US 20120100497A1

(19) United States

(12) Patent Application Publication

(10) Pub. No.: US 2012/0100497 A1

(43) Pub. Date: Apr. 26, 2012

Joo

(54) **BURNER USING PLASMA**

(76) Inventor: **Sung Ho Joo**, Seoul (KR)

(21) Appl. No.: **13/380,701**

(22) PCT Filed: **Jun. 22, 2010**

(86) PCT No.: **PCT/KR2010/004032**

§ 371 (c)(1),
(2), (4) Date: **Dec. 23, 2011**

(30) **Foreign Application Priority Data**

Jun. 23, 2009 (KR) 10-2009-0056123

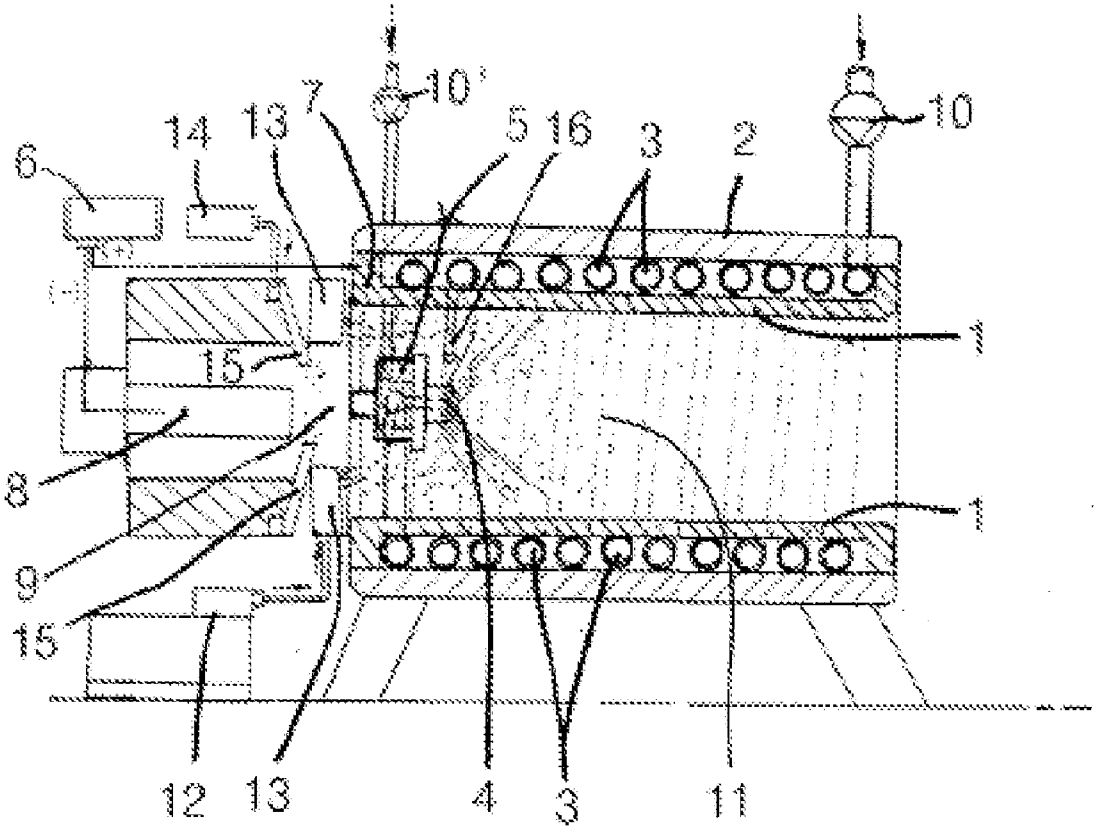
Publication Classification

(51) **Int. Cl.**
F23Q 7/22 (2006.01)
F23D 99/00 (2010.01)

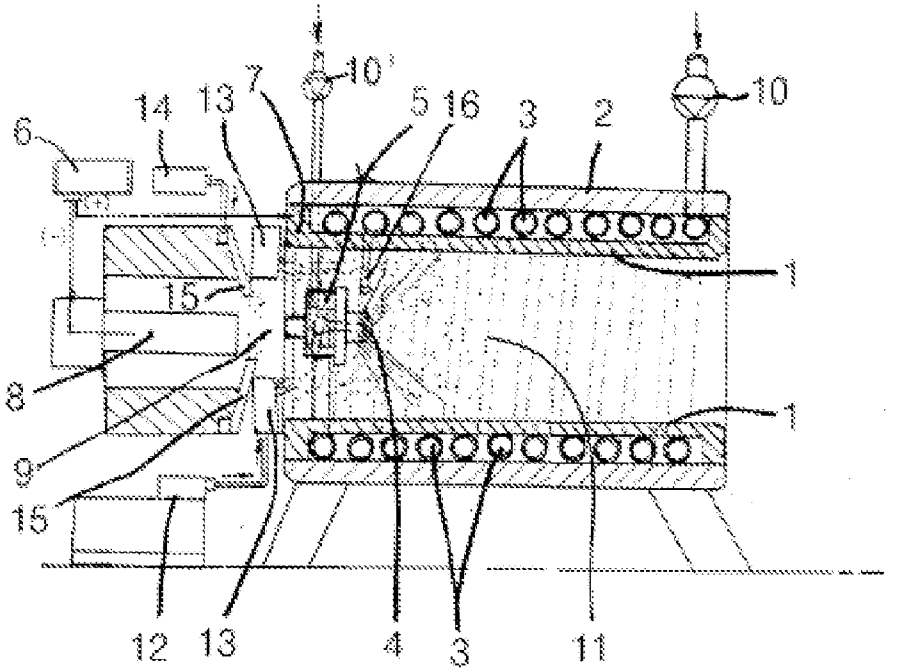
(52) **U.S. Cl.** **431/258**; 431/354

(57) **ABSTRACT**

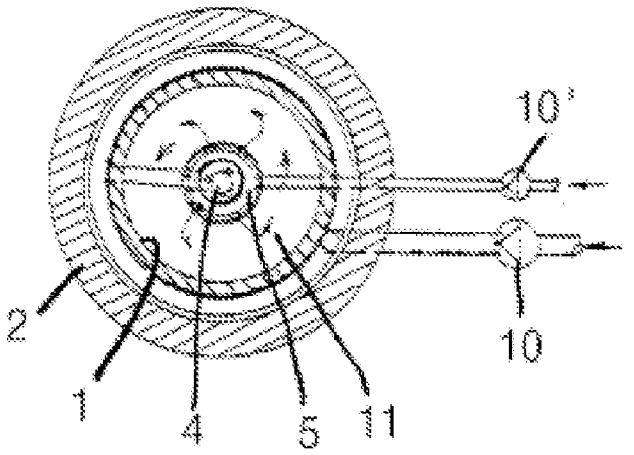
The present invention relates to a burner using plasma, which uses a mixture fuel in which water and industrial waste oil are mixed at an appropriate ratio. A combustion tank has a positive electrode (+), a rod installed at one side of the combustion tank has a negative electrode (−), and direct current electricity is supplied to the combustion tank and to the rod from a direct current electricity supply unit. A steam supply pipe of a steam generator is installed together with a plasma torch unit which is coupled to the combustion tank, such that high-temperature steam is discharged from the steam supply pipe together with the plasma torch generated by the plasma torch unit. Thus, the high-temperature plasma torch generates a high-temperature plasma flame of 800° C. or higher to heat a combustion chamber at the inner wall of the combustion tank. A mixture fuel supply pipe is wound into a coil on the outer surface of the combustion chamber, such that the mixture fuel supply pipe is preheated by high-temperature heat. The mixture fuel in the mixture fuel supply pipe is supplied at an air pressure of 50 through a high pressure pump, and water in the mixture fuel is decomposed into hydrogen and oxygen and waste oil in the mixture fuel is decomposed into carbons. The mixture fuel is injected or sprayed through a nozzle at a high temperature to effectively and completely burn the mixture fuel. The plasma torch unit operates by means of the direct current electricity supplied by the direct current electricity supply unit if needed, to adjust the temperature of the combustion chamber of the combustion tank, thereby enabling the smooth use of the burner.



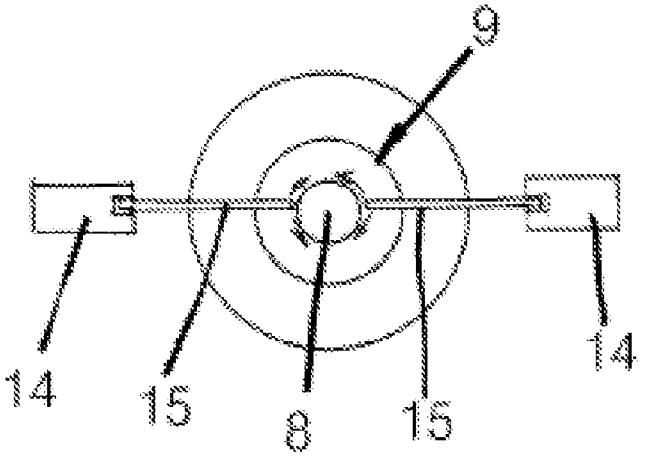
[Fig 1]



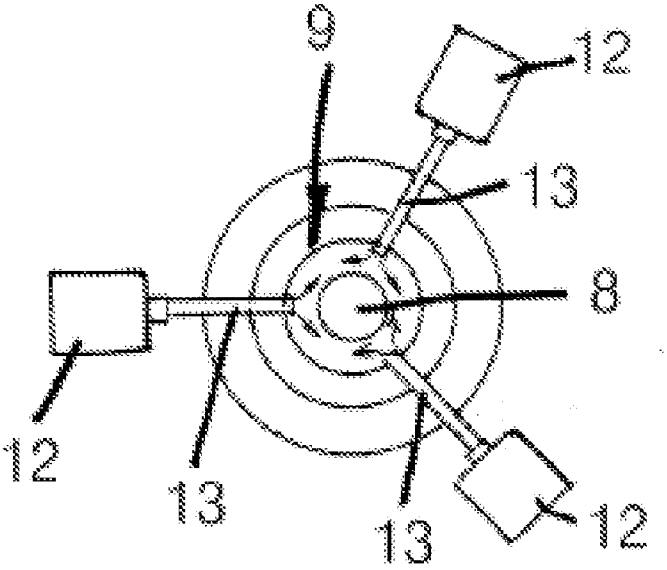
[Fig 2]



[Fig 3]



[Fig 4]



BURNER USING PLASMA

TECHNICAL FIELD

[0001] The present invention relates to a burner using plasma in which a mixture fuel can be used as a combustion fuel, thus heating a boiler or the something with a cheaper fuel, with the mixture fuel being made by mixing water and industrial waste oil at a proper ratio.

[0002] The present invention is basically directed to using a burner using plasma characterized in that a combustion tank helping spray a mixture fuel via a nozzle and combust the same is designated as a positive electrode (+), and a rod installed at one side of the same is designated as a negative electrode (−), thus receiving a DC (Direct Current) electricity of a DC electricity supply part, and a steam supply pipe is installed, so a mixture fuel supply pipe surrounding a combustion tank in a coil shape can be heated or preheated in such a way to heat an inner wall of the combustion tank by means of a high temperature plasma flame of above 800° C. in a combustion chamber with the aid of a flame generation of a high temperature steam plasma torch from a steam supply pipe, and a fuel can be supplied at a pressure above 50 atm by a high pressure pump as a nozzle of a mixture fuel supply pipe is ignited, so the mixture can be more effectively combusted as compared to a simply spray combustion which uses a nozzle in a combustion chamber of a combustion tank owing to a high pressure and a high temperature of above 800° C., and a more continuous, safer combustion might be achieved at a lower cost in the event that a plasma torch part is used together.

BACKGROUND ART

[0003] The oil burner generally used at a boiler or the something is designed to use a relatively expensive fuel oil and to spray via a nozzle in a mist form, thus combusting the fuel; however the maintenance of the boiler is costly which leads to a higher economic burden to a user.

[0004] To overcome the above problems, an industrial water oil is being suggested as a fuel; however the production of the industrial waste oil is very limited, thus limiting its actual application. Since diverse contaminations are contained in the waste oil, without a high temperature combustion, a harmful gas generated during an incomplete combustion could contaminate air. When it is needed to properly process such harmful gas, a high temperature heat decomposition process is needed at each step, and the industrial waste oil is needed to be processed in a mixing chamber which decomposes the oil into O_2, H and OH-group, and the serious contamination substances contained in the waste oil can be stabilized using hydrogen fluoride, hydrogen chloride, CO_2, etc; however the decomposition process system of such serious contamination substances require very expensive further facilities and high operation costs, which substantially retards the applications.

[0005] There is another conventional art characterized in that water and waste oil are mixed at a proper ratio, and the mixture fuel of water and the waste oil is sprayed via a nozzle in a mist form in a combustion chamber and is combusted in the same, and a long mixture fuel supply pipe, adapted as a means for enhancing a combustion efficiency during a spray combustion of a mixture fuel, is installed in a separate preheating chamber in a coil shape, thus enhancing a fuel spray via a nozzle in a mist form, and a combustion efficiency; however the above conventional art has some limits in that it is almost impossible to increase the mixture fuel supply pipe formed in a coil shape to a proper temperature (above 800° C.) with only the heating apparatus which is designed to exclusively heat the preheating chamber, so the spray combustion of the mixture fuel with the aid of the nozzle becomes unstable, which results in a lower combustion efficiency in the boiler owing to an incomplete combustion.

DISCLOSURE OF INVENTION

[0006] Accordingly, it is an object of the present invention to provide a burner using plasma which overcomes the problems encountered in the conventional art and makes it possible to achieve a more efficient ignition combustion and a complete combustion by using a mixture fuel formed of water and a waste oil.

[0007] It is an object of the present invention to provide a burner using plasma which makes it possible to supply a mixture oil at a high pressure of above 50 atm using a high pressure pump in such a way that a mixture fuel supply pipe surrounding a combustion tank in a coil shape preheats the mixture fuel before it is sprayed in a mist form from a combustion chamber of a combustion tank to a nozzle and is combusted therein, the process of which achieves a high temperature combustion is performed in the combustion chamber, and since a combustion heat of the combustion chamber is well received by an inner wall of the combustion tank, thus helping complete combust the mixture fuel in the combustion chamber by continuously heating the mixture fuel supply pipe, and the direct current electricity is supplied from the direct current electricity supply part in such a way that a positive electrode part conducted with a positive voltage (+) of the direct current electricity supply part is provided in the combustion tank, and a rod conducted with a negative voltage (−) is configured in one side of the same, and a steam supply pipe is secured between the positive and negative electrode parts, thus producing a flame of a high steam plasma torch in the combustion chamber of the combustion tank, so the interior of the combustion chamber of above 800° C., which is a proper combustion temperature of the mixture fuel, can serve to perform a heating and preheating process, which leads to a more efficient combustion of the mixture fuel formed of water and a waste oil.

[0008] It is further another object of the present invention to provide a burner using plasma which makes it possible to achieve a simple construction burner, and to significantly decrease an economical cost in terms of a combustion in a boiler or the something since the present invention provides a burner using plasma in which a mixture fuel made from water and an industrial waste oil can be completely combusted.

[0009] To achieve the above objects, there is provided a burner using plasma characterized in that a combustion tank in which a mixture fuel supply pipe is wound in a coil shape around an outer surface of a cylindrical combustion tank with its both sides open, is designated as a positive electrode part, and a rod installed at an outer side of the same is designated as a negative electrode, thus receiving a direct current electricity from a direct current supply part, and a plasma torch part is configured in such a way that a steam supply pipe designed to receive steam from a steam generation part is installed between the combustion tank and the negative part, thus generating a high temperature steam plasma flame in the combustion chamber. The flame in the combustion chamber of the combustion tank, which is a high temperature steam plasma

torch flame of above 800° C. proper to heat the mixture fuel, attributes to heat and consequently preheat the inner wall of the combustion tank for a short time with the aid of a circulation heating, so the mixture fuel supplied at a high pressure of above 50 atm from the high pressure pump can be well sprayed in a mist state and can be well combusted with the aid of a high pressure at the nozzle and a high temperature above 800° C., which leads to a complete combustion.

ADVANTAGEOUS EFFECTS

[0010] As described above, the burner using plasma according to the present invention is characterized in that a combustion tank **1** configured in such a way that a mixture fuel supply pipe **3** is wound in a coil shape on an outer surface of a combustion tank **1**, is designated as a positive electrode part **7**, and a rod engaged at an outer side of the same is designated as a negative electrode part **8**, so a direct current electricity is supplied from a direct current electricity supply part **6**, and a steam supply pipe **13** serving to receive steam from the steam generation part **12** is disposed between the combustion tank **1** and the negative electrode part **8**, thus forming a plasma torch part **9**, so a flame of a high temperature steam plasma torch is generated in the combustion chamber **11** of the combustion tank **1**. In the mode of the activation, a high temperature plasma flame can be generated at a high temperature of above 800° C., and since the inner wall of the combustion tank is heated and consequently preheated, the mixture fuel can be supplied at a high pressure of above 50 atm, and the water is decomposed into hydrogen and oxygen in the mixture fuel supply pipe **3**, and the waste oil is decomposed into carbon components. When such components pass through the nozzle **4**, a high heat is generated and is burnt on the basis of complete combustion.

[0011] The mixture fuel combustion in the combustion tank **1** helps to perform a preheating combustion and to adjust the combustion state with the aid of the operation of the plasma torch part **9**, thus always achieving complete combustion, and the water in the mixture fuel is decomposed into hydrogen and oxygen, and the waste oil therein is decomposed into carbon components, so the air contamination due to the waste oil can be significantly filtered and prevented, thus achieving an economically advantageous effect.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] The present invention will become better understood with reference to the accompanying drawings which are given only by way of illustration and thus are not limitative of the present invention, wherein;

[0013] FIG. **1** is a cross sectional view illustrating the entire construction of a burner using plasma according to the present invention;

[0014] FIG. **2** is a cross sectional view illustrating a combustion tank according to the present invention;

[0015] FIG. **3** is a side view illustrating parts of an argon gas exhaust pipe and a negative electrode part according to the present invention; and

[0016] FIG. **4** is a side view illustrating part of a steam supply pipe according to the present invention.

* Descriptions of the reference numerals in the drawings*

1:	combustion tank
3:	mixture fuel supply pipe
6:	direct current electricity supply part
7:	positive electrode part
8:	negative electrode part
11:	combustion chamber
12:	steam generation part
13:	steam supply pipe

MODES FOR CARRYING OUT THE INVENTION

[0017] The preferred embodiments of the present invention will be described with reference to the accompanying drawings.

[0018] It is noted that the same reference numerals are assumed to indicate the same elements or parts. During the descriptions of the present invention, the related known functions or constructions are omitted not to make the gist of the preset invention indefinite.

[0019] FIG. **1** is a cross sectional view illustrating the entire construction of a burner using plasma according to the present invention, FIG. **2** is a cross sectional view illustrating a combustion tank according to the present invention, FIG. **3** is a side view illustrating parts of an argon gas exhaust pipe and a negative electrode part according to the present invention, and FIG. **4** is a side view illustrating part of a steam supply pipe according to the present invention.

[0020] The present invention is characterized in that heat is collected via a combustion tank **1** formed by winding a mixture fuel supply pipe **3** in a coil shape on an outer surface of the combustion tank **1** as a mixture fuel made by well mixing, with a mixer, water and waste oils is supplied by a high pressure pump **10** to an outer surface of a cylindrical tank **10** with its both sides open. The inner end of the mixture fuel supply pipe **3** is connected to a nozzle **4** installed in the combustion chamber **11**, and the mixture fuel is supplied via the nozzle **4** to the mixture fuel supply pipe **3** at a high pressure of above 50 atm with the aid of the high pressure pump **10**, so the mixture fuel is sprayed into the combustion chamber **11** via the spray holes of the nozzle **4** in a mist form, thus achieving a high temperature combustion.

[0021] A heat insulation cover **2** is covered on an outer side of the mixture fuel supply pipe **3** for the mixture fuel supply pipe **3** to fully receive the combustion heat of the combustion chamber **11** and the heat of a high temperature steam plasma, and a combustion air tank **5** is installed in such a way to cover the entire outer portions of the nozzle **4** for an external air to be inputted from the pump **10'** at an outer side of the nozzle **4**, thus air cooling the nozzle **4**, and the combustion air is forced to circulate in the combustion chamber **11**, so enough amount of air injection and combustion flame circulate in the interior of the combustion chamber **11** and is discharged to the outside.

[0022] The combustion tank **1** is designated as a positive electrode part **7**, with the combustion tank **1** electrically conducting a positive electricity(+) from the direct current electricity supply part **6** so as to form the combustion tank **1** with a plasma torch part, and the rod electrically conducting a negative electricity (−) from the direct current electricity supply part **6** is designated as a negative electrode part **8**, thus forming a plasma torch part **9**.

[0023] A steam supply pipe **13** serving to receive a high temperature steam from the steam generation part **12** is secured between the side wall of the combustion tank **1** and the plasma torch part **9**, thus supplying a direct current electricity, and in the mode of activation, a steam in a form of mist and a steam plasma flame are generated in the plasma torch part **9** over the combustion chamber **11**, thus generating a high temperature plasma flame of above 800° C.

[0024] An argon gas exhaust pipe **15** is connected to the negative electrode part **8** formed of a rod, in order to prevent a corrosion and transformation of the rod of the negative electrode part **8** for thereby receiving an argon gas from the argon gas supply part **14**. In the drawings, reference numeral **16** represents an igniter.

[0025] The operation of the burner using plasma according to the present invention is as follows. As the direct current electricity from the direct current supply part **6** is concurrently supplied to the positive electrode part **7** of the combustion tank **1** and the negative electrode part **8** of the rod, and a high temperature steam of the steam generator **12** is provided in a form of mist via the steam supply pipe **13**, so a high temperature steam plasma flame is generated at the plasma torch part **9**. At this time, since the plasma flame of above 800° C. heats the inner wall of the combustion tank 1 on which the mixture fuel supply pipe **3** is wound, thus performing a preheating process of the spray combustion of the nozzle **4**.

[0026] The water contained in the mixture fuel is decomposed into hydrogen and oxygen by means of the preheating of the mixture fuel supply pipe **3** wound on the outer surface of the combustion tank **1**, and the waste oil is decomposed into very small carbon components, thus generating a high temperature when passing through the nozzle **4**, and the mixture fuel of the mixture fuel supply pipe **3** is supplied in a state of a high pressure above 50 atm increased by means of the high pressure pump **10**, so the mixture fuel can be completely combusted with the aid of a high pressure above 50 atm and a high temperature of above 800° C. in the combustion chamber **11**.

[0027] In the present invention, enough preheating is performed by means of the plasma flame generation in the combustion tank **1**, and when the mixture fuel is sprayed in a form of mist via the spray holes of the nozzle **4**, and the spray combustion is performed, the direct current electricity supply of the direct current electricity supply part **6** is stopped, thus stopping the generation of plasma flame, and the mixture fuel is continuously supplied at a high pressure above 50 atm to the combustion chamber **11** via the nozzle **4** by means of the high pressure pump **10**, thus performing a continuously high temperature combustion.

[0028] During the combustion of the present invention, an external combustion air circulates via the combustion air tank **5** installed outside the nozzle **4** by means of the pump **10'**, and the nozzle **4** is continuously cooked, so the safety combustion of the nozzle **4** is achieved, and the external combustion air injected into the combustion chamber **11** by means of the pump **10'** circulates in the combustion chamber **11** along with the combustion flame with the aid of the construction that the passage of the combustion air tank **5** is formed in a screw shape, thus continuously contact-heating the inner wall of the combustion tank **1**. During the combustion by means of the nozzle **4**, the mixture fuel of the mixture fuel supply pipe **3** continues to burn at a high temperature in the combustion chamber **11** along with the preheating. When the temperature of the combustion chamber **11** of the combustion tank **1** decreases, and consequently the combustion is less performed, the heating to a higher temperature by means of the mixture fuel spray combustion by the nozzle **4** and the generation of a high temperature plasma flame can be adjusted by adjusting the supply of the direct current electricity of the direct current supply part **9**, so a safe, easy use of the burner using plasma can be achieved.

[0029] The same reference numerals in the drawings indicate the same elements operating with the same functions.

[0030] The above descriptions of the present invention are not limited to the above disclosed embodiments and accompanying drawings, and it is obvious to those who skilled in the art that various substitutions, changes and modifications are possible without departing from the concepts of the present invention.

1. A burner using plasma, comprising:

a cylindrical combustion tank operating as a positive electrode part, the combusting tank being installed by winding in a coil shape a mixture fuel supply pipe on an outer surface of the cylindrical combustion tank with its both sides open;

a rod operating as a negative electrode part the rod being installed at an outer one side of the same, wherein a direct current electricity is received from a direct current electricity supply part; and

a plasma torch part configured by installing a steam supply pipe between the combustion tank and the negative electrode part, thus receiving the steam of a steam generation part, whereby to generate a high temperature plasma flame in the combustion tank.

* * * * *