

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
15 January 2009 (15.01.2009)

PCT

(10) International Publication Number
WO 2009/008588 A1

(51) International Patent Classification:
F23D 14/58 (2006.01)

(21) International Application Number:
PCT/KR2008/002423

(22) International Filing Date: 29 April 2008 (29.04.2008)

(25) Filing Language: Korean

(26) Publication Language: English

(30) Priority Data:
10-2007-0068722 9 July 2007 (09.07.2007) KR

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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

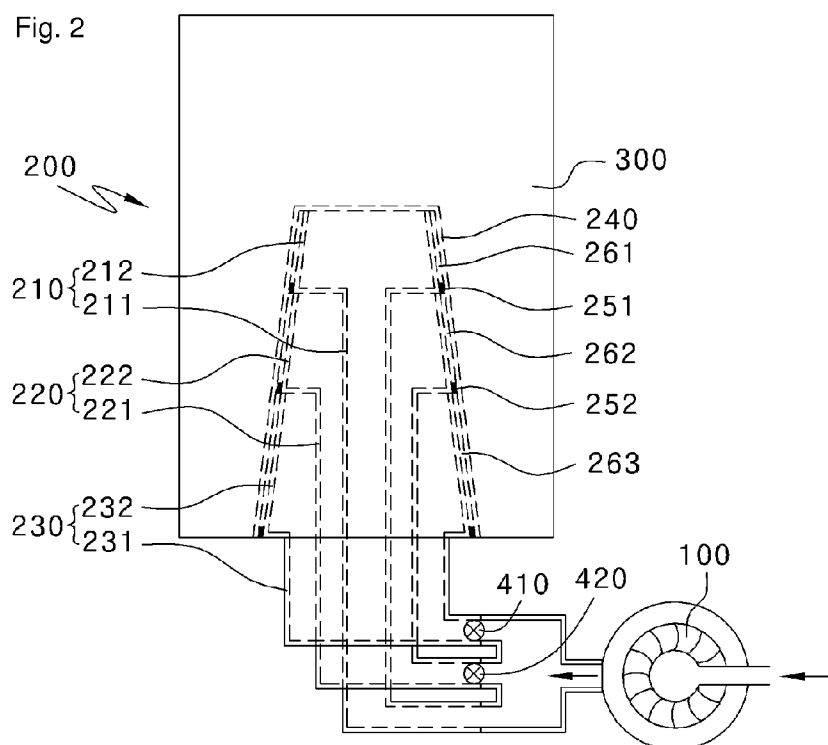
(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— with international search report

(54) Title: COMBUSTION APPARATUS EQUIPPED WITH MULTI LAYER CYLINDRICAL BURNER

Fig. 2



(57) Abstract: It is an object of the present invention to provide a combustion apparatus with a cylindrical burner of a multiple stage structure, which is capable of improving a turn-down ratio by configuring a distribution plate for evenly distributing mixed gas to a combustion chamber in the multiple stage structure and independently supplying the mixed gas to the distribution plate of the multiple stage structure in a gas boiler with the cylindrical burner and of allowing combustion to be stably performed at a low load to a high load according to a heating load required in the boiler. In order to achieve the above-described object, a combustion apparatus having a cylindrical burner of a multiple stage structure includes a distribution unit including a plurality of mixed gas pipes branched to a plurality of paths at an inlet through which mixed gas transferred by a blower is introduced and in which an inner pipe is installed in an inside of an outer pipe with being

spaced from the outer pipe so that the mixed gas can pass in an inside of a combustion chamber, and a plurality of distribution plates having a cylindrical thin plate with a plurality of holes positioned at an edge of the plurality of mixed gas pipes and installed in a vertical lamination structure; and a porous plate having a plurality of flame holes, which is spaced from outer surfaces of the plurality of distribution plates.

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Description

COMBUSTION APPARATUS EQUIPPED WITH MULTI LAYER CYLINDRICAL BURNER

Technical Field

- [1] The present invention relates to a cylindrical burner of a multiple stage structure, and more particularly, to a cylindrical burner of a multiple stage structure that can improve a turn-down ratio by configuring a distribution plate installed in the burner, which equalizes mixed gas, in the multiple stage structure.

Background Art

- [2] In general, a burner used in a gas boiler is classified into a cylindrical burner and a flat-type burner in accordance with a shape of the burner. Among them, it is known that the cylindrical burner optimizes and stabilizes combustion by enabling heat to be stably absorbed and distributed.
- [3] FIG. 1 is a schematic view illustrating an example of a gas boiler employing a cylindrical burner according to the related art. FIG. 1 (a) shows a tapered cylindrical burner and FIG. 1 (b) shows a cylindrical burner.
- [4] The gas boiler includes a blower 10 that supplies mixed gas of air introduced from the outside and fuel gas to the burner, a burner 20 that combusts the mixed gas supplied from the blower 10 using an igniter, a combustion chamber 30 where the mixed gas is combusted by the burner 20, and a heating water channel 41 and a heating water pipe 42 which are installed on an outer wall of the combustion chamber 30 and to which heat is transmitted from the combustion chamber 30.
- [5] The burner 20 includes a distribution plate 21 that has a plurality of holes formed on a cylindrical or a tapered cylindrical thin plate to evenly distribute mixed gas, and a porous plate 22 that is distantly installed outside of the distribution plate 21 by a predetermined distance, which has a plurality of flame holes punched on the cylindrical or tapered cylindrical thin plate to stably produce a flame. Metal fiber may be installed on the outside of the porous plate 22.
- [6] In such gas boiler, a turn-down ratio (TDR) is set according to a heating load required in the boiler. The turn-down ratio (TDR) means the ratio of a 'maximum gas flow rate to a minimum gas flow rate' in a gas combustion apparatus capable of variably controlling a jetting amount of gas. For example, in case that the maximum gas flow rate is 30,000 kcal/h and the minimum gas flow rate is 6,000 kcal/h, the turn-down ratio (TDR) becomes 5:1. The turn-down ratio (TDR) is limited according to how low the minimum gas flow rate for maintaining the stabilized flame can be adjusted.

Disclosure of Invention

Technical Problem

- [7] In the case of a gas boiler, as a turn-down ratio (TDR) increases, the control of the gas boiler becomes convenient.
- [8] That is, combustion is performed with the maximum heating power to reach a target heating temperature in a short time during the initial combustion, but the combustion is performed by gradually reducing an amount of gas supplied to a burner 20 as a current heating temperature becomes close to the target heating temperature.
- [9] In this case, if the turn-down ratio (TDR) is low (that is, in the case in which the minimum gas output is high), it becomes difficult to control the boiler by reducing the amount of gas for decreasing an output of the burner 20.
- [10] Accordingly, various methods for improving the turn-down ratio (TDR) of the burner applied to a conventional gas boiler have been proposed.
- [11] The present invention has been finalized in order to solve the above-described problems. An object of the present invention is to provide a combustion apparatus with a cylindrical burner of a multiple stage structure, which is capable of improving a turn-down ratio by configuring a distribution plate as the multiple stage structure for evenly distributing mixed gas to a combustion chamber and by independently supplying the mixed gas to the distribution plate with the multiple stage structure, and capable of allowing combustion to be stably performed at a low load to a high load according to a heating load required in the boiler.

Technical Solution

- [12] In order to achieve the above-described object, according to the present invention, there is provided a combustion apparatus having a cylindrical burner of a multiple stage structure. The combustion apparatus includes a distribution unit including a plurality of mixed gas pipes branched to a plurality of paths at an inlet through which mixed gas transferred by a blower is introduced and in which an inner pipe is installed in an inside of an outer pipe with being spaced from the outer pipe by a predetermined interval so that the mixed gas can pass in an inside of a combustion chamber, and a plurality of distribution plates having a cylindrical or tapered cylindrical thin plate with a plurality of holes positioned at an edge of each of the plurality of mixed gas pipes and installed in a vertical lamination structure; and a porous plate having a plurality of flame holes, which is spaced from outer surfaces of the plurality of distribution plates to form a space between the porous plate and outer surfaces of the plurality of distribution plates.
- [13] In this case, it is preferable that the space be divided into spaces of the number corresponding to the number of the distribution plates by shielding members formed

between the plurality of distribution plates and the porous plate.

[14] Here, the combustion apparatus may further include a control valve for controlling to selectively supply the mixed gas through one or more paths among the plurality of distribution units.

[15] In the combustion apparatus, air is transferred to the mixed gas pipes of the plurality of distribution units by a blower, and control valves for controlling a selective supply of fuel to the plurality of mixed gas pipes are installed on fuel supply pipes branched from the mixed gas pipes.

Advantageous Effects

[16] According to a combustion apparatus with a cylindrical burner of a multiple stage structure of the present invention, it is possible to allow combustion to be stably performed at a low load to a high load depending on a heating load required in a boiler by improving a turn-down ratio.

Brief Description of the Drawings

[17] FIG. 1 is a schematic view illustrating an example of a gas boiler employing a cylindrical burner according to the related art.

[18] FIG. 2 is a schematic view illustrating a combustion apparatus with a cylindrical burner according to an embodiment of the invention.

[19] FIG. 3 is an exploded perspective view illustrating components of the cylindrical burner shown in FIG. 2.

[20] FIG. 4 is a schematic view illustrating a combustion apparatus with a cylindrical burner according to another embodiment of the invention.

[21] FIG. 5 is a schematic view illustrating a fuel introduction unit of a combustion apparatus with a cylindrical burner according to a further embodiment of the invention.

Best Mode for Carrying Out the Invention

[22] Hereinafter, configuration and effects of preferred embodiments of the present invention will be described in detail with reference to the accompanying drawings.

[23] FIG. 2 is a schematic view illustrating a combustion apparatus with a cylindrical burner according to an embodiment of the invention. FIG. 3 is an exploded perspective view illustrating components of the cylindrical burner shown in FIG. 2.

[24] Mixed gas of air and fuel for combustion is transferred to a burner 200 by a blower 100. FIG. 2 shows a structure in which the mixed gas is introduced into the blower 100. However, a structure in which only the air is transferred by the blower 100 and the fuel is mixed with the transferred air may be adopted.

[25] The mixed gas transferred by the blower 100 is dividedly transferred by a first distribution unit 210, a second distribution unit 220, and a third distribution unit 230.

[26] In this embodiment, three distribution units are used, but two or four or more dis-

tribution units may be used in accordance with an area where an output of the burner is desired to be controlled according to a heating load (that is, in accordance with a turn-down ratio to be set). That is, as the number of distribution units increases, the turn-down ratio increases in proportion to the number of distribution units.

[27] Mixed gas pipes 211, 221, and 231 are provided with the first distribution unit 210, the second distribution unit 220, and the third distribution unit 230, respectively.

[28] Control valves 410 and 420 are installed on the two mixed gas pipes 221 and 231 among the three mixed gas pipes 211, 221, and 231. In order to control the output of the burner according to the heating load, by opening and closing the two control valves 410 and 420, the mixed gas is selectively supplied through one or more paths among the three distribution units 210, 220, and 230.

[29] An inner pipe is inserted into an outer pipe with being spaced from the outer pipe by a predetermined gap in each mixed gas pipe so that the mixed gas can be separately supplied to the three mixed gas pipes 211, 221, and 231.

[30] That is, the first mixed gas pipe 211 is installed with being inserted into the second mixed gas pipe 221 and the second mixed gas pipe 221 is installed with being inserted into the third mixed gas pipe 231.

[31] In this case, an outer surface of the first mixed gas pipe 211 and an inner surface of the second mixed gas pipe 221, and an outer surface of the second mixed gas pipe 221 and an inner surface of the third mixed gas pipe 231 are spaced from each other by the predetermined gap. As a result, the mixed gas is introduced into the spaced gap and jetted to the inside of a combustion chamber 300 through distribution plates 212, 222, and 232.

[32] The first distribution plate 212, the second distribution plate 222, and the third distribution plate 232 of an expanded shape for evenly distributing the mixed gas are formed at upper edges of the first mixed gas pipe 211, the second mixed gas pipe 221, and the third mixed gas pipe 231, respectively.

[33] The first to third distribution plates 212, 222, and 232 are formed with a tapered cylindrical shape by a thin plate. A plurality of holes are formed on surfaces of the distribution plates. An edge on a bottom surface of the first distribution plate 212 comes in contact with an edge of a top surface of the second distribution plate 222 and an edge of a bottom surface of the second distribution plate 222 comes in contact with an edge of a top surface of the third distribution plate 232, thereby forming a vertical lamination structure.

[34] A porous plate 240 in which a plurality of flame holes are punched on the thin plate to stably form flames is installed outside the first to third distribution plates 212, 222, and 232.

[35] An inner surface of the porous plate 240 is spaced from outer surfaces of the first to

third distribution plates 212, 222, and 232 by a predetermined distance, thereby forming a first space 261, a second space 262, and a third space 263.

[36] The first space 261 and the second space 262 are separated from each other by a shielding member 251, thereby preventing mixed gas passing through the first distribution plate 212 from being jetted to the combustion chamber 300 through the second space 262, or mixed gas passing through the second distribution plate 222 from being jetted to the combustion chamber 300 through the first space 261.

[37] Also, the second space 262 and the third space 263 are separated from each other by a shielding member 252, thereby preventing the mixed gas passing through the second distribution plate 222 from being jetted to the combustion chamber 300 through the third space 263 or mixed gas passing through the third distribution plate 232 from being jetted to the combustion chamber 300 through the second space 262.

[38] An operation according to a load amount required in the combustion apparatus having the above-described configuration will now be described.

[39] First, in order to actuate the burner in a low load, the mixed gas is supplied with the two control valves 410 and 420 closed. In this case, the mixed gas is jetted to the combustion chamber 300 through the first distribution plate 212 by way of the first mixed gas pipe 211 and combustion is performed by ignition of an igniter (not shown).

[40] In order to actuate the burner in a middle load, one control valve 410 is closed and the other control valve 420 is opened. Thereby, the mixed gas is jetted to the combustion chamber 300 through the first and second distribution plates 212 and 222 by way of the first and second mixed gas pipes 211 and 221, and then the combustion is performed.

[41] In order to actuate the burner in a high load, the two control valves 410 and 420 are opened. Thereby, the mixed gas is jetted to the combustion chamber 300 through the first to third distribution plates 212, 222, and 232 by way of the first to third mixed gas pipes 211, 221, and 231.

[42] When the combustion is controlled in the above-described manner, the combustion is stably performed even in the low load, thereby realizing a high turn-down ratio.

[43] FIG. 4 is a schematic view illustrating a combustion apparatus with a cylindrical burner according to another embodiment of the invention.

[44] In the embodiment of FIG. 2, the porous plate and the distribution plates have the tapered cylindrical shape, but in this embodiment, a porous plate 270 and distribution plates 214, 224, and 234 have the cylinder shape. Reference numerals 213, 223, and 233 not described, represent mixed gas pipes.

[45] FIG. 5 is a schematic view illustrating a fuel introduction unit of a combustion apparatus with a cylindrical burner according to a further embodiment of the invention.

[46] In the embodiment of FIG. 2, introduction of the mixed gas is controlled by the

control valves 410 and 420, but in the embodiment of FIG. 5, air is supplied by the blower 100 and fuel supply is controlled by control valves 430 and 440.

[47] That is, the air is transferred to mixed gas pipes 215, 225, and 235 by the blower 100, and the control valves 430 and 440 for controlling the selective supply of the fuel to the mixed gas pipes 215, 225, and 235 are installed on fuel supply pipes 216, 226, and 236 branched from the mixed gas pipes 215, 225, and 235.

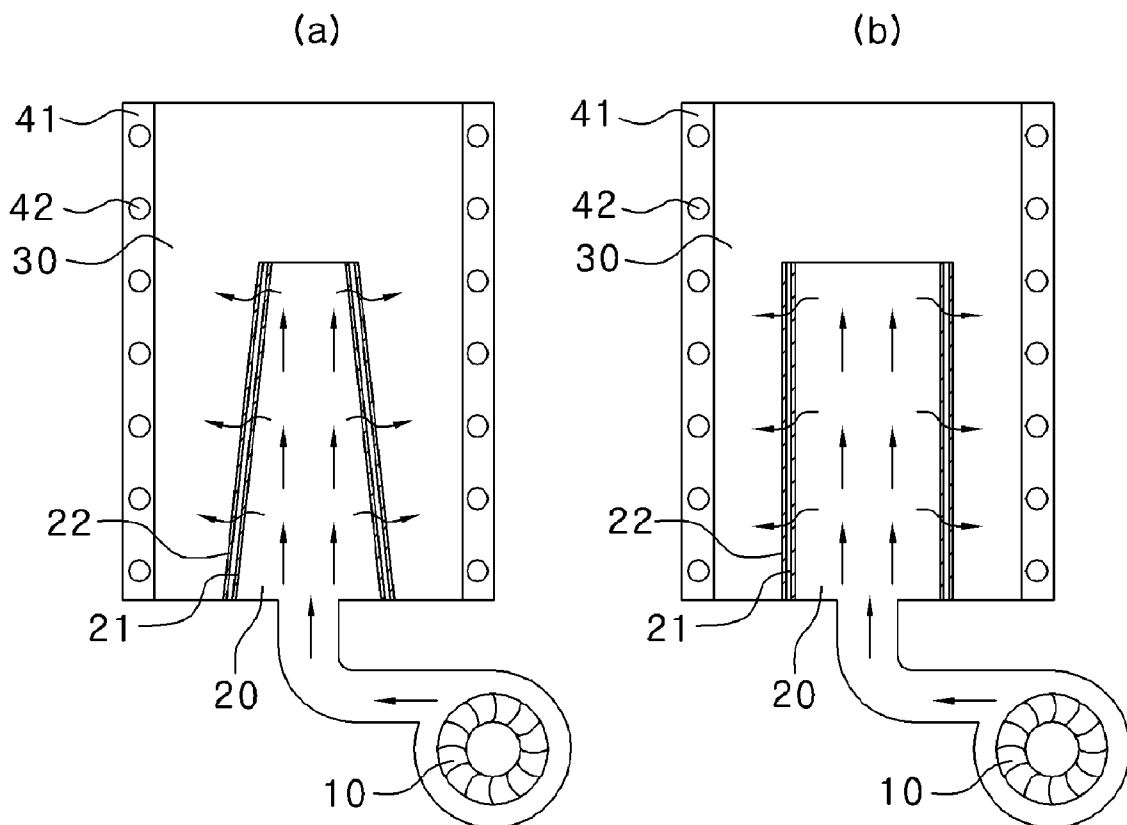
[48] Accordingly, when the open and close of the control valves 430 and 440 are controlled according to the load area, the combustion can be stably performed in the low load to the high load, thereby realizing the high turn-down ratio.

[49] As described above, while the invention has been described with reference to the embodiments, the embodiments are just illustrative. Therefore, it will be understood by those skilled in the art that various changes and modifications may be made without departing from the spirit and scope of the invention.

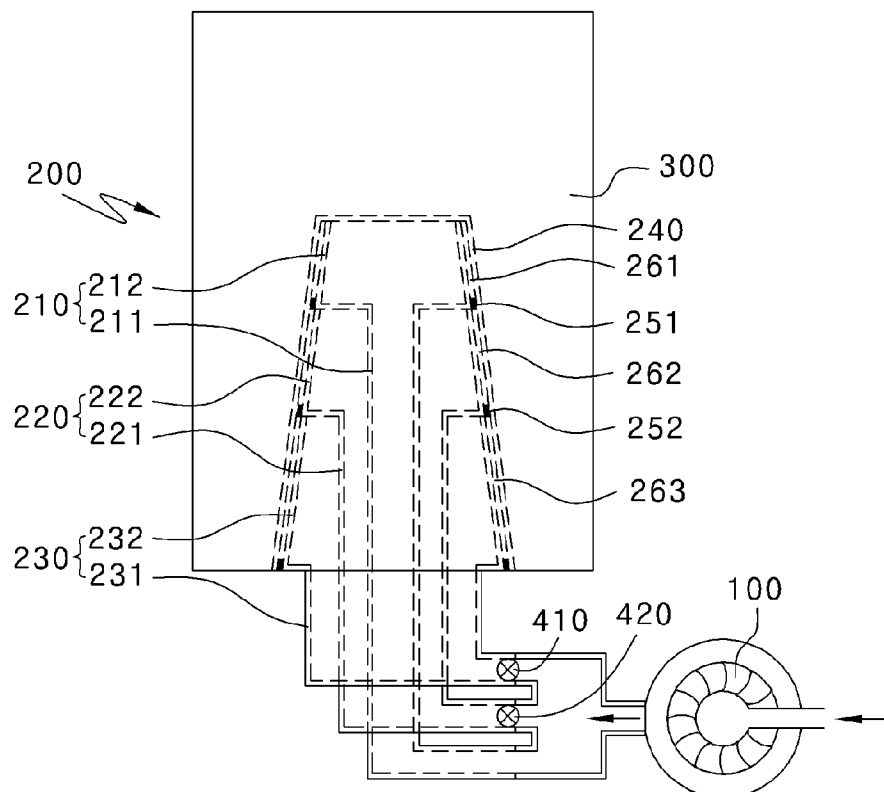
Claims

- [1] A combustion apparatus having a cylindrical burner of a multiple stage structure, the combustion apparatus comprising:
a distribution unit including a plurality of mixed gas pipes branched to a plurality of paths at an inlet through which mixed gas transferred by a blower is introduced and in which an inner pipe is installed in an inside of an outer pipe with being spaced from the outer pipe by a predetermined interval so that the mixed gas can pass in an inside of a combustion chamber, and a plurality of distribution plates having a cylindrical or tapered cylindrical thin plate with a plurality of holes positioned at an edge of each of the plurality of mixed gas pipes and installed in a vertical lamination structure; and
a porous plate having a plurality of flame holes, which is spaced from outer surfaces of the plurality of distribution plates to form a space between the porous plate and outer surfaces of the plurality of distribution plates.
- [2] The combustion apparatus of claim 1,
wherein the space is divided into spaces of the number corresponding to the number of the distribution plates by shielding members formed between the plurality of distribution plates and the porous plate.
- [3] The combustion apparatus of claim 1 or 2, further comprising:
a control valve for controlling to selectively supply the mixed gas through one or more paths among the plurality of distribution units.
- [4] The combustion apparatus of claim 1 or 2,
wherein air is transferred to the mixed gas pipes of the plurality of distribution units by a blower, and
control valves for controlling a selective supply of fuel to the plurality of mixed gas pipes are installed on fuel supply pipes branched from the mixed gas pipes.

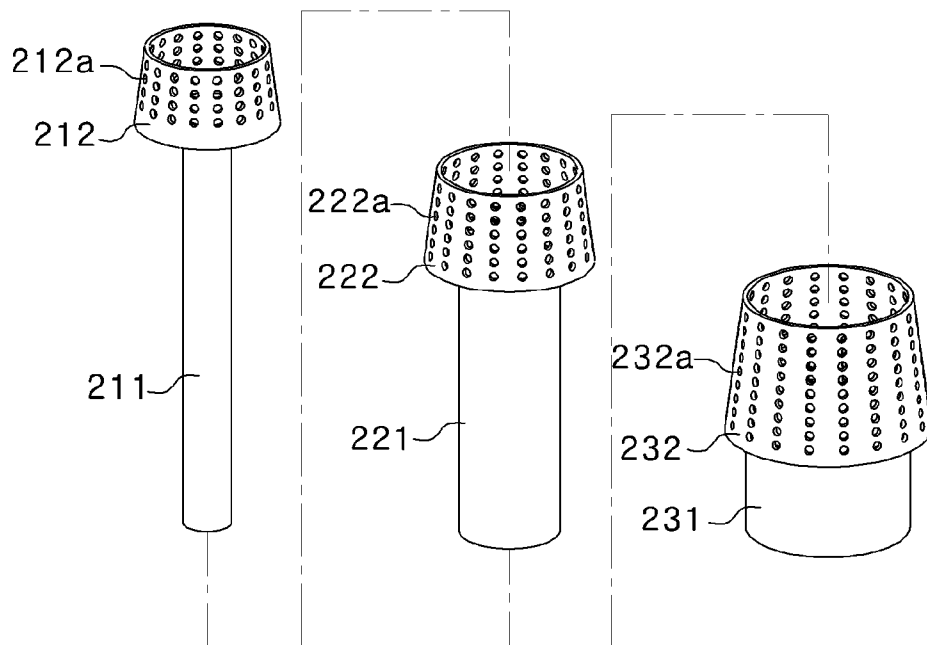
[Fig. 1]



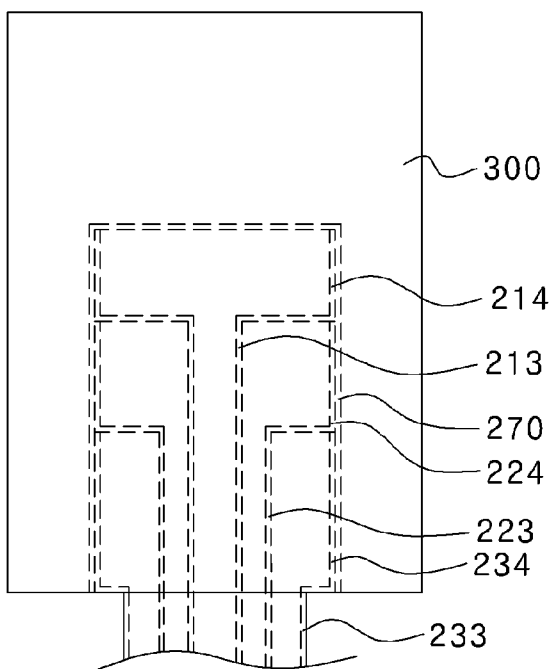
[Fig. 2]



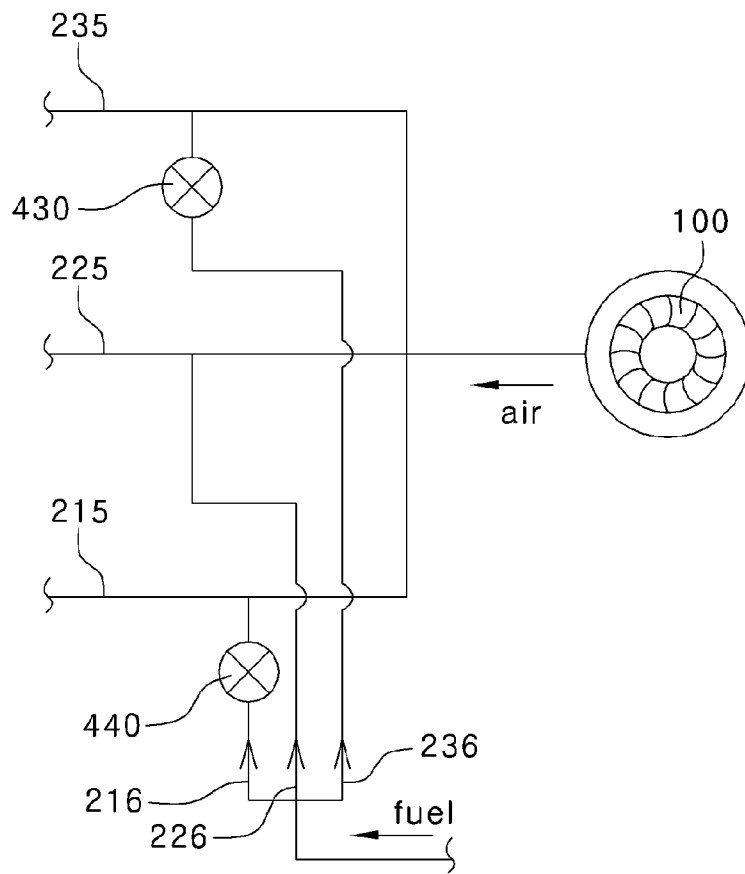
[Fig. 3]



[Fig. 4]



[Fig. 5]



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2008/002423**A. CLASSIFICATION OF SUBJECT MATTER****F23D 14/58(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 : F23D

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 model since 1975

Japanese utility models and applications for utility model since 1975

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

eKIPASS(KIPO internal) & Keywords: "combustion", "multiple", "stage", "distribution", "gas", and "pipe"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	KR 20-0351914 Y1 (YOO, J. H.) 04 June 2004 See claim 1 and figures 1-12	1-4
A	KR 20-1998-0062704 U (KIM, K. S.) 16 November 1998 See claims 1-4 and figures 1-5	1-4
A	KR 10-0179692 B1 (HAN-KOOK ENGINEERING CO., LTD.) 20 March 1999 See claims 1-5 and figures 1-3	1-4
A	KR 10-0495505 B1 (KYUNG DONG BOILER CO., LTD.) 14 June 2005 See claim 2 and figures 1-4	1-4
A	JP 09-250714 A (TOKYO GAS CO., LTD.) 22 September 1997 See claims 1-6 and figures 1-8	1-4

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

* Special categories of cited documents:

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

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Date of the actual completion of the international search

14 OCTOBER 2008 (14.10.2008)

Date of mailing of the international search report

14 OCTOBER 2008 (14.10.2008)

Name and mailing address of the ISA/KR

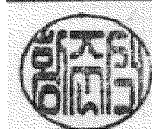
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/KR2008/002423

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