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(54) **Exhaust gas purification method and system**

(57) An exhaust gas purification method and system is closed to connect an ozone/negative ion generator (2) to the waste gas exhaust pipe (1) of a motor vehicle or gas water heater by a pipeline and to connect the ozone/negative ion generator (2) to the power source of the

motor vehicle or gas water heater so that when the motor vehicle or gas water heater is started, the ozone/negative ion generator (2) generates ozone/negative ions (22) for mixing with the exhausted waste gas to decompose carbon dioxide and other chemical pollutants, purifying the exhausted gas.

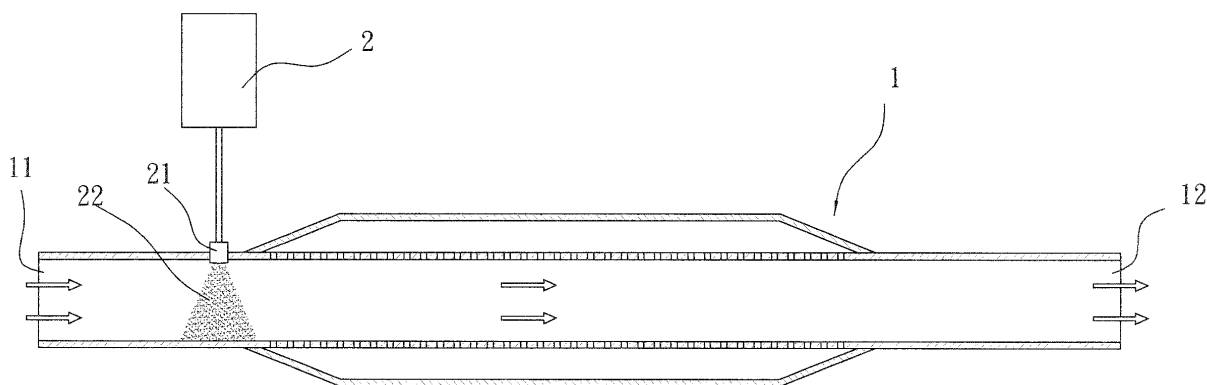


FIG. 1

Description

BACKGROUND OF THE INVENTION

a) Field of the Invention

[0001] The present invention relates to an exhaust gas purification technology and more particularly, to a method and system to purify the discharged gas of the exhaust pipe of a car, motorcycle or water heater, preventing air pollution.

b) Description of the Prior Art

[0002] It has been realized that gases in the atmosphere cause a greenhouse effect which affects the planet's temperature. Carbon dioxide and other pollutants discharged by cars and motorcycle pollute the air severely, causing the rise in temperature that the Earth experiences. If everybody takes a mass transportation system instead of driving a car, gas consumption and carbon dioxide discharge amount can be greatly reduced, giving contribution to reduction of the planet's temperature. Nowadays, every country around the world encourages vehicle manufacturer to develop environmentally friendly vehicle engine and request vehicle owners to maintain their vehicles, lowering the discharge amount of waste carbon dioxide and pollutants. However, few countries around the world provide effective measures to solve the vehicle waste gas discharge problem

[0003] Further, either gasoline engines or diesel engines, conventional vehicle engines discharge much waste gas that causes a greenhouse effect. In late of 20th century, people realized the severe pollution problem of diesel engines. This problem has become the concern of environmental protection people. It is well known that a diesel vehicle uses compression ignition to burn fuel oil or substitute fuel, performing the diesel cycle to convert chemical energy into thermal energy and power output. During combustion, pollutants including PM (particulate matter), smoke, NO_x (mono-nitrogen oxides), CO (carbon monoxide), SO_x (sulfur oxides), CO₂ (carbon dioxide), HC (hydrocarbon) and other waste matters are produced and discharged out of the exhaust pipe into the atmosphere, causing damage to the ozone layer, occurrence of acidic rain and rise in greenhouse effect. In case PM (particulate matter) in exhausted waste gas contain polycyclic aromatic hydrocarbons or metal oxides, breathing in such exhausted waste gas may cause lung, bronchi or breathing passage diseases. According to estimation from TED 4.2, 46% of particulate matter and 51 % of NO_x of mobile source of air pollution came from diesel vehicles. Most big scale public transportation vehicles are of diesel vehicles. Controlling discharge of diesel engine waste gas is an important measure to improve air quality. The automotive industry has been continuously proposing new measures to reduce the exhaust amount of waste gas. One of the best ways to reduce

the exhaust amount of waste gas from the diesel engine of a diesel vehicle is to install an exhaust gas purifier in the exhaust pipe. However, carbon will deposit in the filter element of the exhaust gas purifier to block the passage after a long period of work, thereby affecting exhausting effect and normal functioning of the diesel engine.

[0004] When a certain amount of carbon is cumulated in the filter element of the exhaust gas purifier of the exhaust pipe of a diesel vehicle, the passage of the exhaust gas purifier will be partially blocked, causing a rise in pressure (back pressure) in the exhaust pipe. Therefore, a backpressure sensor may be installed in the exhaust pipe of a diesel engine to detect the pressure level of the waste gas in the filter element of the exhaust gas purifier, monitoring the status of deposition of carbon. When the deposition of carbon in the inside wall of the exhaust pipe reaches a certain thickness, the backpressure sensor will detect a high level of back pressure, and the engine management system will give a signal to increase the working temperature of the diesel engine, thereby burning out cumulated carbon. However, when a vehicle stops frequently due to a poor traffic condition or frequently runs at idle speed due to driver's personal driving habit, the low engine speed cannot raise the engine working temperature for enabling the cumulated carbon to be burned out. When an excessive amount of carbon is cumulated in the exhaust gas purifier of the exhaust pipe, the driver may have to send the vehicle to an auto repair and service center, asking a mechanic to clean the exhaust pipe and to remove deposition of carbon from the exhaust gas purifier. This manner is inconvenience and time-wasting.

[0005] Further, the ozone layer in the upper atmosphere filters potentially damaging ultraviolet light from reaching the Earth's surface. Ozone is mainly located in the lower portion of the stratosphere from approximately 37 km to 74 km above Earth, though the thickness varies seasonally and geographically. Further, ozone is present in low concentrations (0.01~0.04ppm) throughout the Earth's atmosphere to prevent abnormal growth of bacteria. However, continuous increase of CFC (chlorofluorocarbon) gas in the atmosphere causes the ozone layer to be seriously weakened. According to investigation, the Earth's surface temperature has raised 2°C when compared to the record 50 years ago. In consequence, the average environmental magnetic field has dropped from the early 0.5 Gauss to the present 0.45 Gauss.

[0006] Further, industrial and vehicle waste gases are bad ozone produced after a chemical reaction that is a pollutant that is a significant health risk, especially for children with asthma. During a traffic jam, discharged waste gases from vehicles produce much bad ozone. Repeated exposures to 125ppb ozone enhance bronchial allergen responses. Exposure to ozone also causes deterioration of rubber and plastic products.

[0007] Further, it is well known that ozone is a triatomic molecule consisting of three oxygen atoms, having many industrial and consumer applications. When compared

to chlorine or cresol, ozone shows a better result in bacteria killing. Further, bacteria are single-celled microorganisms which can exist either as independent (free-living) organisms or as parasites (dependent upon another organism for life). Bacterial particles consist of protein, polysaccharide and lipids. Further, virus is a small infectious agent that can replicate only inside the living cells of organisms. Virus particles consist of genes made from either DNA or RNA, long molecules that carry genetic information; a protein coat that protects these genes, and in some cases an envelope of lipids that surrounds the protein coat. To kill or inactivate bacteria or virus, it is necessary to destroy or decompose their contents. Ozone can penetrate bacteria and virus, causing them to be changed into enzyme. Thus, RNA can be decomposed, and DNA can be destroyed.

[0008] Further, ozone can be decomposed into O₂ molecules and oxygen atom. Ozone's deodorizing action is a chemical destruction of the compounds that create the odors. Ozone deodorization is extremely effective for more serious odor. Ozone is highly reactive and combines with malodor molecules to chemically alter their structure and rid property of odor. Ozone also kills bacteria and fungi and works as a sanitizing agent.

[0009] According to "Economy Daily News", negative ions are beneficial to human body in four major ways:

- (a) Strengthen the functions of autonomic nerves;
- (b) Reinforces collagen (tissues that are resilient and tension-related);
- (c) Improves the permeability of the cell's prototype plasma membranes (improves metabolism); and
- (d) Strengthens the body's immune system.

[0010] It is also known that negative ions neutralize pollutants and provide positive effects on health to

[0011] Further, negative ions have the functions of:

- (a) Purify the air
- Negative ions, are particles with one or more extra electrons, conferring a net negative charge to the particle.

[0012] Further, negative ions have the extra benefits of:

- (a) Air purification and electrostatic dust collection: Negative ions are electrically-charged particles in the air that remove airborne contaminants from the air we breathe, and have a rejuvenating effect when interacting with the respiratory system
- (b) Detoxification: Negative ions are able to help protect the body from induced physical stress. Negative ions are found to significantly improve all physiological states, particularly during rest. Exposure to negative ions increases levels of the protective antioxidant enzyme superoxide dismutase in mammalian erythrocytes.

(c) Smoke clearance: Negative ions are effective to neutralize smoke.

(d) Bacteria killing: Ionizing a room reduces bacteria in the air. Negative air ionization can have a significant impact on the airborne microbial load in a poultry house and at least a portion of this effect is through direct killing of the organisms.

(e) Deodorization: Ionizing the gas to negative ions can absorb odor components in the gas to a photocatalyst, and decompose the odor components.

SUMMARY OF THE INVENTION

[0013] The present invention has been accomplished under the circumstances in view. It is the main object of the present invention to provide an exhaust gas purification method and system, which effectively purifies the discharged gas of the exhaust pipe of a car, motorcycle or water heater, preventing air pollution. It is another object of the present invention to provide an exhaust gas purification method and system, which utilizes ozone and/or negative ions to decompose toxic substances in waste exhaust gas, avoiding carbon monoxide poisoning.

[0014] To achieve these and other objects of the present invention, an exhaust gas purification method is to connect an ozone/negative ion generator to a power source electrically by an electric wire, and then to connect the ozone/negative ion generator to a waste gas exhaust pipe having a waste gas inlet and a waste gas outlet by a connection pipeline, and then to turn on the ozone/negative ion generator to generate ozone/negative ions upon flowing of a flow of waste gas from the waste gas inlet of the waste gas exhaust pipe toward the waste gas outlet.

[0015] To achieve these and other objects of the present invention, an exhaust gas purification system comprises a waste gas exhaust pipe having a waste gas inlet and a waste gas outlet, and an ozone generator installed in the waste gas exhaust pipe and electrically connected to an external power source and adapted for generating ozone into the waste gas exhaust pipe to mix with a flow of waste gas passing from the waste gas inlet of the waste gas exhaust pipe toward the waste gas outlet.

[0016] Further, a gas filter may be installed in the waste gas exhaust pipe for removing solid matters from the waste gas passing through the waste gas exhaust pipe.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017]

FIG 1 is a schematic sectional view of an exhaust gas purification system in accordance with a first embodiment of the present invention.

FIG 2 is a schematic sectional view of an exhaust gas purification system in accordance with a second

embodiment of the present invention.

FIG 3 is a schematic sectional view of an exhaust gas purification system in accordance with a third embodiment of the present invention.

FIG 4 is a schematic sectional view of an exhaust gas purification system in accordance with a fourth embodiment of the present invention.

FIG 5 is an enlarged view of a part of FIG 4, showing the structure of the negative ion nozzle head.

FIG 6 is a cross sectional view of FIG 5, showing flowing of the discharged negative ion flow.

FIG 7 is a schematic sectional view of an exhaust gas purification system in accordance with a fifth embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0018] Referring to FIG 1, an exhaust gas purification system in accordance with a first embodiment of the present invention is shown comprising an ozone generator 2 installed in an engine exhaust pipe 1. The ozone generator 2 is connected to a flow divider 21 at the engine exhaust pipe 1 near its waste gas inlet 11. The ozone generator 2 is electrically connected to the power circuit of the vehicle engine. When the vehicle engine is started, the ozone generator 2 is simultaneously turned on to generate ozone 22, enabling generated ozone 22 to be distributed into the inside of the engine exhaust pipe 1 to decompose toxic particles in the waste gas flowing in direction from the waste gas inlet 11 toward the waste gas outlet 12 of the engine exhaust pipe 1.

[0019] FIG 2 illustrates an exhaust gas purification system in accordance with a second embodiment of the present invention. This second embodiment is substantially similar to the aforesaid first embodiment with the exception that the ozone generator 2 and the flow divider 21 are installed in the engine exhaust pipe 1 near its waste gas outlet 12. This second embodiment achieves the same effect.

[0020] FIG 3 illustrates an exhaust gas purification system in accordance with a third embodiment of the present invention. This third embodiment is substantially similar to the aforesaid first embodiment with the exception that the configuration of the flow divider 21.

[0021] FIGS. 4-6 illustrate an exhaust gas purification system in accordance with a fourth embodiment of the present invention. According to this fourth embodiment, the exhaust gas purification system is used in a motor vehicle, comprising a negative ion generator 4 electrically connected to the vehicle battery 5, and a negative ion nozzle head 3 installed in the vehicle engine exhaust pipe 6 between its waste gas inlet 61 and waste gas outlet 62 and connected to the negative ion generator 4. The vehicle engine exhaust pipe 6 is connected with a muffler (not shown) for the discharge of engine waste gas. The negative ion nozzle head 3 comprises a flange 31 affixed to the peripheral wall of the vehicle engine exhaust pipe

6, a heat resistant insulation 33 wrapped about the periphery thereof and a nozzle tube 32 suspending inside the vehicle engine exhaust pipe 6. The heat resistant insulation 33 can be prepared from ceramic, stainless or any other heat resistant material.

[0022] The negative ion generator 4 starts to generate negative ions upon connection of high voltage electric current. The generated flow of negative ions is discharged through the nozzle tube 32 into the inside of the vehicle engine exhaust pipe 6. Subject to the structural design of the nozzle tube 32, the discharged flow of negative ions flows spirally in the vehicle engine exhaust pipe 6 to mix with the waste gas thoroughly, thereby purifying the waste gas that flows out of the vehicle engine exhaust pipe 6 through the waste gas outlet 62.

[0023] FIG 7 illustrates an exhaust gas purification system in accordance with a fifth embodiment of the present invention. According to this fifth embodiment, the exhaust gas purification system is used in a gas water heater 7, comprising an ozone generator 2 installed in the exhaust pipe 71 of the gas water heater 7 between its waste gas inlet 711 and waste gas outlet 712, and electrically connected to power source, and a gas filter 8 installed in the exhaust pipe 71 between the ozone generator 2 and the waste gas outlet 712 of the exhaust pipe 71. When switching on the igniter (not shown) of the gas water heater 7, the ozone generator 2 is simultaneously turned on to generate ozone for mixing with the waste gas passing through the exhaust pipe 71 to decompose carbon monoxide and other toxic substances contained in the waste gas into non-toxic substances or to lower the toxicity of the substances. The gas filter 8 is adapted for removing impurities and solid matters from the waste gas passing therethrough. Further, the ozone generator 2 can be electrically connected to city AC power supply by an electrical wire, or directly connected to the battery of the gas water heater 7.

[0024] The gas filter 8 can be a precious metal catalyst honeycomb ceramic filter cartridge. When the ozone treated waste gas passes through the gas filter 8, impurities and solid matters are seized by the gas filter 8, allowing purified gas to flow out of the waste gas outlet 712 of the exhaust pipe 71 into the outside open air. The precious metal catalyst honeycomb ceramic filter cartridge is prepared by mixing magnesium oxide, aluminum oxide or silicon oxide with ceramics and then sintering the mixture into a ceramic carrier having about 1000 pores per inch, wherein each pore has its one end opened and its other end closed. Thus, the waste gas cannot pass through the pores directly. The 7-13 μ pore wall catches 99% of toxic particles from the waste gas flowing therein. At this time, the precious metal coating (prepared from platinum, palladium, rhodium or titanium) on the ceramic surface of the precious metal catalyst honeycomb ceramic filter cartridge of the gas filter causes any toxic gas to be oxidized or reduced into a non-toxic condition for dissipation into the outside open air.

[0025] Although particular embodiments of the inven-

tion have been described in detail for purposes of illustration, various modifications and enhancements may be made without departing from the spirit and scope of the invention. Accordingly, the invention is not to be limited except as by the appended claims.

Claims

1. An exhaust gas purification method, comprising the steps of:
 - a) connecting an ozone generator to a power source by an electric wire;
 - b) using a connection pipeline to connect said ozone generator to a waste gas exhaust pipe having a waste gas inlet and a waste gas outlet;
 - c) turning on said ozone generator to generate ozone upon flowing of a flow of waste gas from said waste gas inlet of said waste gas exhaust pipe toward said waste gas outlet.
2. The exhaust gas purification method as claimed in claim 1, wherein said ozone generator is replaceable by a negative ion generator.
3. The exhaust gas purification method as claimed in claim 1, further comprising a sub-step of installing a gas filter in said waste gas exhaust pipe near said waste gas outlet for removing solid particles from the waste gas passing therethrough.
4. The exhaust gas purification method as claimed in claim 3, wherein said gas filter is a precious metal catalyst honeycomb ceramic filter cartridge.
5. An exhaust gas purification system, comprising:
 - a waste gas exhaust pipe having a waste gas inlet and a waste gas outlet; and
 - an ozone generator installed in said waste gas exhaust pipe and electrically connected to an external power source and adapted for generating ozone into said waste gas exhaust pipe to mix with a flow of waste gas passing from said waste gas inlet of said waste gas exhaust pipe toward said waste gas outlet.
6. The exhaust gas purification system as claimed in claim 5, wherein said ozone generator is replaceable by a negative ion generator.
7. The exhaust gas purification system as claimed in claim 5, further comprising a gas filter installed in said waste gas exhaust pipe and adapted for removing solid matters from the waste gas passing through said waste gas exhaust pipe.
8. The exhaust gas purification system as claimed in claim 5, 6 or 7, wherein said waste gas exhaust pipe is an engine exhaust pipe of a motor vehicle.
9. The exhaust gas purification system as claimed in claim 5, 6 or 7, wherein said waste gas exhaust pipe is an exhaust pipe of a gas water heater.
10. The exhaust gas purification system as claimed in claim 6, wherein said negative ion generator comprises a negative ion nozzle head fixedly mounted in said waste gas exhaust pipe and adapted to guide generated negative ions into the inside of said waste gas exhaust pipe for mixing with the flow of waste gas passing through said waste gas exhaust pipe.
11. The exhaust gas purification system as claimed in claim 7, wherein said gas filter is a precious metal catalyst honeycomb ceramic filter cartridge

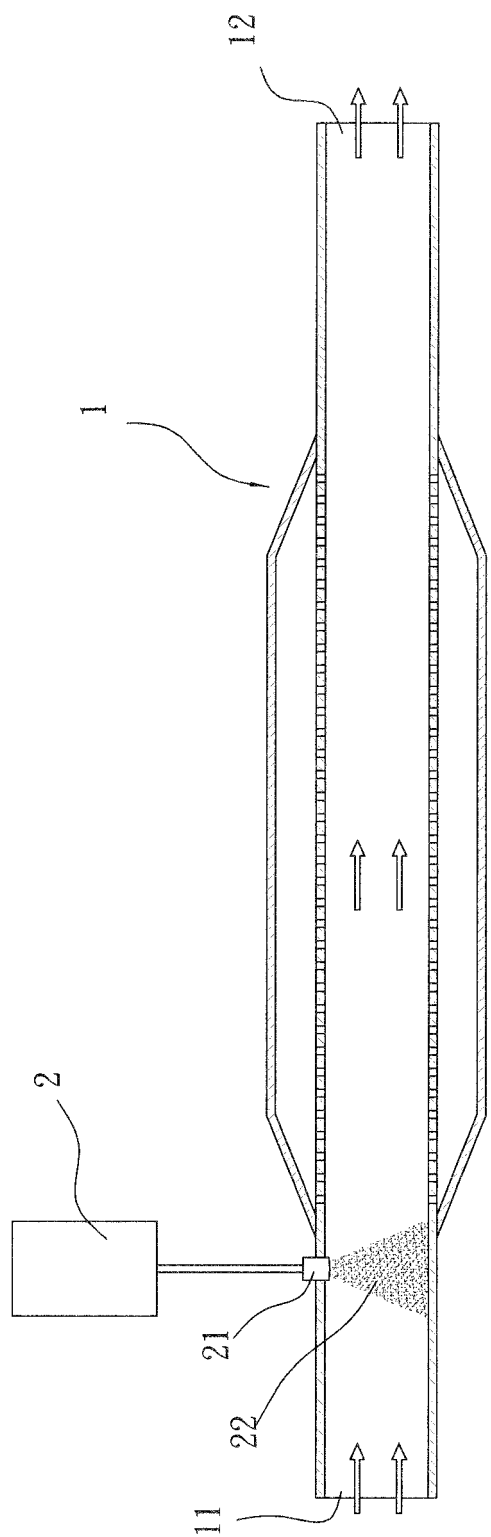


FIG. 1

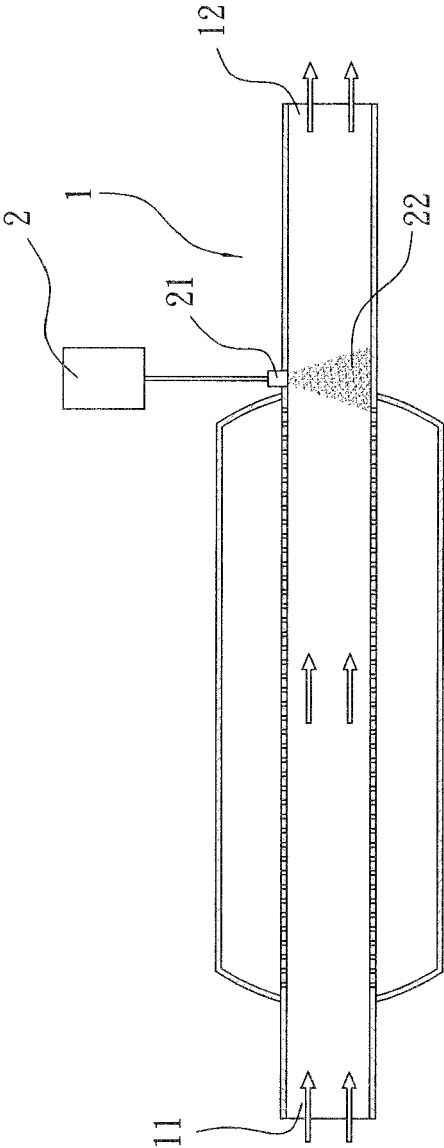


FIG. 2

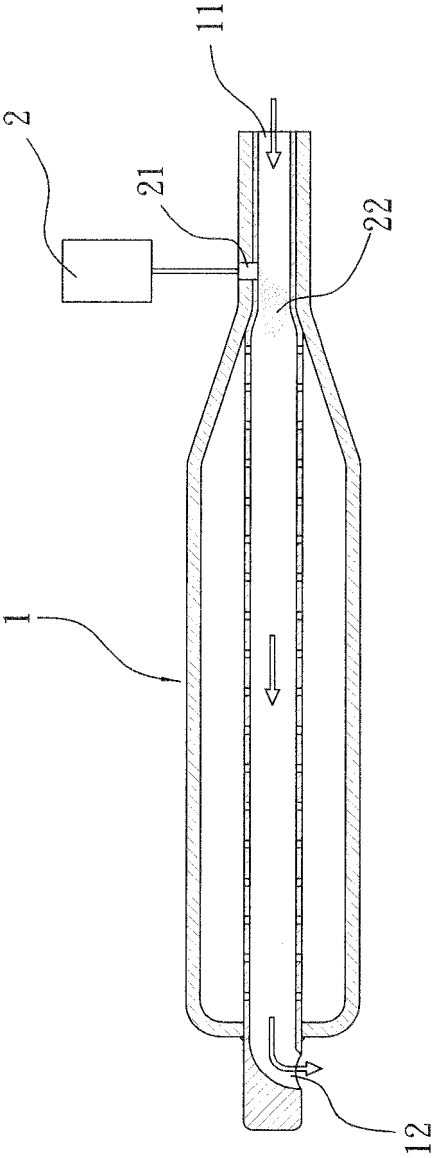


FIG. 3

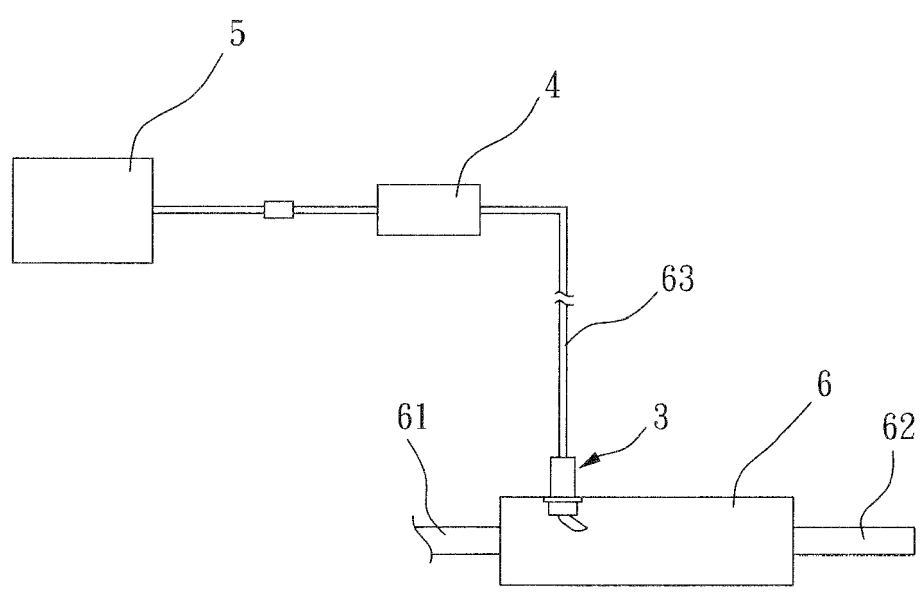


FIG. 4

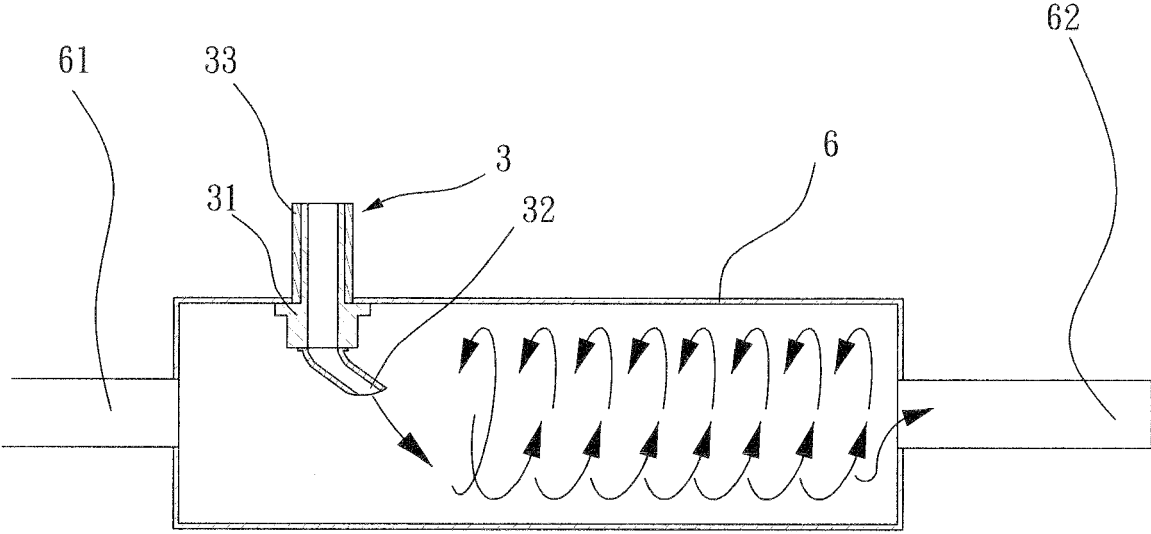


FIG. 5

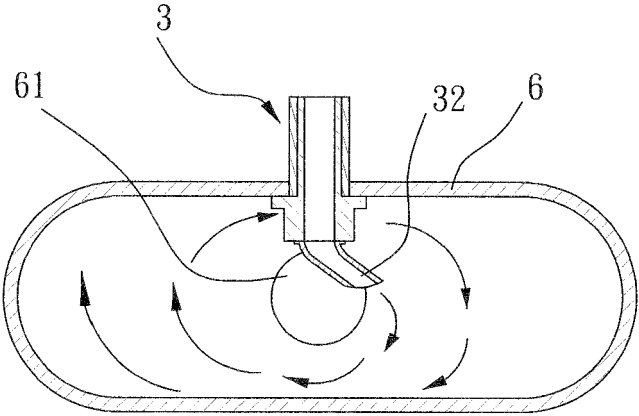


FIG. 6

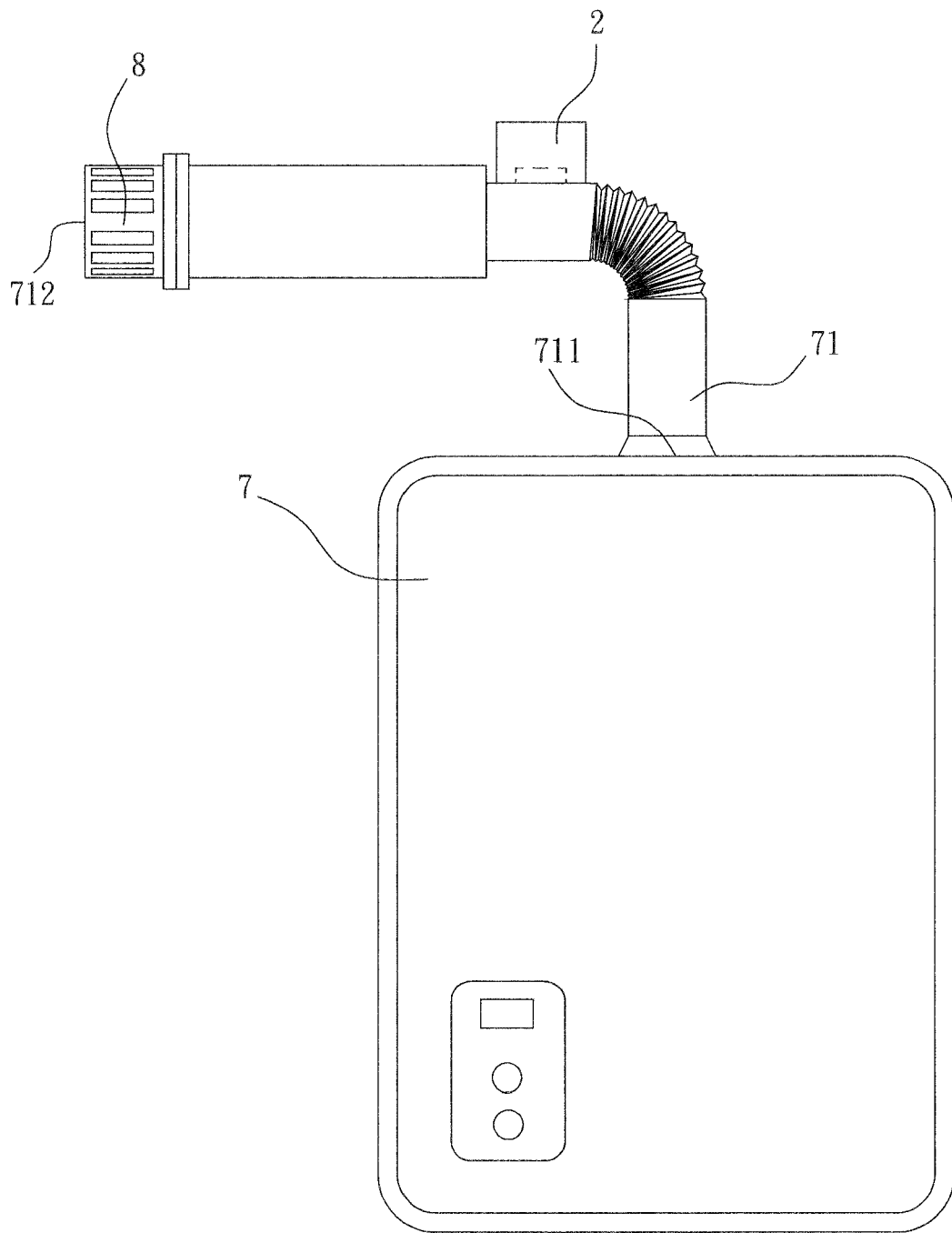


FIG. 7



EUROPEAN SEARCH REPORT

Application Number
EP 10 19 1131

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 2 147 713 A1 (TOYOTA MOTOR CO LTD [JP]) 27 January 2010 (2010-01-27) * paragraphs [0012] - [0014], [0027], [0029] * * figures 1,2 *	1,3,4, 7-9,11	INV. F01N3/029
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X	WO 97/24515 A1 (HYUNDAI PRECISION & IND CO LTD [KR]; SEONDO ELECTRIC CO LTD [KR]; PARK) 10 July 1997 (1997-07-10) * abstract *	1,2,5,6	
			TECHNICAL FIELDS SEARCHED (IPC)
			F01N
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 23 February 2011	Examiner Ikas, Gerhard
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 10 19 1131

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82