas apparatus also comprises an oxidation catalyst arranged downstream of the particle filter and the NOx trap.

[0035] There is also provided a method for regenerating an NOx trap which removes NOx from exhaust gas flowing in an exhaust gas conduit, the NOx trap being provided in the exhaust gas conduit, the method comprising the following steps:

[0036] providing a cold flame gas,

[0037] letting the cold flame gas flow through the NOx trap, thereby regenerating the NOx trap.

[0038] There is also provided a method for regenerating cleaning means for exhaust gas flowing in an exhaust gas conduit where the cleaning means comprises a particle filter for the removal of particulate matter from the exhaust gas and an NOx trap for the removal of NOx from the exhaust gas wherein the particle filter and the NOx trap being arranged in the exhaust gas conduit. The method comprises the following steps:

[0039] providing a cold flame gas,

[0040] letting the cold flame gas flow through the particle filter and the NOx trap, thereby regenerating both the particle filter and the NOx trap in a single operation.

[0041] Again, the cold flame gas may be provided by partially oxidizing fuel in preheated air in a cold flame vaporizer which is arranged in fluid communication with the exhaust conduit. In the cold flame vaporizer air and fuel is mixed in a proportion of typically 0.3-1.0, but only a small fraction of the air is used in the cold flame reaction.
In order to remove particulate matter from the exhaust gas before the exhaust gas passes through the NOx trap, the method also comprises the step of arranging the NOx trap downstream of the particle filter.

The method also comprises the step of providing one or more valve means for controlling the flow of cold flame gas from the cold flame vaporizer into the exhaust gas conduit.

The method also comprises the step of providing a fuel supply arranged in fluid communication with the cold flame vaporizer, and an air supply and heating means for the preheating of the air, the air supply being arranged in fluid communication with the cold flame vaporizer. Furthermore, the method comprises the step of providing valve means for controlling the flow of fuel and preheated air to the cold flame vaporizer.

There is also provided a method for regenerating cleaning means for exhaust gas flowing through an exhaust conduit section of an exhaust gas conduit, the exhaust conduit section being formed with at least two flow paths for the exhaust gas. The cleaning means are provided in each of the flow paths and comprises a filter for the removal of particulate matter from the exhaust gas, an NOx trap for the removal of NOx from the exhaust gas

The method comprises the following steps:

providing a cold flame gas,

letting the cold flame gas flow through the particle filter and the NOx trap in at least one of the flow paths of the exhaust conduit section.

The particle filter and the NOx trap in the at least one flow path are thereby both, in one operation, regenerated.

As mentioned several times, the cold flame gas may be provided by partially oxidizing fuel in preheated air in at least one cold flame vaporizer which is arranged in fluid communication with all the flow paths of the exhaust conduit section. In the cold flame vaporizer air and fuel is mixed in a proportion of 0.3-1.0 (again 1.0 is stoichiometric air/fuel ratio), but only a small fraction of the air is used in the cold flame reaction.

The method also comprises the step of providing one or more valve means for separately controlling the flow of cold flame gas from the cold flame vaporizer into each flow path of the exhaust gas conduit.

Furthermore, the method also comprises the step of providing a fuel supply arranged in fluid communication with the cold flame vaporizer, and an air supply and heating means for the preheating of the air, the air supply being arranged in fluid communication with the cold flame vaporizer.

The method also comprises the step of providing one or more valve means for controlling the flow of fuel and preheated air to the cold flame vaporizer.

The method also comprises the step of arranging, in each flow path in the exhaust conduit section, the NOx trap downstream of the respective particle filter.

The method also comprises the step of arranging an oxidation catalyst in the exhaust conduit section downstream of the particle filter and the NOx trap.

There is also provided a use of the exhaust gas cleaning apparatus where the NOx trap is arranged in the exhaust conduit of a compression ignition engine.

There is also provided a use of the exhaust gas apparatus wherein the exhaust conduit section forms part of the exhaust gas conduit of a compression ignition engine.

There is also provided a use of the method for regenerating an NOx trap wherein the NOx trap is arranged in the exhaust conduit of a compression ignition engine.

There is also provided a use of the methods for regenerating cleaning means for exhaust gas, the cleaning means comprising a particle filter and an NOx trap, with a compression ignition engine.

Above, only a cold flame gas produced by a cold flame vaporizer has been mentioned. A cold flame is one method to achieve a partially oxidized fuel gas among a number of other partially oxidized fuel gases with the same properties. The present invention should therefore not be seen as limited to only a cold flame gas, but should include other partially oxidized fuel gases with the same or similar properties as the cold flame gas.

In the following, an embodiment of the invention is disclosed in detail with reference to the enclosed figures, where

FIG. 1 illustrates an embodiment of the invention where a NOx trap is arranged in an exhaust conduit.

FIG. 2a illustrates an embodiment of the invention where a particle filter and a NOx trap is arranged in a section of an exhaust conduit which is

FIG. 2b is an illustration of the section A-A through the particle filter in FIG. 2a.

FIG. 2c is an illustration of the section B-B through the NOx trap in FIG. 2a.

FIG. 3a illustrates a similar embodiment of the invention where a particle filter and a NOx trap is arranged in a section of an exhaust conduit.

FIG. 3b is an illustration of the section A-A through the particle filter in FIG. 3a.

FIG. 3c is an illustration of the section B-B through the particle filter in FIG. 3a.

FIG. 1 illustrates a first embodiment of the invention. An exhaust gas flows in an exhaust gas conduit 14 with valve means 18 controlling the flow of exhaust gas through a NOx trap 30.

There is also provided a cold flame vaporizer 11 with a fuel supply 12, which may be diesel or heavy fuel oil, and an air supply 13. The air supply may be provided with an air intake 15 including an air filter (not shown). Valve means 16, 19 controls the flow of air through fluid line 25 and flow of fuel through fluid line 26 to the cold flame vaporizer 11 respectively.

When the NOx trap needs to be regenerated, valve means 18 is preferably closed and valve means 17 is opened such that cold flame gas can flow through the NOx trap, thereby regenerating it.

In FIG. 2a-2c there is shown a second embodiment of the invention. Exhaust gas, indicated by arrow 20 on the figure, flows in exhaust gas conduit 14 and through an exhaust conduit section 10 comprising at least a particle filter 30 and a NOx trap 40. Further downstream there is provided an oxidation catalyst 50. The oxidation catalyst could also be placed together with the particle filter 30 and the NOx trap 40.

The exhaust conduit section 10 is formed with two separate flow paths as can easily be seen on FIGS. 2b and 2c, which illustrate sections through the particle filter 30 and the NOx trap 40 respectively. The two flow paths are formed by a partition 25 dividing the exhaust conduit section 10 in two
parts in the longitudinal direction. In each flow path there is provided a particle filter 30 and a NOx trap 40. There is also provided means, like valve means, to control the flow of exhaust gas and cold flame gas through the exhaust conduit section 10.

[0076] There is also provided a cold flame vaporizer 11 with a fuel supply 12 and an air supply 13. There is no difference from the first embodiment of the invention shown in FIG. 1, so it will not be described any further here.

[0077] When the particle filters 30 and the NOx traps 40, arranged in the fluid paths 41 and 42 in the exhaust conduit section 10, are to be regenerated using the cold flame gas from the cold flame vaporizer 11, one of the flow paths 41, 42 is closed for the flow of exhaust gas 20 while the other flow path is kept open for the flow of exhaust gas. Valve means 17 are opened and cold flame gas flows through the flow path 41, 42 which has been for the flow of exhaust gas. The particle filter 30 and the NOx trap 40 in that flow path are thereby regenerated in one operation while exhaust gas is allowed to flow through the other flow path. There is therefore not necessary to stop the engine from which the exhaust gas originates.

[0078] When the particle filter and the NOx trap in one flow path 41, 42 have been regenerated, the valve means switches positions so that the exhaust gas now flows through the flow path 41, 42 containing the regenerated particle filter and NOx trap, while the cold flame gas is directed through the flow path 41, 42 in which the particle filter 30 and NOx trap 40 is not yet regenerated. The regeneration of the particle filter 30 and the NOx trap 40 can thereby be carried out in one operation without having to stop the engine.

[0079] In this embodiment of the invention, the exhaust conduit section 10 is provided with only two flow paths 41, 42. It is however, possible to provide any number of flow paths for the exhaust gas through the exhaust conduit section 10.

[0080] In FIG. 3a-3c a very similar embodiment of the invention to the embodiment on FIG. 2a-2c, is shown. Again the cold flame vaporizer 11 with its fuel supply 12 and air supply 13 is identical to what has already been described and will not be repeated.

[0081] The embodiment of the invention shown on FIG. 3a-3c is also provided with two flow paths 34, 35 through which the exhaust gas may flow, but are now in the form of two separate exhaust sections. There is also provided fluid lines so that cold flame gas from the cold flame vaporizer 11 can flow through the two flow paths 34, 35.

[0082] Flow paths 34, 35 are provided with valve means 32, 33 which control the flow of exhaust gas through the two flow paths. Valve means 17 control the flow of cold flame gas to the two flow paths 34, 35.

[0083] Both flow paths are provided with an exhaust conduit section 10 comprising at least a particle filter 30 and a NOx trap 40. On FIG. 3a it is also shown that the exhaust conduit section 10 comprises an oxidation catalyst, but this is optional as mentioned above.

[0084] As before, when the particle filters 30 and the NOx traps 40 need to be regenerated, one of the flow paths 32, 33 is closed for the flow of exhaust gas by valve means 32, 33 and the one of valve means 17 opens such that cold flame gas from the cold flame vaporizer 11 is directed to and flows through the exhaust conduit section 10 which has been closed for the flow of exhaust gas. The particle filter 30 and the NOx trap in one of the exhaust conduit sections 34, 35 are regenerated by the cold flame gas in one operation.

[0085] Later the direction of flow of exhaust gas and cold flame gas through the two exhaust conduit sections will change so that the particle filters 30 and the NOx trap 40 in the other exhaust conduit section 10 are also regenerated by the cold flame gas.

[0086] FIGS. 3b and 3c are sections through the particle filters 30 and the NOx trap 40 respectively. As can be seen on the figure, the filters cover substantially the whole cross-section as opposed to the embodiment shown in FIG. 2a-2c.

[0087] Again, the embodiment shown on FIG. 3a-3c are provided with two flow paths 34, 35, but it would be possible to provide as many flow paths as is necessary for any given purpose.

1. Exhaust gas cleaning apparatus for the cleaning of exhaust gas flowing in an exhaust gas conduit, the exhaust cleaning apparatus comprising at least one NOx trap arranged in the exhaust gas conduit such that the NOX trap at least partially removes NOx from the exhaust gas flowing through the exhaust gas conduit, characterized in that the exhaust gas cleaning apparatus further comprises a cold flame vaporizer wherein fuel is partially oxidized in preheated air to form a cold flame gas, the cold flame vaporizer being arranged in fluid communication with the exhaust gas conduit such that the cold flame gas can flow through the NOx trap in the exhaust gas conduit, thereby regenerating the NOx trap.

2. Exhaust gas cleaning apparatus according to claim 1, characterized in that the cold flame vaporizer is arranged outside the exhaust gas conduit and, if necessary, connected to the exhaust gas conduit by fluid lines.

3. Exhaust gas cleaning apparatus according to claim 1, characterized in that the cold flame vaporizer is arranged within the exhaust gas conduit.

4. Exhaust gas cleaning apparatus according to one of the claims 1-3, characterized in that the exhaust gas cleaning apparatus comprises valve means controlling the flow of cold flame gas from the cold flame vaporizer into the exhaust gas conduit.

5. Exhaust gas cleaning apparatus according to one of the claims 1-4, characterized in that exhaust gas cleaning apparatus comprises valve means controlling the flow of exhaust gas through the exhaust gas conduit.

6. Exhaust gas cleaning apparatus according to one of the claims 1-5, characterized in that the exhaust gas cleaning apparatus comprises a fuel supply arranged in fluid communication with the cold flame vaporizer.

7. Exhaust gas cleaning apparatus according to one of the claims 1-6, characterized in that the exhaust gas cleaning apparatus comprises an air supply and means for preheating the air, the air supply being arranged in fluid communication with the cold flame vaporizer.

8. Exhaust gas cleaning apparatus according to claim 6 or 7, characterized in that the exhaust gas cleaning apparatus comprises valve means controlling the flow of fuel and preheated air into the cold flame vaporizer.

9. Exhaust gas apparatus for the cleaning of exhaust gas, the exhaust gas apparatus comprising an exhaust conduit section which is formed with at least two separate flow paths, each flow path being provided with a particle filter for the removal of particulate matter from the exhaust gas, an NOx trap for the removal of NOx from the exhaust gas, characterized in that the exhaust gas apparatus further comprises
at least one cold flame vaporizer in which fuel is partially oxidized in preheated air to form a cold flame gas, the cold flame vaporizer being arranged in fluid communication with each of the flow paths in the exhaust conduit section such that the cold flame gas can flow through the particle filter and the NOx trap, and valve means for controlling the flow of cold flame gas from the cold flame vaporizer to each flow path in the exhaust conduit section, whereby both the particle filter and the NOx trap in at least one of the flow paths can be regenerated in a single operation.

10. Exhaust gas apparatus according to claim 9, characterized in that the flow paths are formed by providing the exhaust conduit section with one or more partitions such that two or more separate flow paths for the exhaust gas are formed in the exhaust conduit section.

11. Exhaust gas apparatus according to claim 9, characterized in that the flow paths are formed by providing the exhaust conduit section with at least two separate conduits through which the exhaust gas can flow.

12. Exhaust gas apparatus according to one of the claims 9-11, characterized in that the at least one cold flame vaporizer is arranged outside the flow paths and that the cold flame vaporizer, if necessary, is connected to each of the flow paths of the exhaust conduit section by fluid lines or conduits.

13. Exhaust gas apparatus according to one of the claims 9-11, characterized in that the at least one cold flame vaporizer is arranged within the exhaust conduit section.

14. Exhaust gas apparatus according to one of the claims 9-13, characterized in that exhaust gas apparatus comprises one or more valve means controlling the flow of exhaust gas through each of the flow paths of the exhaust conduit section.

15. Exhaust gas apparatus according to one of the claims 9-14, characterized in that the exhaust gas apparatus comprises a fuel supply which is arranged in fluid communication with the cold flame vaporizer.

16. Exhaust gas apparatus according to one of the claims 9-15, characterized in that the exhaust gas apparatus comprises an air supply and heating means for preheating the air, the air supply being arranged in fluid communication with the cold flame vaporizer.

17. Exhaust gas apparatus according to claim 15 or 16, characterized in that the exhaust gas apparatus comprises one or more valve means controlling the flow of fuel and preheated air to the cold flame vaporizer.

18. Exhaust gas apparatus according to one of the claims 9-17, characterized in that, in each flow path, the NOx trap is arranged downstream of the particle filter.

19. Exhaust gas apparatus according to one of the claims 9-18, characterized in that the exhaust gas apparatus comprises an oxidation catalyst arranged downstream of the particle filter and the NOx trap.

20. Method for regenerating an NOx trap which removes NOx from exhaust gas flowing in an exhaust gas conduit, the NOx trap being provided in the exhaust gas conduit, characterized in that the method comprises the following steps:

- providing a cold flame gas,
- letting the cold flame gas flow through the NOx trap, thereby regenerating the NOx trap.

21. Method for regenerating cleaning means for exhaust gas flowing in an exhaust gas conduit, the cleaning means comprising
- a particle filter for the removal of particulate matter from the exhaust gas,
- an NOx trap for the removal of NOx from the exhaust gas, the particle filter and the NOx trap being arranged in the exhaust gas conduit, characterized in that the method comprises the following steps:
- providing a cold flame gas,
- letting the cold flame gas flow through the particle filter and the NOx trap, thereby regenerating both the particle filter and the NOx trap in a single operation.

22. Method according to claim 21, characterized by arranging the NOx trap downstream of the particle filter.

23. Method according to claim 21 or 22, characterized by arranging an oxidation catalyst in the exhaust conduit section downstream of the particle filter and the NOx trap.

24. Method according to one of the claims 20-23, characterized by providing valve means for controlling the flow of cold flame gas from the cold flame vaporizer into the exhaust gas conduit.

25. Method according to one of the claims 20-24, characterized by providing a fuel supply arranged in fluid communication with the cold flame vaporizer, and an air supply and heating means for the preheating of the air, the air supply being arranged in fluid communication with the cold flame vaporizer.

26. Method according to one of the claims 20-25, characterized by providing valve means for controlling the flow of fuel and preheated air to the cold flame vaporizer.

27. Method for regenerating cleaning means for exhaust gas flowing through an exhaust conduit section of an exhaust gas conduit, the exhaust conduit section being formed with at least two flow paths for the exhaust gas, the cleaning means being provided in each of the flow paths and comprising
- a particle filter for the removal of particulate matter from the exhaust gas,
- an NOx trap for the removal of NOx from the exhaust gas, characterized in that the method comprises the following steps:
- providing a cold flame gas,
- letting the cold flame gas flow through the particle filter and the NOx trap in at least one of the flow paths of the exhaust conduit section, thereby, in one operation, regenerating both the particle filter and the NOx trap in said at least one flow path.

28. Method according to claim 27, characterized by providing one or more valve means for separately controlling the flow of cold flame gas from the cold flame vaporizer into each flow path of the exhaust gas conduit.

29. Method according to claim 27 or 28, characterized by providing a fuel supply arranged in fluid communication with the cold flame vaporizer, and an air supply and heating means for the preheating of the air, the air supply being arranged in fluid communication with the cold flame vaporizer.

30. Method according to one of the claims 27-29, characterized by providing one or more valve means for controlling the flow of fuel and preheated air to the cold flame vaporizer.

31. Method according to one of the claims 27-30, characterized by arranging, in each flow path in the exhaust conduit section, the NOx trap downstream of the respective particle filter.
32. Method according to one of the claims 27-31, characterized by arranging an oxidation catalyst in the exhaust conduit section downstream of the particle filter and the NOx trap.

33. Use of the exhaust gas cleaning apparatus according to one of the claims 1-8, where the NOx trap is arranged in the exhaust conduit of a compression ignition engine.

34. Use of the exhaust gas apparatus according to one of the claims 9-17, wherein the exhaust conduit section forms part of the exhaust gas conduit of a compression ignition engine.

35. Use of the method for regenerating an NOx trap according to claim 20, wherein the NOx trap is arranged in the exhaust conduit of a compression ignition engine.

36. Use of the method for regenerating cleaning means according to claim 21, with a compression ignition engine.

37. Use of the method for regenerating cleaning means according to one of the claims 27-32, with a compression ignition engine.

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