Description

LIQUID FUEL PROCESSING DEVICE

[Technical Field]

[0001]

This application relates to a device for processing liquid fuel wherein noxious substances such as CO, CO_2, HC, NO_x, PM in exhaust gas emitted from heat engines used in diesel vehicles, gasoline-fueled vehicles, LP gas-fueled vehicles, vessels, diesel generators and boilers can be substantially reduced.

[Background arts]

[0002]

Heretofore, magnetic processing is known to be effective in saving fuel consumption in heat engines used in diesel vehicles, gasoline-fueled vehicles, LP gas-fueled vehicles, ships and vessels, diesel generators and boilers. At the same time, other such approaches seem to be often attempted. However, such proposals and approaches lacked certainty and stability in their outcomes, and thus they have not been commercialized on an industrial basis.

On the other hand, no stable effect in improvement of fuel efficiency and in reduction of noxious substances in exhaust gas could have been obtained from a device using ordinarily available magnet when it was mounted on an automobile in order to be subject to a running test.

The inventor of the present application found that significant effect of around 30% of fuel saving can be obtained when magnet having various features are manufactured (see for example Patent Document 1), from which a device for processing liquid fuel is fabricated and mounted on a vehicle in order to perform a running test, and confirmed with reproducibility that CO, CO_2, HC, NO_x and PM can be substantively reduced as a result of diesel emission 13-mode cycle test with a diesel vehicle for example. Furthermore, it is disclosed that fuel efficiency improvement effect can be obtained by applying south-pole magnetism to liquid fuel (for example in Patent Document 1).

[0003]

However, mass production of conventional metal specialty magnet was difficult and thus commercialization on an industrial basis could not have been easily done.

Furthermore, a configuration for applying south-pole magnetism to liquid fuel more efficiently and specific settings therefor were not clarified.

[Prior art Documents]

[Patent Documents]

[0004]

[Patent Document 1] JP Patent No. 2003078

[Patent Document 2] WO 2006/008969

[Outline of the invention]

[Problems to be solved by the invention]

[0005]

Thus, the main purpose of this application is to efficiently apply south-pole magnetism to liquid fuel in a short period of time, and to provide a device for processing liquid fuel enabling substantive reduction of major noxious substances such as CO, CO_2, HC, NO_x and PM in exhaust gas.

[Means for solving the problem]

[0006]

The device for processing liquid fuel according to this invention is a device for processing liquid fuel disposed on a flow channel for providing liquid fuel to heat engine in order to reduce noxious materials in exhaust gas emitted from the heat engine, having a plurality of walls for applying magnetism arranged at an appropriate interval on the flow channel, and characterized in that a surface of the wall for applying magnetism at an upstream side of the flow channel is constituted from a magnet with south-pole magnetism between 0.2mT and 1.5mT.

Furthermore, in the device for processing liquid fuel according to this invention, the ratio of north-pole magnetism to south-pole magnetism in the wall for applying magnetism is preferably less than 30%.

Furthermore, in the device for processing liquid fuel according to this invention, one surface and other surface of the wall for applying magnetism preferably comprises a magnetism applying portion formed from the magnet, and the device preferably has, between the magnetism applying portions, a magnetic portion or a nonmagnetic portion for reducing north-pole magnetism.

Moreover, in the device for processing liquid fuel according to this invention, the walls for applying magnetism are preferably installed at an interval between 1mm and 35mm.

Moreover, in the device for processing liquid fuel according to this invention, the flow channel is preferably formed inside a metal pipe.

Further, in the device for processing liquid fuel according to this invention, a pathway is preferably provided in the walls for applying magnetism such that the liquid fuel flows in a zigzag manner between the walls for applying magnetism inside the metal pipe in order that area in which south-pole magnetism is applied to the liquid fuel is increased.

Additionally, in the device for processing liquid fuel according to this invention, the device for processing liquid fuel is preferably installed inside a fuel tank of the liquid fuel.

[Effect of the invention]

[0007]

In a device for processing liquid fuel according to this invention, as a plurality of walls for applying magnetism are arranged on the flow channel for providing liquid fuel to heat engine, and as a surface of the wall for applying magnetism at the upstream side of the flow channel is composed of a magnet with south-pole magnetism between 0.2mT and 1.5mT, it can efficiently apply south-pole magnetism to the said liquid fuel in a short period of time. Therefore, in a device for processing liquid fuel according to this invention, combustion efficiency of heat engines used in diesel vehicles, gasoline-fueled vehicles, LP gas-fueled vehicles, vessels, and boilers can be improved and energy-saving effect can be obtained, in addition to substantively reducing all noxious substances in exhaust gas, namely CO, CO_2, HC, NO_x and PM.

Furthermore, in the device for processing liquid fuel according to this invention, as the ratio of north pole magnetism to south-pole magnetism is formed at less than 30%, south-pole magnetism can be more efficiently applied to liquid fuels to be provided to heat engines.

Moreover, in the device for processing liquid fuel according to this invention, as the walls for applying magnetism are arranged at an interval ranging between 1mm and 35mm, south-pole magnetism can further be efficiently applied to liquid fuel to be provided to heat engines.

Additionally, in the device for processing liquid fuel according to this invention, as a flow channel is formed inside a metallic pipe, and as pathways are provided in a plurality of walls for applying magnetism inside the metallic pipe such that liquid fuel to be provided to heat engines flow between the walls for applying magnetism in a zigzag manner, area in which south-pole magnetism is applied to liquid fuel is enlarged, and thus south-pole magnetism can further efficiently be applied to liquid fuels.

Furthermore, in the device for processing liquid fuel according to this invention, as a device for processing the said liquid fuel is disposed in the fuel tank, south-pole magnetism can be applied to liquid fuel without installing another device for processing liquid fuel in the intermediate of pipes providing liquid fuel from the fuel tank to heat engine.

[0008]

The purpose described above, and other purposes, features and advantages will become clearer with the explanation on modes for working the invention below given by reference to the drawings.

[Brief description of drawings]

[0009]

[Figure 1] is a cross-sectional view showing an embodiment mode of the device for processing liquid fuel according to this invention.

[Figure 2] is an exploded perspective view of a wall for applying magnetism used in the device for processing liquid fuel according to this invention.

[Figure 3] is an A-A cross-sectional view of the device for processing liquid fuel according to this invention.

[Figure 4] is a cross-sectional view showing another embodiment mode of the device for processing liquid fuel according to this invention.

[Figure 5] (a) is a sectional front view and [Figure 5] (b) is a planar sectional view showing further different embodiment mode of the device for processing liquid fuel according to this invention.

[Figure 6] (a) is a sectional front view and [Figure 6] (b) is a planar sectional view showing another embodiment mode of the device for processing liquid fuel according to this invention.

[Mode for working the invention]

[Embodiment 1]

[0010]

Figure 1 is a cross-sectional view showing an embodiment mode of a device for processing liquid fuel according to this invention. Besides, Figure 2 is an exploded perspective view of a wall for applying magnetism used in the device for processing liquid fuel according to this invention, and Figure 3 is an A-A cross-sectional view of the device for processing liquid fuel according to this invention. The device (10) for processing liquid fuel increases combustion efficiency in heat engines, etc. by applying south-pole magnetism to liquid fuel to reduce fuel consumption, and is used for reducing the amount of noxious substances (CO, CO_2, HC, NO_x and PM) in exhaust gas emitted from these heat engines, etc. Device (10) for processing liquid fuel is connected in the intermediate of a pipe for providing fuel from fuel tank to heat engines such as engine, for example.

Besides, liquid fuel in this application is referred to as fuels mainly composed from carbon hydride, for example petroleum fraction, coal carbonization and cracked petroleum, or heavy oil, light oil, gasoline etc., and biofuel.

[0011]

Now, effect of applying south-pole magnetism to liquid fuel is explained.

By applying south-pole magnetism to liquid fuel, molecular group (cluster) consisting that liquid fuel can be minified. Therefore, as spraying condition is improved by using south-pole magnetism applied liquid fuel, combustion speed can be accelerated and as a result, combustion

efficiency can be increased.

On the other hand, while liquid fuel is sprayed from a spray nozzle in a liquid fuel combustion chamber in the heat engines, etc., nozzle hole is narrowed when insoluble substances such as impurities contained in liquid fuel etc. adhere to spray nozzle, and spraying condition is deteriorated. Furthermore, while static electricity generates against impurities, etc. when liquid fuel circulates in the pipes, as those impurities, etc. have a characteristic they adhere to south-pole magnetism but not to north-pole magnetism, insolvable substances can be separated and removed by making us of this characteristic. Therefore, by applying south-pole magnetism to liquid fuel, adhesion of impurities to spray nozzle can be prevented so as to restore spraying condition, and as a result combustion efficiency can be improved.

[0012]

This device (10) for processing liquid fuel is composed of main body portion (20), inhaling side surface (30), discharging side surface (40), walls (50a, 50b) for applying magnetism, and fixing member (70) for wall for applying.

[0013]

The main body portion (20) constitutes the exterior part of the device (10) for processing liquid fuel with the inhaling side surface (30) and the discharging side surface (40), and is provided for holding internally walls (50a, 50b) for applying magnetism and fixing member (70) for wall for applying. The main body portion (20) is formed, for example in a tubular form the cross-sectional surface of which is circular, and is molded by a magnetic container of metal. Furthermore, a first opening portion (22) and a second opening portion (24) are formed at the inhaling side (upstream side) and discharging side (downstream side) of the main body portion (20). And inside the main body portion (20), flow channel (26) is formed in which liquid fuel circulates. In the present embodiment, the main body portion (20) is formed for example at 60mm in external diameter, 55mm in internal diameter and 140mm in length. Moreover, the main body portion (20) is not limited to a tubular form the cross-sectional surface of which is circular as in the present embodiment, but can be in any form such as a quadranguler cross-sectional surface, etc.

[0014]

The inhaling side surface (30) is formed for blocking the opening portion at the inhaling side in the main body portion (20). The inhaling side surface (30) is formed at a dimension roughly isomorphic to the first opening portion (22) at the inhaling side, and is tightly appressed by welding for example to the first opening portion (22) at the inhaling side of the main body portion (20). At a rough center of the inhaling side surface (30), an inhaling portion (32) is formed. Inhaling portion

(32) is provided for example in order to inhale liquid fuel provided from the fuel tank into the device 10 for processing liquid fuel. Inhaling portion (32) is formed in a form in which a pipe for liquid fuel provided from fuel tank is connectable.

Furthermore, discharging side surface (40) is formed for blocking the second opening portion (24) at the discharging side in the main body portion (20). Discharging side surface (40) is formed at a dimension roughly isomorphic to the second opening portion (24) at the discharging side, and is tightly appressed by welding for example to the second opening portion (24) at the discharging side of the main body portion (20). Furthermore, at a rough center of the discharging side surface, a discharging portion (42) is formed. Discharging portion (42) is provided for example in order to discharge liquid fuel from the device (10) for processing liquid fuel into heat engine. Discharging portion (42) is formed in a form in which a pipe for providing liquid fuel into heat engine is connectable.

By forming inhaling hole (32) and discharging hole (42) at respective rough centers of the inhaling side surface (30) and the discharging side surface (40), device (10) for processing can be stably fixed when installed on a pipe. Furthermore, inhaling side surface (30) and discharging side surface (40) can be easily worked.

[0015]

On the flow channel (26) formed inside the main body portion (20), a plurality of walls (50a, 50b) for applying magnetism will be arranged in order to apply south-pole magnetism to liquid fuel provided to the device (10) for processing liquid fuel according to this invention. Subsequently, positioning relationships in the main body portion (20) of walls (50a, 50b) for applying magnetism are explained in details.

The main body portion (20) has an upper surface and a bottom surface opposing each other at a distance in a direction perpendicular to shaft core direction (in the direction of the diameter). Wall (50a) for applying magnetism is projected from one surface to the other surface in a roughly perpendicular way. A space is provided as pathway (52a) between the wall (50a) for applying magnetism and the other surface. Furthermore, wall (50b) for applying magnetism is projected from the other surface to the one surface in a roughly perpendicular way. A space is provided as pathway (52b) between this wall (50b) for applying magnetism and the one surface. Then, wall (50a) for applying magnetism and wall (50b) for applying magnetism are alternately arranged with an adequate interval in the shaft core direction.

[0016]

In other words, walls (50a, 50b) for applying magnetism are arranged, for example in a perpendicular direction against the direction of liquid fuel flow channel. Meanwhile, the installation

interval of walls (50a, 50b) for applying magnetism can be between 1mm and 35mm, while it is particularly preferable that the walls are installed at an interval of 10mm. Furthermore, when safety is considered, it is preferable that walls (50a, 50b) for applying magnetism are installed at an interval not smaller than 2mm. In case the main body portion (20) is formed in a tubular form as in this embodiment, it is preferable that walls (50a, 50b) for applying magnetism are installed at an interval roughly equal to the internal diameter of inhaling portion (32) and discharging portion (42). Thereby, flow volume of liquid fuel circulating within the device (10) for processing liquid fuel can be stabilized. Meanwhile, in case the walls (50a, 50b) for applying magnetism are installed at an interval greater than the internal diameter of inhaling portion 32 and discharging portion 42, liquid fuel inhaled in the device (10) for processing liquid fuel risks to be mixed with already inhaled liquid fuel.

As a result, in the walls (50a, 50b) for applying magnetism, pathways (52a, 52b, 52c, 52d) are formed such that liquid fuel flows in the main body portion (20) in a zigzag manner between the walls (50a, 50b). Pathways (52a, 52b, 52c, 52d) are provided such that at least a dimension of one tenth to three tenth of the diameter of the main body portion (20) is ensured. In other words, in pathways (52a, 52b, 52c, 52d), the dimension in the direction perpendicular to the direction of the flow channel is preferably formed in a dimension greater than the internal diameter of inhaling portion (32) and discharging portion (42). Thus, flow volume of the liquid fuel circulating in the device (10) for processing liquid flow can be stabilized. In this embodiment, pathways (52a, 52b, 52c, 52d) are formed by parallel cutting walls (50a, 50b) for applying magnetism at approximately two-third from its center. Furthermore, dimension of pathways (52a, 52b, 52c, 52d) are appropriately modifiable depending on the flow volume of the liquid fuel. Moreover, walls (50a, 50b) for applying magnetism are arranged such that liquid fuel does not circulate in any place other than pathways (52a, 52b, 52c, 52d). Walls (50a, 50b) for applying magnetism are composed of magnetism applying portions (54, 54) and nonmagnetic portion (60). Furthermore, magnetism applying portion (54) is further composed of magnet (56) and magnet holding member (58).

[0017]

Magnet (56) is provided such that one surface (51a) and other surface (51b) of walls (50a, 50b) for applying magnetism are south-pole magnetized. That is to say that it is provided such that top surfaces (56a, 56a) of the magnets (56, 56) are south-pole magnetized and back surfaces (56b, 56b) are north-pole magnetized. Therefore, top surface (54a) of the magnetism applying portion (54) is south-pole magnetized and back surface (54b) is north-pole magnetized. Furthermore, magnet (56) is formed lamellar and roughly round. Magnet (56) is formed from permanent magnet and in particular from plastic magnet preferably. Meanwhile, magnet (56) can be other resins or synthetic rubber if the material is not oil-soluble. By using such magnet, magnet (56) can be freely molded

and mass-produced, and as mass-production in compact size is possible, it is particularly preferable. Furthermore, the strength of magnetic flux of south-pole magnetism of magnet (56) is preferably between 0.2mT and 1.5mT and in particular between 0.8mT and 1.0mT. Meanwhile, if the strength of magnetic flux is more than 1.5mT, the improvement of effectiveness according to the present invention will be difficult to be found, and if the strength of magnetic flux is less than 0.2mT, the advantage to remove impurities diminishes. The thickness of magnet (56) is formed for example between 4mm and 10mm. In the present embodiment, magnet (56) is formed, for example, at 0.8mT for the strength of magnet flux, at a diameter of 54mm and 4mm thick.

[0018]

Meanwhile, the form of magnet (56) used in the device for processing liquid fuel according to this invention may either be round or quadrangular, but preferably round in order that compact size, low price and mass-production are achieved.

Furthermore, as side surfaces of walls (50a, 50b) for applying magnetism, against which north-pole magnetism is applied by the fact that walls (52a, 52b) for applying magnetism are disposed in a magnetic main body portion (20), contact inner wall surface of main body portion (20), surfaces on which north-pole magnetism is applied to liquid fuel will be the surfaces of pathways (52a, 52b, 52c, 52d) only. Therefore, the area in which liquid fuel contact with south-pole magnetized surface will be larger, and in contrast, the area in which liquid fuel contact with north-pole magnetized surface can be minified. Furthermore, as north-pole magnetism is dispersed by magnet holding member (58) and nonmagnetic portion (60) described below, the ratio of north-pole magnetism to south-pole magnetism is formed such that not to exceed 30%. Thereby, south-pole magnetism can be more strongly applied to liquid fuel. In the present embodiment, for example, when the strength of south-pole magnetic flux is 0.8mT, the strength of north-pole magnetic flux is formed at less than 0.3mT.

[0019]

Magnet holding member (58) has a role as a case for embedding magnet (56), and is provided in order to lessen north-pole magnetism of magnet (56) by dispersing it. Magnet holding member (58) is formed in a plate-like roughly round form in conformity to the form of the cross-section of main body portion (20). Then, a recess (58b) is formed at the top surface (58a) side of the magnet holding member 58 for embedding and supporting the magnet (56). Recess (58b) is formed roughly identical to the form of the magnet (56). The depth of recess (58b) is formed roughly identical to the thickness of the magnet (56), and then a recessed portion (56c) is formed at the side surface (56c) of the magnet (56) and a projected portion (58d) is formed at the side surface of recess (58b) of the magnet holding member (58). That is to say that the magnet (56) is fixed without

moving in upward, downward, left or right direction by being embedded in recess (58b). Furthermore, magnet (56) is disposed at magnet holding member (58) such that top surface (56a) of the magnet (56) and top surface (58a) of the magnet holding member (58) form a same planar surface. Thereby, the flow volume of liquid fuel is stabilized. Furthermore, in order to further disperse north-pole magnetism, the thickness of the side surface of the magnet holding member (58) and the thickness from the base surface to the back surface (58c) of the recess (58b) are formed roughly identical. The thickness of the magnet holding member (58) functions to adjust the effect of reducing north-pole magnetism, and is appropriately modifiable. In the present embodiment, for example, the magnet holding member (58) is formed at 54mm in diameter and 7mm thick.

Magnetism applying portion (54) constitutes a member in which north-pole magnetism is reduced (north-pole demagnetized magnet) by combining magnet (56) with magnet holding member (58).

[0020]

Nonmagnetic portion (60) is provided in order to further reduce north-pole magnetism from magnet (56) applied to the recess (58b) of the magnet holding member (58), and additionally, to connect by the north-pole magnetism, without being seriously repulsive between back surfaces (58c, 58c) of the magnet holding members (58, 58). Nonmagnetic portion (60) is arranged between magnetism applying portion (54, 54) and formed into a wall-plate like nonmagnetic body having one surface (60a) and other surface (60b). The thickness of the nonmagnetic portion (60) functions to adjust effect of reducing north-pole magnetism, and is appropriately modifiable. In the present embodiment, for example, nonmagnetic portion (60) is formed at 54mm in diameter and 6mm thick.

[0021]

Fixing member (70) for walls for applying magnetism is formed, for example circularly by a magnetic metal, and is provided, for example to arrange walls (50a, 50b) for applying magnetism at an appropriate interval. Fixing members (70) for walls for applying magnetism is provided to fix walls (50a, 50b) for applying magnetism inside the main body portion (20), and are arranged at the respective intervals of a plurality of walls (50a, 50b) for applying magnetism. The breadth of fixing member (70) for walls for applying magnetism functions to adjust the number and interval of walls (50a, 50b) for applying magnetism to be arranged, is appropriately modifiable, and preferably formed in a dimension roughly identical to that of the internal diameter of inhaling portion (32) or discharging portion (42). Thereby, the flow volume of liquid fuel circulating within the device (10) for processing liquid fuel will be stabilized. In the present embodiment, for example, fixing member (70) for walls for applying magnetism is formed at 54mm in diameter, 48mm in internal diameter and 6mm thick.

Meanwhile, in case the length in the longitudinal direction of the main body portion (20) exceeds 140mm, a device for processing liquid fuel wherein walls (50a, 50b) for applying magnetism are respectively in a number of more than 2 and are arranged at an interval of less than 35mm is preferable.

[0022]

Next, a mechanism to apply south-pole magnetism to liquid fuel provided to device (10) for processing liquid fuel according to the present invention is described.

First, liquid fuel inhaled from inhaling portion (32) contacts perpendicularly to one surface (51a) of wall (50a) for applying magnetism and south-pole magnetism is applied to the liquid fuel. Then, the said liquid fuel flows in the direction of pathway (52a). Subsequently, the said liquid fuel flows into the interval between other surface (51a) of the wall (50a) for applying magnetism and other surface (51b) of the wall (50b) for applying magnetism, and south-pole magnetism from one surface (51a) of the wall (50b) for applying magnetism and other surface (51b) of the wall (50a) for applying magnetism is applied to the said liquid fuel. Furthermore, the liquid fuel flows into the next pathway (52b), and subsequently, south-pole magnetism is applied to the liquid fuel until the liquid fuel is discharged from the discharging portion (42), and thereafter, flows between one surface (51a) of the wall (50a) for applying magnetism and other surface (51b) of the wall (50b) for applying magnetism to sequentially flow into pathway 52c and pathway 52d, and the liquid fuel is discharged from discharging portion (42).

As stated above, as areas to which south-pole magnetism is applied is expanded by disposing on the pathway of the liquid fuel, a plurality of walls (52a, 52b) for applying magnetism in which south-pole magnetism is applied to one surface (51a) and other surface (51b) and by configuring such that the liquid fuel efficiently flows between these walls, south-pole magnetism can be efficiently applied to liquid fuels.

[Embodiment 2]

[0023]

The device for processing liquid fuel according to this invention may be configured as shown in Figure 4. Figure 4 is a cross-sectional view showing another embodiment of the device for processing liquid fuel according to this invention. This device (110) for processing liquid fuel is configured by combining wall (50a) for applying magnetism and magnetism applying portions (54). That is to say that, the device (110) for processing liquid fuel according to this invention disposes wall (50a) for applying magnetism at a rough median in the longitudinal direction of the main body portion (20), and disposes a plurality of magnetism applying portions (54) between the inhaling side surface (30) and wall (50a) for applying magnetism and between discharging side surface (40) and

wall (50a) for applying magnetism. These wall (50a) for applying magnetism and magnetism applying portion (54) are, as in the case of device (10) for processing liquid fuel, fixed by the fixing member (70) for walls for applying magnetism. Magnetism applying portion (54), which is arranged at the inhaling side surface (30) side with regard to the wall (50a) for applying magnetism, is arranged such that the south-pole magnetism of the magnet (56) is oriented toward inhaling side surface (30), and magnetism applying portion (54) which is arranged at the discharging side surface (40) side, is arranged such that the south-pole magnetism of the magnet (56) is oriented toward discharging side surface (40).

[Embodiment 3]

[0024]

Figure 5 shows a further embodiment of a device for processing liquid fuel according to this invention, (a) being a sectional front view and (b) being a planar sectional view. This device (210) for processing liquid fuel disposes on allover the respective sides of base surface (82) and side surface (84) of the fuel tank (80) the wall (50a) for applying magnetism or the magnetism applying portion (54). In this embodiment, magnetism applying portion (54) is disposed on allover the respective sides of base surface (82) and side surface (84), and the back surface (54b) of the magnetism applying portion (54) is adhered to base surface (82) and side surface (84). Therefore, in the fuel tank (80), magnetism applying portion (54) is provided such that the south-pole magnetism applies inward. Furthermore, at the rough center portion when viewed planarly, fuel feed pipe (86) is installed upright. Then, inlet (86a) which is one edge of the fuel feed pipe (86) is provided such as to be installed closely to the base surface (82). Therefore, in case the liquid fuel is discharged from fuel feed pipe (86) through the intermediary of inlet (86a), a pathway (226) is formed which arises from the side surface (84) along the base surface (82) and is oriented toward the inlet (86a). Furthermore, magnetism applying portion (54) is arranged radially from the inlet (86a). Thus, south-pole magnetism is efficiently applied to the liquid fuel discharged through fuel feed pipe (86).

[Embodiment 4]

[0025]

Figure 6 shows a further embodiment of a device for processing liquid fuel according to this invention, (a) being a sectional front view and (b) being a planar sectional view. This device (310) for processing liquid fuel arranges the wall (50a) for applying magnetism or the magnetism applying portion (54) such that they touch a base surface (182) of the fuel tank (180).

At a rough center portion when viewed planarly, fuel feed pipe (86) is installed upright. Then, inlet (86a) which is one edge of the fuel feed pipe (86) is provided such as to be installed closely to the base surface (182). Therefore, in case the liquid fuel is discharged from fuel feed pipe

(86) through the intermediary of inlet (86a), a pathway (326) is formed which arises from the side surface (84) along the base surface (182) and is oriented toward the inlet (86a). Furthermore, wall (50a) for applying magnetism abuts against base surface (182) such as to surround fuel feed pipe (86). In this embodiment, fuel feed pipe (86) abut against 4 walls (50a, ..., 50a) in 4 directions and further abuts against 4 walls (50a, ..., 50a) for applying magnetism in 4 directions around them. Thereby, as liquid fuel discharged through fuel feed pipe (86) circulates between walls (50a, 50a) for applying magnetism arranged perpendicular to the direction of the flow channel (326) such as to block it, south-pole magnetism is efficiently applied to the liquid fuel.

[0026]

(Test Example 1)

A test was performed on a highway at a speed of 80km/h with a Toyota diesel car the date of which the car was first registered is 1999, the car body shape is a cab over, with a maximum output of 91ps/4000rpm, total stroke volume or declared power of 2.98L or kW, and gross vehicle weight of 2.75t. The test result is shown on Table 1.

In this Test Example 1, as a result of a test run using the device (10) for processing liquid fuel, combustion efficiency substantially increased and fuel consumption was considerably reduced as shown in Table 1.

[0027]

[Table 1]

	Before mounting the device	After mounting the device
Travel distance (km)	126	126
Light oil consumption (ℓ)	15.0	11.2
Travel distance per fuel consumption (km/ℓ)	8.4	11.3
Travel distance Index (%)	100	135

[0028]

The test car utilized in Test Example 1 was used for 8 years and 9 months, and had 106,000km on the odometer. A device (10) for processing liquid fuel was mounted on the said test car, and a diesel emission 13-mode cycle test was performed in a test laboratory designated by the Ministry of Land, Infrastructure, Transport and Tourism. Then, the result obtained from this test was compared to the emission test result filed by the car manufacturer with the Ministry of Land, Infrastructure, Transport and Tourism at the time when the said car was a new car. Though we could confirm that CO, HC, NO_x, PM are considerably reduced compared to the test at the time when the

car was new, a comparison for CO_2 could not be performed as a data for the time when the car was new was not available. Apparatus for testing, chassis dynamometer, was manufactured by Ono Sokki Co., Ltd, and emission analyzer, constant volume sampling apparatus, and dilution tunnel was manufactured by HORIBA, Ltd. The comparison result is shown in Table 2.

[0029]

[Table 2]

Component of exhaust gas	CO Carbon monoxide	HC Carbon hydride	NOx Nitrogen oxide	PM Particulate matter	CO_2 Carbon dioxide
Average emission in the specification at the time of a new car	3.26g/kwh	0.78g/kwh	4.40g/kwh	0.24g/kwh	
Average emission of the fuel improvement device	1.79g/kwh	0.32g/kwh	3.66g/kwh	0.11g/kwh	1175g/kwh
Differential	-1.47	-0.46	-0.74	-0.13	
Reduction rate (%)	45.0	59.2	16.8	54.5	

[0030]

(Test Example 2)

A test was performed on a highway at a speed of 80km/h with a Nissan diesel car the date of which the car was first registered is 1990, the car body shape is a cab over, with a maximum output of 200ps/4000rpm, total stroke volume of 4.16kW, and gross vehicle weight of 4.9t. The test result is shown on Table 3.

In this Test Example 2, as a result of a test run using the device (110) for processing liquid fuel, combustion efficiency substantially increased and fuel consumption was considerably reduced as shown in Table 3.

[0031]

[Table 3]

	Before mounting the device	After mounting the device
Travel distance (km)	103	103

Light oil consumption (ℓ)	15.4	11.8
Travel distance per fuel consumption (km/ℓ)	6.7	8.7
Travel distance index(%)	100	130

[0032]

The test car utilized in Test Example 2 was used for approximately 18 years, and had 26,000km on the odometer. A device (110) for processing liquid fuel was mounted on the said test car, and a diesel emission 13-mode cycle test was performed in a test laboratory designated by the Ministry of Land, Infrastructure, Transport and Tourism. However, as the Ministry of Land, Infrastructure, Transport and Tourism has no data of diesel emission 13-mode cycle test for this car model and thus comparison was impossible, the result obtained from this test was compared to the emission regulation value at 1994 (effective for 11 years from 1994) for a car the gross vehicle weight of which is more than 2.5t. Though we could confirm that CO, HC, NO_x, PM are considerably reduced compared to the test at the time when the car was new, a comparison for CO_2 could not be performed as a data for the time when the car was new was not available. Apparatus for testing, chassis dynamometer was manufactured by Ono Sokki Co., Ltd, and emission analyzer, constant volume sampling apparatus, and dilution tunnel was manufactured by HORIBA, Ltd. The comparison result is shown in Table 4.

[0033]

[Table 4]

Component of exhaust gas	CO Carbon monoxide	HC Carbon hydride	NO x Nitrogen oxide	PM Particulate matter	CO_2 Carbon dioxide
Average emission of Regulation value in 1994	Less than 7.4g/kwh	Less than 2.9g/kwh	Less than 6.0g/kwh	Less than 0.7g/kwh	
Average value of the fuel improvement device	3.00g/kwh	0.22g/kwh	4.04g/kwh	0.35g/kwh	1090g/kwh
Differential	-4.4	-2.68	-1.96	-0.35	
Reduction rate (%)	59.	92.4	32.7	50.0	

[0034]

(Test Example 3)

A test was performed on a highway at a speed of 80km/h with a Toyota diesel car the date

of which the car was first registered is November 1993, the car body shape is a station wagon, model Y-KZH100G, with a maximum output of 130ps/3600rpm, total stroke volume or declared power of 2.98L or kW, and gross vehicle weight of 2.4t. The test result is shown on Table 5.

In this Test Example 3, as a result of a test run using the device (110) for processing liquid fuel, combustion efficiency substantially increased and fuel consumption was considerably reduced as shown in Table 5.

[0035]

[Table 5]

	Before mounting the device	After mounting the device
Travel distance (km)	98	101
Light oil consumption (ℓ)	13.6	11.3
Travel distance per fuel consumption (km/ℓ)	7.2	8.9
Travel distance index(%)	100	124

[0036]

With the devices (10, 110, 210, 310) for processing liquid fuel according to the present invention, as are formed a plurality of walls (50a) for applying magnetism provided such that one surface (51a) and other surface (51b) become south-pole magnetism on the pathway (26) formed in the main body portion (20), south-pole magnetism can be efficiently applied to liquid fuel circulating in the main body portion (20), and thus major noxious substances such as CO_2, CO, NO_x, HC, PM which are comprised in the exhaust emitted by heat engines, etc. can be considerably reduced.

[0037]

Furthermore, with the devices (10, 110, 210, 310) for processing liquid fuel according to the present invention, as nonmagnetic portion (60) is provided between the magnetism applying portions (54, 54) consisting the wall (50a) for applying magnetism, north-pole magnetism can be more efficiently reduced.

[0038]

Meanwhile, though pathways (52a, 52b, 52c, 52d) were provided in the embodiments, the invention is not limited to these embodiments, and path holes can be provided in a circular wall (50a) for applying magnetism formed in conformity to the sectional form of the main body portion (20) such that the liquid fuel flows in a zigzag manner between the walls (50a, 50b) for applying

magnetism.

[0039]

Furthermore, though magnet (56), magnet holding member (58) and nonmagnetic portion (60) are formed in the embodiments as separate members, are not limited to and at least magnet holding member (58) and nonmagnetic portion (60) may be constituted as an integral.

[0040]

Moreover, though main body portion (20), inhaling side surface (30) discharging side surface (40) and magnet holding member (58) are formed from a magnetic material, are not limited and may be formed from a nonmagnetic material. On the other hand, though non magnetic portion (60) is formed from a nonmagnetic material, it is not limited to and may be formed from a magnetic material.

[0041]

Additionally, the number of walls (50a, 50b) for applying magnetism arranged is appropriately modifiable depending on the length of main body portion (20) or the size of fuel tanks (80, 180).

[0042]

Furthermore, though inhaling portion (32) was defined to be formed at the rough center of the inhaling side surface (30) in the embodiments, is not limited to and may be formed anywhere on the inhaling side surface (30). Similarly, though discharging portion (42) was defined to be formed at the rough center of the discharging side surface (40), is not limited to and may be formed anywhere on the discharging side surface (40). Meanwhile, inhaling portion (32) can apply more south-pole magnetism to liquid fuel by being formed on the inhaling side surface (30) at the opposite side of pathway 52a, and similarly, discharging portion (42) can apply more south-pole magnetism to liquid fuel by being formed on the discharging side surface (40) at the opposite side of pathway 52d.

[0043]

Moreover, though the embodiments describes on processing liquid fuel that are fuels used for heat engines that are devices for processing liquid fuel, as south-pole magnetism is disclosed as being efficient for preventing water rotting (JP Patent No. 2582207) or for decomposition treatment of dirty water (JP Patent No. 2769465), the device of processing liquid fuel according to these embodiments can be used for preventing water rotting or for decomposition treatment of dirty water.

[Industrial applicability]

[0044]

This invention relates to a device for processing liquid fuel used on liquid fuel that are liquid fuel for heat engines for diesel vehicles, passenger vehicles, vessels and boilers, etc. and is suitably used for substantively reducing CO_2, CO, NO_x, HC, PM that are major noxious materials in exhaust gas.

Furthermore, most importantly industrially, as low cost and mass production in compact size was enabled, popularization became possible.

[Explanation of numerals]

[0045]

10, 110, 210, 310	Device for processing liquid fuel
20	Main body portion
22	First opening portion
24	Second opening portion
26, 226, 326	Flow channel
30	Inhaling side surface
32	Inhaling portion
40	Discharging side surface
42	Discharging portion
50a, 50b	Wall for applying magnetism
51a	One surface
51b	Other surface
52a, 52b, 52c, 52d	Pathway
54	Magnetism applying portion
54a	Top surface
54b	Back surface
56	Magnet
56a	Top surface
56b	Back surface
56c	Recessed portion
58	Magnet holding member
58a	Top surface
58b	Recession
58c	Back surface
58d	Projected portion

60	Nonmagnetic portion
60a	One surface
60b	Other surface
70	Fixing member for wall for applying magnetism
80, 180	Fuel tank
82, 182	Base surface
84	Side surface
86	Fuel feed pipe
86a	Inlet

CLAIMS

[Claim 1]
A device for processing liquid fuel arranged on a flow channel for providing liquid fuel to heat engine in order to reduce noxious materials in exhaust emitted from heat engine, comprising a plurality of walls for applying magnetism arranged at an appropriate interval on the flow channel, and
characterized in that a surface of the wall for applying magnetism at an upstream side of the flow channel is constituted from a south-pole magnet magnetized between 0.2mT and 1.5mT.

[Claim 2]
Device for processing liquid fuel according to Claim 1, characterized in that the ratio of north-pole magnetism to south-pole magnetism in the wall for applying magnetism is less than 30%.

[Claim 3]
Device for processing liquid fuel according to Claim 1 or Claim 2 wherein one surface and other surface of the wall for applying magnetism comprises a magnetism applying portion formed from the magnet,
characterized in that it has, between the magnetism applying portions, a magnetic portion or a nonmagnetic portion for reducing north-pole magnetism.

[Claim 4]
Device for processing liquid fuel according to one of Claims 1-3 characterized in that the walls for applying magnetism are installed at an interval between 1mm and 35mm.

[Claim 5]
Device for processing liquid fuel according to one of Claims 1-4 characterized in that the flow channel is formed inside a metal pipe.

[Claim 6]
Device for processing liquid fuel according to Claim 4 characterized in that a pathway is provided in the walls for applying magnetism such that the liquid fuel flows in a zigzag manner between the walls for applying magnetism inside the metal pipe in order that area in which south-pole magnetism is applied to the liquid fuel is increased.

[Claim 7]

Device for processing liquid fuel according to one of Claims 1-4 characterized in that the device for processing liquid fuel is installed inside a fuel tank of the liquid fuel.