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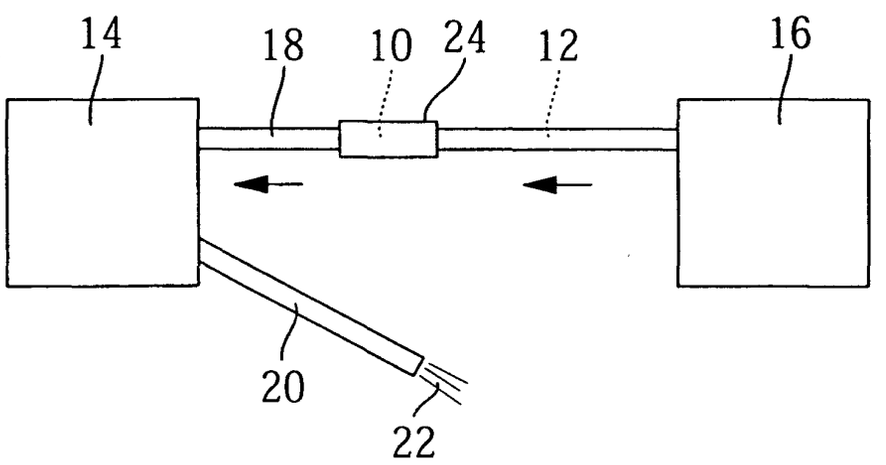
(54) EXHAUST GAS PURIFYING DEVICE

(57) In a path of a fuel pipe 18 from a fuel tank 16 to an internal combustion engine 14, a tube body 24 packed with a catalyst material 10 made of a mixture of nylon and ceramics that generate minus ions is connected to impart negative electric charges to liquid fuel 12 such as petroleum that is supplied. Thereby, in a path of a fuel pipe from a fuel tank to an internal combustion engine, a catalyst that applies pre-combustion treatment to liquid fuel is interposed and thereby harmful matters in exhaust gas from the internal combustion engine is reduced.

FIG.1



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Description

Technical Field

[0001] The present invention relates to exhaust emission purifying devices in a field of exhaust emission purification of internal combustion engines of such as automobiles, ships and airplanes, in particular exhaust emission purifying devices in which a catalyst material is interposed in a path of a fuel pipe from a fuel tank to an internal combustion engine to reduce harmful matters in the exhaust emission from the internal combustion engine.

Background Art

[0002] In an automobile, it is general to attach a ternary catalyst in the middle of an exhaust pipe of an internal combustion engine, this being post-processing of harmful matters emitted from the internal combustion engine. Furthermore, intermediate processing is carried out in a lean burn engine that improves combustion effect of an internal combustion engine and in a direct-injection diesel engine and a direct-injection gasoline engine. However, such post-processing or intermediate processing alone is not enough to sufficiently reduce the harmful matters.

[0003] In this connection, there are approaches in which a catalyst material is disposed in a path of a fuel pipe from a fuel tank to an internal combustion engine to apply treatment before liquid fuel reaches the internal combustion engine, that is, pre-combustion treatment, thereby the harmful matters are accelerated to decrease.

[0004] As this kind of catalyst materials, ones disclosed in, for instance, patent literatures 1 and 2 can be cited. Catalyst materials described in JP-A-11-153319 (patent literature 1) are constituted of any one of nylon, silk and trimidite that can be easily positively charged. Furthermore, catalyst materials described in Japanese Patent No. 2918880 (patent literature 2) are constituted by pressure-molding compositions made of a resin, a carbon source, a silicon dioxide source and glass fiber under heating followed by aging.

[0005] Both patent literatures describe that by letting liquid fuel go through the catalyst material, the combustion efficiency of the liquid fuel can be improved and harmful matters in the exhaust gas can be reduced.

[0006] However, like the catalyst materials described in patent literature 1, in the case of any one of nylon, silk and trimidite being used singularly, the harmful matters can be certainly reduced but cannot be satisfyingly reduced. Moreover, in the case of silk or trimidite being used, there is a problem in that because of poor moldability thereof performance is likely to vary for individual products.

[0007] Furthermore, like the catalyst materials described in patent literature 2, when many raw materials are blended at a certain weight ratio, a producing process becomes complicated and a rise in the producing cost is likely to be caused.

[0008] The present invention intends to improve a catalyst that is used in pre-combustion treatment of liquid fuel and thereby to provide an exhaust emission purifying device that can excellently reduce the harmful matters and improve the combustion efficiency and at the same time can realize the stabilization of product performance and cost reduction.

Disclosure of Invention

[0009] In order to overcome the abovementioned problems, in an exhaust emission purifying device according to the present invention, in a path of a fuel pipe from a fuel tank to an internal combustion engine, a catalyst material that imparts negative charges to petroleum liquid fuel that goes through the fuel pipe is disposed, the catalyst material being made of a mixture of nylon and ceramics that generate minus ions.

[0010] As mentioned above, in the invention, a mixture of nylon and ceramics is used as a catalyst of petroleum liquid fuel. Thereby, the combustion efficiency of an internal combustion engine can be improved, the harmful matters (CO, HC, NOx) in the exhaust gas emitted from the internal combustion engine are reduced to contribute to environmental protection, harmful matter reduction effect several tens percent higher than that of the catalyst material made of nylon ball alone can be obtained, and more stable effect can be attained.

[0011] Furthermore, in comparison with the catalyst material that uses ceramics alone, the inventive catalyst material is lighter in weight and has excellent moldability owing to the action of nylon; accordingly, the catalyst material can be arranged substantially uniformly in its magnitude and shape, resulting in stabilizing product performance. Still furthermore, in comparison with the catalyst material that is constituted by blending many raw materials, the producing cost can be suppressed lower.

[0012] Specifically, a tube body in which a catalyst material is housed is inserted in a fuel pipe and liquid fuel past through the fuel pipe is brought into contact with the catalyst material.

[0013] Thereby, owing to the catalyst treatment prior to the combustion in the internal combustion engine, the liquid fuel can be negatively charged and thereby the combustion efficiency of fuel can be improved, resulting in enabling to reduce the harmful matters emitted from the internal combustion engine, to contribute to environmental protection and

to save the fuel.

[0014] Furthermore, the catalyst material is formed into balls having a diameter in the range of 5 to 10 mm by blending nylon and ceramics powders, a blending ratio of nylon and ceramics being in the range of (85: 15) to (95: 5) by weight ratio. Still furthermore, principal constituents of the ceramics that constitute the catalyst material include at least one kind of cerium, lanthanum, fluorine, neodymium and silicon dioxide.

[0015] Still furthermore, the tube body is formed of nylon material that is likely to generate positive static electricity, and a place that is likely to be negatively charged such as a shroud next to a fan of a car body of the internal combustion engine and the tube body are connected so as to send negative charges to the tube body.

[0016] Thereby, since negative electric charges can be continuously sent to the tube body, the liquid fuel can be assuredly negatively charged.

Brief Description of the Drawings

[0017]

Fig. 1 is a schematic layout diagram of an exhaust emission purifying device involving one embodiment according to the invention, Fig. 2 being a vertical sectional view thereof, Fig. 3 being a perspective view of a catalyst material provided with a hole and groove, Fig. 4 being a schematic layout diagram of an exhaust emission purifying device involving another embodiment.

Best Mode for Carrying Out the Invention

[0018] In what follows, embodiments according to the invention will be detailed with reference to the drawings. An exhaust emission purifying device according to the present invention cleans up an emission gas from an internal combustion engine of such as an automobile, ship or an aircraft, and as shown in Fig. 1 a catalyst material 10 that imparts negative electric charges to petroleum liquid fuel 12 past through a fuel pipe 18 is disposed in a path of the fuel pipe 18 from a fuel tank 16 to an internal combustion engine 14. Reference numerals 20 and 22, respectively, denote an exhaust tube and an exhaust gas. Specifically, as shown in Fig. 2, the catalyst material 10 is packed in a tube body 24 that is inserted in the fuel pipe 18.

[0019] The catalyst material 10 is made of a mixture of nylon and ceramics that generate minus ions, and when the liquid fuel 12 is brought into contact with the catalyst material 10 the minus ions are imparted to the liquid fuel 12 to negatively charge the liquid fuel 12 and thereby to negatively ionize. This is desirably performed immediately before the liquid fuel 12 enters the internal combustion engine 14.

[0020] Furthermore, the catalyst material 10 is preferably made in such a manner that nylon and ceramics made of powdery bodies of several μm to several hundreds μm are blended and formed into balls having a diameter of 5 to 10 mm, a blending ratio of nylon and ceramics being preferably in the range of (85: 15) to (95: 5) by weight ratio. When the catalyst material 10 is smaller than 5 mm in diameter, the ventilation resistance of the liquid fuel 12 is likely to be large, and when it is larger than 10 mm in diameter, the deposition efficiency of the minus ions is unfavorably deteriorated. Still furthermore, when the blending ratio of nylon and ceramics is out of the above range, the deposition efficiency of the minus ions is unfavorably deteriorated.

[0021] Furthermore, as principal constituents of the ceramics, cerium Ce, lanthanum La, fluorine F, neodymium Nd and silicon dioxide SiO_2 that generate minus ions much are preferably contained, at least one kind thereof being able to be contained.

[0022] Thus, the catalyst material 10 is constituted of a mixture of nylon and ceramics. Accordingly, in comparison with the catalyst material that uses, for instance, ceramics alone, the catalyst material 10 becomes lighter in weight and excellent in the moldability by the action of nylon, resulting in simplifying to process into balls as mentioned above. As a result, the catalyst material 10 can be easily arranged into substantially uniform particle diameters and thereby the dispersion of performance of the respective products can be suppressed low. Furthermore, as shown in Fig. 3, to the catalyst material 10 that is processed in ball, a hole 30 and a groove 31 can be further formed easily; thereby, a surface area of the catalyst material 10 can be enlarged to increase a contact area with the liquid fuel 12, and thereby function as a catalyst can be further improved. Still furthermore, since the catalyst material 10 is constituted only of nylon and ceramics, in comparison with the catalyst material obtained by blending many raw materials, the producing cost can be suppressed low.

[0023] In the above configuration, the liquid fuel 12 is brought into contact with the catalyst material 10 inserted in the fuel pipe 18 from the fuel tank 16 to the internal combustion engine 14, and thereby the liquid fuel 12 is negatively ionized. On the other hand, air that becomes an air-fuel mixture, being deprived of electric charges owing to friction with a car body, is positively ionized. When the negatively ionized fuel 12 and positively ionized air form an air-fuel mixture, since like electrostatic coating that makes use of static electricity, the respective electric charges attract each

other, a homogeneous mixture can be obtained and thereby the combustion efficiency of the liquid fuel 12 can be heightened.

[0024] In Fig. 4, a tube body 24 is formed of nylon that is likely to be positively charged, in order to negatively charge the tube body 24 the tube body 24 is connected with a place that is likely to be negatively charged such as a shroud next to a fan 28 of a car body of an internal combustion engine, negative electric charges are continuously sent to the tube body 24 to negatively charge the liquid fuel 12, and thereby the combustion efficiency of the liquid fuel 12 is heightened.

[0025] It goes without saying that in the present invention, without restricting to the above embodiments, various corrections and modifications may be applied to the above embodiments within the range of the present invention.

(Example 1)

[0026] Two kinds of a fuel-ionizing exhaust emission purifying device in which in a tube body 24 having a diameter of 30 mm and a length of 95 mm nylon balls (diameter: 8 mm) are packed and a fuel-ionizing exhaust emission purifying device that uses a mixture of nylon and ceramics and in which in a tube body 24 (diameter: 30 mm and length: 95 mm) balls (diameter: 8 mm) made by blending powders of nylon and ceramics of 2 to 5 μm at a weight ratio of 90: 10 are packed were connected to the same automobile fuel pipes of a 1800 cc gasoline engine to investigate concentrations of CO and HC of an exhaust gas 22. Results are as shown in a table below.

Table 1

1800 cc gasoline engine	CO (%)	HC (ppm)
Normal	0.29	242
With device (nylon)	0.12	83
With device (nylon and ceramics)	0.08	44

[0027] Above measurements were carried out with a CO-HC analyzer EIR2105 (manufactured by Yanagawa Seisakusho KK) and an exhaust gas during idling was measured. From the experimental results, it is found that a fuel-ionizing exhaust emission purifying device that uses a mixture of nylon and ceramics can very stably and effectively reduce the harmful matters contained in the exhaust gas.

(Example 2)

[0028] By use of an automobile having a 3000 cc gasoline engine, experiments were carried out similarly to example 1. Results are as shown in a table below.

Table 2

3000 cc gasoline engine	CO (%)	HC (ppm)
Normal	0.38	111
With device (nylon)	0.06	13
With device (nylon and ceramics)	0.01	6

[0029] From the experimental results as well, it can be judged that a fuel-ionizing exhaust emission purifying device due to the mixture of nylon and ceramics can more stably and effectively reduce the harmful matters contained in exhaust gas.

[0030] Thus, it can be judged that in a little large automobiles and so on having a 1800 cc or 3000 cc engine, particularly stably and effectively, the harmful matters contained in the exhaust gas can be reduced.

Industrial Applicability

[0031] The present invention is useful as a catalyst for various kinds of internal combustion engines that are mounted on automobiles, ships and the like and use petroleum fuel.

Claims

1. An exhaust emission purifying device that ionizes liquid fuel to clean up exhaust gas from an internal combustion engine of an automobile, a ship or the like, **characterized in that** in a path of a fuel pipe from a fuel tank to an internal combustion engine, a catalyst material that imparts negative electric charges to petroleum liquid fuel that goes through the fuel pipe is disposed, the catalyst material being formed of a mixture of nylon and ceramics that generate minus ions.

2. The exhaust emission purifying device according to claim 1, **characterized in that** a tube body that houses the catalyst material is inserted in the fuel pipe and liquid fuel that goes past the fuel pipe is brought into contact with the catalyst material.

3. The exhaust emission purifying device according to claim 1 or 2, **characterized in that** the catalyst material is one that is obtained by blending powders of nylon and ceramics and molding into balls having a diameter in the range of 5 to 10 mm.

4. The exhaust emission purifying device according to any one of claims 1 through 3, **characterized in that** a blending ratio of nylon and ceramics that form the catalyst material is in the range of (85: 15) to (95: 5) by weight ratio.

5. The exhaust emission purifying device according to any one of claims 1 through 4, **characterized in that** principal component of the ceramics that constitutes the catalyst material includes at least one of cerium, lanthanum, fluorine, neodymium and silicon dioxide.

6. The exhaust emission purifying device according to any one of claims 2 through 5, **characterized in that** the tube body is formed of nylon material that is likely to be positively charged and connected with a position that is likely to be negatively charged such as a shroud next to a fan of a car body of the internal combustion engine to send negative charges to the tube body.

FIG.1

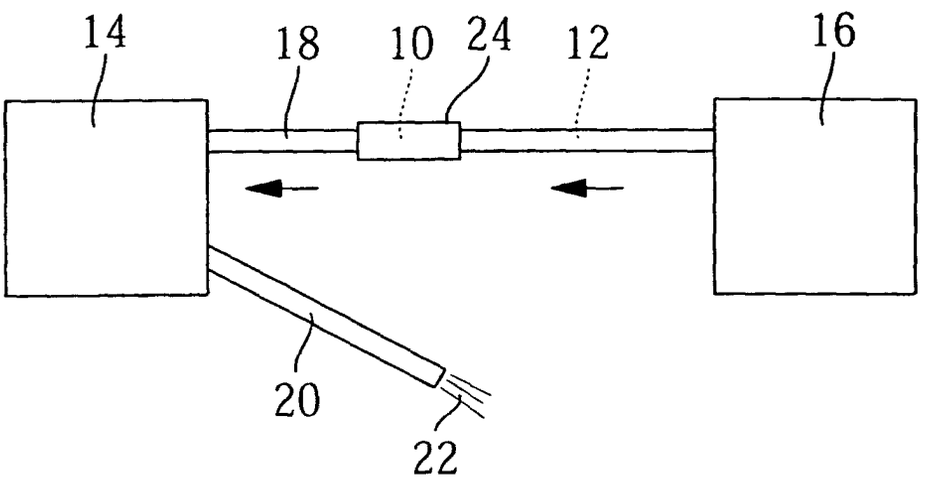


FIG.2

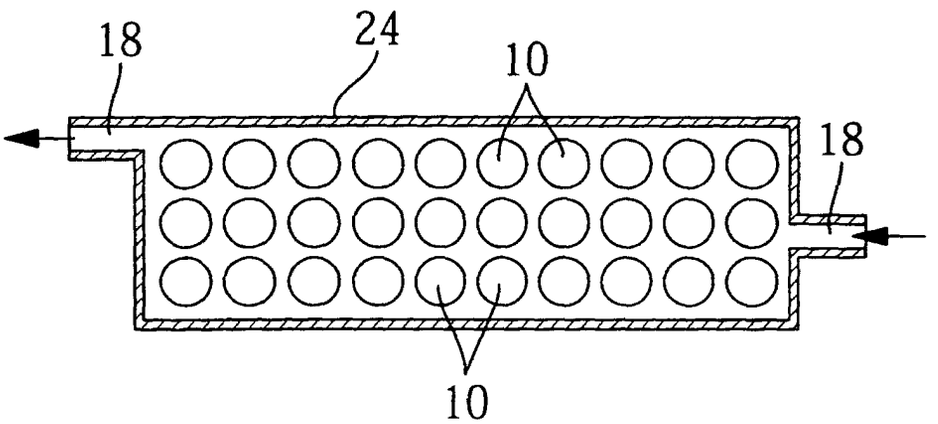


FIG.3

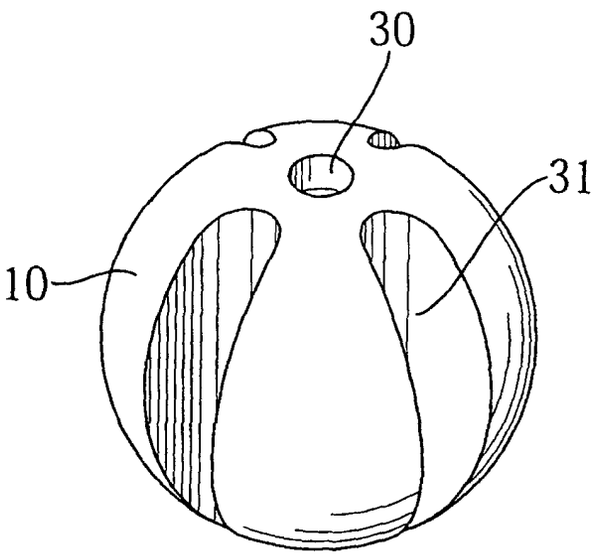
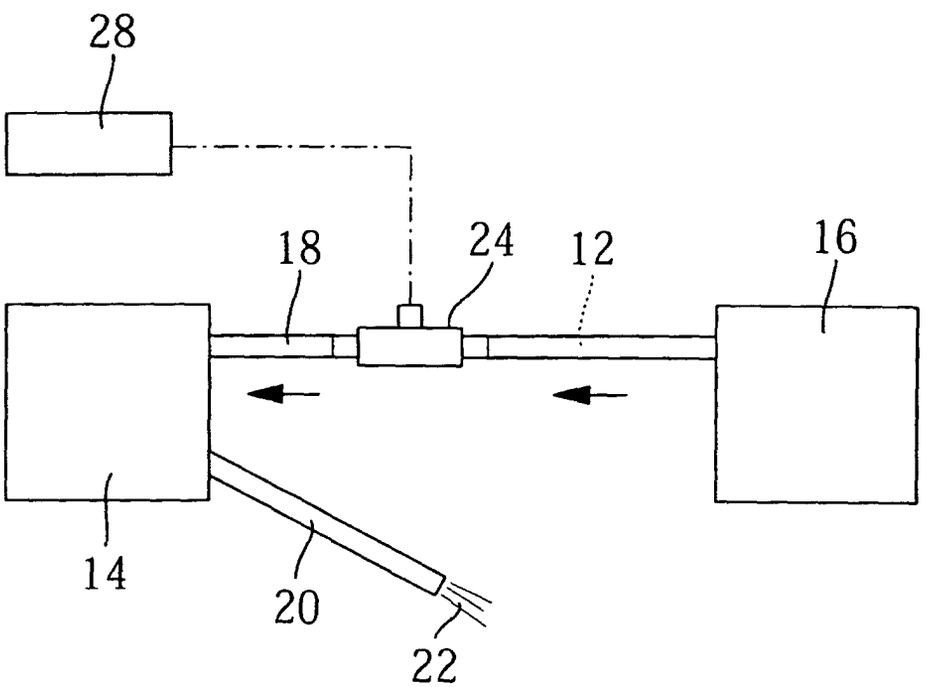


FIG.4



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP03/04995

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] F02M21/04, C10L1/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl[7] F02M21/04, C10L1/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho	1922-1996	Toroku Jitsuyo Shinan Koho	1994-2003
Kokai Jitsuyo Shinan Koho	1971-2003	Jitsuyo Shinan Toroku Koho	1996-2003

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 11-12022 A (Hachiro MARUCHI), 19 January, 1999 (19.01.99), Full text; all drawings (Family: none)	1-6
Y	JP 7-109958 A (Kabushiki Kaisha Supply Control), 25 April, 1995 (25.04.95), Full text; all drawings (Family: none)	1-6
Y	JP 49-21527 A (Goro FUJII), 26 February, 1974 (26.02.74), Full text; all drawings (Family: none)	1-6

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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Date of the actual completion of the international search 28 July, 2003 (28.07.03)	Date of mailing of the international search report 12 August, 2003 (12.08.03)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP03/04995

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 56-92341 A (Kabushiki Kaisha Takumi), 27 July, 1981 (27.07.81), Full text; all drawings (Family: none)	1-6
A	JP 52-39023 A (Fukoku Shoji Kabushiki Kaisha), 26 March, 1977 (26.03.77), Full text; all drawings (Family: none)	1-6

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