Title: LOW OXYGEN VORTEX BURNER

Abstract: A low oxygen vortex burner is provided. With the use of exhaust gas discharged from a combined boiler internal combustion engine as a supply source of air for re-combustion, it is possible to have the exhaust gas discharged in a state of complete combustion and to suppress the pollution of the natural environment due to the exhaust gas. The low oxygen vortex burner includes: a frame 100 including a barrier plate 130 for segmenting an inlet space 110 and a combustion chamber 120; an outer casing 220 having a plurality of vortex pipes 400 arranged thereon with the same intervals in a tangential direction of the outer casing so as to cause a vortex of the exhaust gas introduced from said inlet space 110 of the frame 100; a nozzle 500 installed along an axial direction of said outer casing 200 and injecting fuel for combustion; an orifice 800 formed at a location corresponding to an end of said nozzle 500 and passing said exhaust gas in the outer casing 200 and the fuel with a higher speed for accelerating the combustion; a choke 700 formed at the opposite side of said orifice 800 located at a side of said combustion chamber 120 so as to re-circulate a flame within the combustion chamber 120; and fire-resistant materials 600 surrounding the combustion chamber 120 except for said choke 700 and said orifice 800.
For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.
Description
LOW OXYGEN VORTEX BURNER

Technical Field

The present invention relates to a low oxygen vortex burner and more particularly to the burner, in which exhaust gas discharged from a combined boiler internal combustion engine is used as a supply source of air for combustion for allowing re-combustion of the exhaust gas. The present invention makes it possible to have the exhaust gas discharged in a state of complete combustion and to suppress the pollution of the natural environment due to the exhaust gas.

Background Art

Generally, in an internal combustion engine, fuel is supplied to a cylinder and expansion force of the gas obtained from combustion and explosion causes a piston to reciprocate. On the other hand, in a boiler, water is heated to generate hot water or steam with high pressure and high temperature for the purpose of supplying it to a heating facility, a bathroom or a turbine drive.

Further, the combined boiler - internal combustion engine is an apparatus in which waste heat of cooling water and the exhaust gas from the internal combustion engine are utilized for operation of the boiler. Since the waste heat and the hot water may be obtained from the internal combustion engine without needing for an additional combustor, energy saving is possible. Also, provided that the boiler is equipped with a steam turbine, it is possible to obtain an additional power source.

Disclosure of Invention

Technical Problem

Such a conventional combined boiler - internal combustion engine comprises: the internal combustion engine; a cooling water circulating system including a water jacket, a boiler and the steam turbine; and a heating conduit extending through the boiler and attached to an end of a exhaust pipe through which the combustion gas from the internal combustion engine flows. The cooling water, which is heated to the high temperature after cooling the internal combustion engine, flows into the boiler and the exhaust gas, which is discharged from the internal combustion engine through the exhaust pipe, heats the boiler while passing through the heating conduit in the boiler. Accordingly, the cooling water with the high temperature flowed into the boiler is heated to generate the steam. The generated steam is condensed after driving the steam turbine and flows into the cooling jacket for the internal combustion engine by means of a circulation pump. The above-described processes are repeated.

However, the above-described structure of the combined boiler internal combustion
engine includes a problem in that the exhaust gas, which is generated from the internal combustion engine when heating the cooling water in the boiler, is discharged out to the environment without any treatment. Accordingly, destruction of the environment as well as air pollution may occur.

**Technical Solution**

Accordingly, the present invention has been made to solve the above-mentioned problems occurring in the prior art, and an object of the present invention is to provide a low oxygen vortex burner, in which the exhaust gas from the combined boiler internal combustion engine is used as the supply source of air for combustion so as to allow the exhaust gas to re-burn and the cooling water to be re-heated thereby. In the present invention, the thermal efficiency of the boiler is significantly enhanced and, at the same time, the exhaust gas is discharged in the state of the complete combustion. Accordingly, the low oxygen vortex burner of the present invention makes it possible to suppress the pollution of the natural environment due to the exhaust gas.

**Advantageous Effects**

In the present invention, the exhaust gas discharged from the combined boiler internal combustion engine flows into an inlet space and thereafter a vortex of the exhaust gas may occur due to an outer casing. In a state that the exhaust gas is mixed with the fuel injected through a nozzle, the vortex of the exhaust gas is further mixed with the fuel injected through the nozzle while passing through an orifice. The mixture of the exhaust gas and the fuel is supplied into a combustion chamber to burn therein. Flame occurring in the combustion chamber may be re-circulated therein by a choke, so that even an incompletely-burnt portion of the fuel may burn thereby. Accordingly, energy saving is possible and the thermal efficiency of the boiler may be enhanced.

Further, since the exhaust gas is discharged in a state of the complete combustion, the present invention makes it possible to suppress the pollution of the natural environment due to the exhaust gas.

**Brief Description of the Drawings**

The foregoing and other objects, features and advantages of the present invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings in which:

- Figure 1 is a cross-sectional view of a low oxygen vortex burner in accordance with the present invention; and
- Figure 2 is a cut-away view taken along the line A A of Figure 1.

**Best Mode for Carrying Out the Invention**

In order to accomplish these objects, in accordance with the present invention, there is provided a low oxygen vortex burner comprising: a frame 100 including a barrier...
plate 130 for segmenting an inlet space 110 for receiving exhaust gas and a combustion chamber 120; an outer casing 220 having a plurality of vortex pipes 400 arranged thereon with the same intervals in a tangential direction of the outer casing so as to cause a vortex of the exhaust gas introduced from said inlet space 110 of the frame 100; a nozzle 500 installed along an axial direction of said outer casing 200 and injecting fuel for combustion; an orifice 800 formed at a location corresponding to an end of said nozzle 500 and passing the exhaust gas in the outer casing 200 and the fuel in a higher speed for accelerating the combustion; a choke 700 formed at the opposite side of said orifice 800 located at a side of said combustion chamber 120 so as to re-circulate a flame in the combustion chamber 120; and fire-resistive materials 600 surrounding the combustion chamber 120 except for said choke 700 and said orifice 800.

In the present invention, the exhaust gas discharged from the combined boiler internal combustion engine flows into the inlet space 110 and then enters the outer casing 200 through the vortex pipes 400 while causing the vortex flow. The exhaust gas is mixed with the fuel injected through the nozzle 500. The mixture of the exhaust gas and the fuel is supplied to the combustion chamber 120 through the orifice 800 with the higher speed for combustion. The flame occurring in the combustion chamber 120 may be re-circulated therein by means of the choke 700. At the same time, the fire-resistive materials 600 reflect radiated heat toward the mixture of the fuel and the exhausted gas injected into the combustion chamber 120. Accordingly, the flame may be stabilized and soot and smoke due to oxidation may be prevented.

Mode for the Invention

Hereinafter, preferred embodiments of the present invention will be described with reference to the accompanying drawings.

Referring to Figures 1 and 2, a cross-sectional of an embodiment of a low oxygen vortex burner of the present invention and a cross-sectional view of an outer casing including vortex pipes are illustrated.

As illustrated in Figures 1 and 2, in the low oxygen vortex burner of the present invention, a barrier plate 130 is installed in a frame 100 so as to segment a combustion chamber 120 and an inlet space 110. An outer casing 200, which is installed in the inlet space 110, has a plurality of vortex pipes 400 arranged thereon with the same interval in a tangential direction of the outer casing 200. A nozzle 500 for injecting fuel into a combustion chamber 120 fixedly extends in the outer casing 200 along an axial direction of the outer casing 200.

At a location corresponding to an end of the nozzle 500, an orifice 800 is formed. The exhaust gas introduced into the outer casing 200 and the fuel injected through the
nozzle 500 pass through the orifice 800 in a mixed state with an accelerated speed. The mixture is supplied to the combustion chamber 120 for combustion therein.

At the opposite side of the orifice 800 located at a side of the combustion chamber 120, a choke 700 is formed so as to re-circulate the flame in the combustion chamber 120. Fire-resistive materials 600 surround the combustion chamber 120 except for the choke 700 and the orifice 800, so as to reflect radiation heat toward the fuel mixed with the exhaust gas and to prevent the flame 100 forming the combustion chamber 120 from being deformed due to the high temperature of the flame.

A connection hole 111 is formed at a side of the inlet space 110 so as to be coupled to an exhaust pipe (not shown) of the combined boiler internal combustion engine. The exhaust gas discharged from the boiler internal combustion engine flows into the inlet space through the exhaust pipe coupled to the connection hole 111.

The outer casing 200 installed in the inlet space 110 has a funnel shape formed with a narrow exit end. Accordingly, the exhaust gas introduced into the outer casing 200 through the vortex pipes 400 is guided toward the combustion chamber 120.

On the other hand, the vortex pipes 200 are fixed to the outer casing 200 in such a manner that an angle ranging from 20 to 60 is formed between each of the vortex pipes 400 and the tangential line extended from the circumference of the outer casing 200. Accordingly, the vortex may occur due to contact of the exhaust gas to an inner surface of the outer casing 200 while the exhaust gas is being introduced into the outer casing 200.

In the operation of the present invention, the exhaust gas discharged from the combined boiler internal combustion engine flows into the inlet space 110 though the connection hole 111 coupled to the exhaust pipe, and then it is guided by the vortex pipes 400 into the outer casing 200. Afterward, the exhaust gas contacts the inner surface of the outer casing 200 to cause the vortex and then it flows to the funnel-shaped exit of the outer casing 200.

Here, through the nozzle 500 extending along the axial direction of the outer casing 200, the fuel is injected into the combustion chamber 120 while being mixed with the exhausted gas.

As described herein before, the mixture of the fuel and the exhaust gas may be supplied to the combustion chamber 120 through the orifice 800 with the higher speed. In the combustion chamber 120, the fuel may burn in such a manner that the flame occurs while the radiation heat reflected by the fire-resistive materials 600 is inwardly directed toward the combustion chamber 120. Also, the flame may be re-circulated within the combustion chamber 120 by the choke 700, which is located at the opposite end of the orifice 800. Accordingly, an incomplete-burnt portion of the fuel may burn exhaustedly.
Industrial Applicability

As described herein before, in the present invention, the exhaust gas discharged from the combined boiler internal combustion engine flows into the inlet space and thereafter the vortex of the exhaust gas occurs due to the outer casing. In a state that the vortex of the exhaust gas is mixed with the fuel injected through the nozzle, the exhaust gas is further mixed with the fuel injected through the nozzle while passing through the orifice. The mixture of the exhaust gas and the fuel is supplied into the combustion chamber to burn therein. The flame occurred in the combustion chamber may be-circulated therein by the choke, so that even the incomplete-burnt portion of the fuel may burn thereby. Accordingly, energy saving is possible and the thermal efficiency of the boiler is enhanced. Furthermore, it is possible to prevent the destruction of the natural environment due to the exhaust gas.

Although several preferred embodiments of the present invention have been described for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.
Claims

[1] A low oxygen vortex burner comprising:
   a frame 100 including a barrier plate 130 for segmenting an inlet space 110 for receiving exhaust gas and a combustion chamber 120;
   an outer casing 220 having a plurality of vortex pipes 400 arranged thereon with the same intervals in a tangential direction of the outer casing so as to cause a vortex of the exhaust gas introduced from said inlet space 110 of the frame 100;
   a nozzle 500 installed along an axial direction of said outer casing 200 and injecting fuel for combustion;
   an orifice 800 formed at a location corresponding to an end of said nozzle 500 and passing the exhaust gas in the outer casing 200 and the fuel with a higher speed for accelerating the combustion;
   a choke 700 formed at the opposite side of said orifice 800 located at a side of said combustion chamber 120 so as to re-circulate a flame within the combustion chamber 120; and
   fire-resistive materials 600 surrounding the combustion chamber 120 except for said choke 700 and said orifice 800.

[2] A low oxygen vortex burner as claimed in claim 1, wherein said inlet space 110 is formed with a connection hole 111 to which a exhaust pipe of a combined boiler internal combustion engine is coupled for discharging the exhaust gas.

[3] A low oxygen vortex burner as claimed in claim 1, wherein said outer casing 200 includes a funnel shape with a narrow exit.

[4] A low oxygen vortex burner as claimed in claim 1, wherein each of said vortex pipes 400 is installed on said outer casing 200 in such a manner that an angle ranging from 20 to 60 is formed between each of the vortex pipes 400 and the tangential line extended from the circumference of the outer casing 200.
INTERNATIONAL SEARCH REPORT

International application No
PCT/KR2007/000478

A. CLASSIFICATION OF SUBJECT MATTER

F23G 7/06(2006.01)i

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)
IPC 8 BOID 53/46, 53/68, F23D 1/00, 14/00, F23G 5/46, 7/06,

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean Utility models and applications for Utility Models since 1975
Japanese Utility models and applications for Utility Models since 1975

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKIPASS (KIPo internal) & keywords "gas combustion", "outer casing", "orifice"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<td>US 2003-0013053 A1 (CORNEL DUTESCU, ELSPEET) 16 JANUARY 2003 See page 2, column 1, line 47 - page 3, column 2, line 13, and figure 2</td>
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<td>JP 2001-355820 A (SUMITOMO SEIKO CHEM CO., LTD) 26 DECEMBER 2001 See page 3, column 2, line 38 - page 6, column 2, line 9</td>
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Further documents are listed in the continuation of Box C

See patent family annex

* Special categories of cited documents
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Date of the actual completion of the international search
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Date of mailing of the international search report
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