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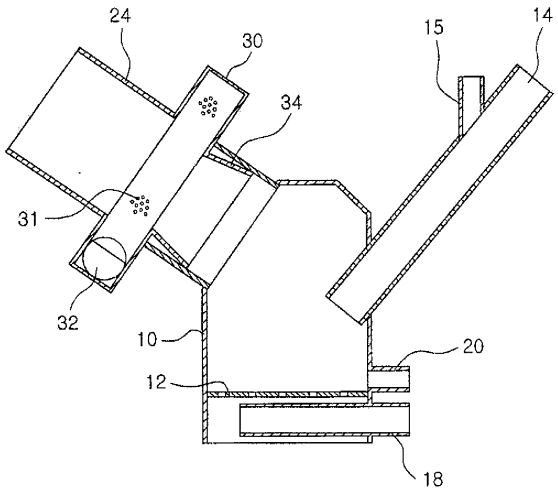
(54) COMBUSTION DEVICE

(57) The present invention pertains to a combustion device which is mounted to a wood boiler or the like and generates high thermal power while decreasing soot by means of a simple structure. According to the present invention, a combustion device comprises: a burner main body (10) having a porous plate (12) which is formed inside and on which injected fuel is stacked; a fuel injection hole (14) communicating with one side of the upper portion of the burner main body (10); a first air supply section (18) communicating with the lower portion of the porous plate (12) of the burner main body (10) and supplying air; an ignition section (20) formed to be adjacent to the porous plate (12) of the burner main body (10) and igniting the fuel; a flame discharge hole (24) extending from the other side of the upper portion of the burner main body (10) and discharging flame and heat caused by combustion; a cyclone section (30) formed in the shape of a short cylinder and expanding in a lateral direction from the outer peripheral surface of the flame discharge hole (24) so as to partially expand the flame discharge hole (24); and a second air supply section (32) communicating with one side of the periphery of the cyclone section (30) and supplying atmospheric air to the cyclone section (30) in a tangential direction.

FIG.2



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Description

Technical Field

[0001] The invention relates to a combustion device, and more particularly to a combustion device which has a simple structure and burns wood chips, wood pellets or other fuel to achieve high heat efficiency and strong thermal power and generate less soot or air pollution.

Background Art

[0002] The combustion devices or burners which use wood fuels such as sawdust, wood chips or wood pellets produced by extruding the wood chips are widely used on the boiler, stove, heater or hot air generator. To use the burner of this type, the user should pour the sawdust, wood chips or wood pellets on the porous plate or grate in the body of the burner and set fire and supply air on them. In this case, if the supplied air is not sufficient, the fuel will not be burned completely, and much soot will be generated and the sufficient thermal power may not be attained. Contrarily, if the air is supplied powerfully for sufficient oxygen, then the unburned particles of wood fuel on the grate or the soot of the incompletely burned fuel particles will fly and be scattered outside the burner by the powerful air blow, which results in the insufficient thermal power or low heat efficiency of the combustion device, and the surrounding air will be polluted owing to the scattered unburned dust or soot of the wood fuel.

Disclosure

Technical Problem

[0003] The invention is suggested to solve the above mentioned problems of the conventional combustion devices, and the object of the invention is to provide a new combustion device which has a simple structure and bums wood chips, wood pellets or other fuel to achieve high heat efficiency and strong thermal power and generate less soot or air pollution.

Technical Solution

[0004] To attain the above object of the invention, according to an aspect of the invention, there is provided a combustion device comprising a main body having a porous plate which is formed inside and on which injected fuel is stacked; a fuel injection section communicating with one side of the upper portion of the main body; a first air supply section communicating with the lower portion of the porous plate of the main body and supplying air; an ignition section formed to be adjacent to the porous plate and igniting the fuel; a flame discharge section extending from the other side of the upper portion of the main body and discharging the flame and heat caused by the combustion; a cyclone section formed in the shape of a short cylinder and expanding in a lateral direction from the periphery of the flame discharge section so as to partially expand the path of the flame discharge section; and a second air supply section communicating with one side of the periphery of the cyclone section and supplying air to the cyclone section in a tangential direction.

[0005] According to another aspect of the invention, the flame discharge section has a tapered inner portion between the main body and the cyclone section to restrict the backward air flow.

[0006] According to another aspect of the invention, the fuel injection section is formed in the shape of tube, and a backfire prevention air injection hole is formed on the periphery of the fuel injection section.

[0007] According to another aspect of the invention, small holes are formed on the periphery of the cyclone section to exhaust the ash generated after combustion.

Advantageous Effects

[0008] According to the invention, as the fuel stacked on the porous plate is burned by the air supplied through the first air supply section and the flame and heat are discharged through the flame discharge section, even though the air is supplied powerfully for sufficient oxygen through the first air supply section, so the unburned particles of fuel or the soot of the incompletely burned fuel are to fly and be discharged through the flame discharge section, they should be induced toward the cyclone section by the centrifugal force of the tangential air inflow through the second air supply section and circulate inside the cyclone section and are burned again by use of the oxygen in the additional air from the second air supply section, which results in almost complete combustion and prevents the unburned fuel particles or the soot of incomplete burned fuel from discharging through the flame discharge section. Therefore, with the combustion device according to the invention it is possible to achieve an effective combustion device having higher thermal power and higher heat efficiency with least environmental pollution owing to the discharged unburned fuel particles, soot or smoke.

[0009] In addition, as the flame discharge section has a tapered inner portion between the main body and the cyclone section to restrict the backward air flow, the circulating air in the cyclone section would flow to exhaust outward rather than flow backward into the main body, so that the flame and air should flow outward smoothly.

[0010] In addition, as the fuel injection section is formed in the shape of tube and a backfire prevention air injection hole is formed on the periphery of the fuel injection section, the flame in the main body of the burner is not prevented from backfiring through the fuel injection section.

[0011] In addition, as small holes are formed on the periphery of the cyclone section, the small amount of ashes created after the second burning of the incompletely burned fuel and soot could be emitted outward,

so the accumulation of the ash inside the cyclone section may be prevented.

Description of the Drawings

[0012] The above and other objects and advantages of the invention will become more apparent by describing a preferred embodiment with reference to the accompanying drawings in which:

FIG. 1 is a perspective view of the preferred embodiment of the invention.

FIG. 2 is a sectional view of the above embodiment of the invention.

FIG. 3 is an example of the hot air generator which the invention is applied to.

Best Mode

[0013] Hereinafter, a preferred embodiment of the invention will be described with reference to the accompanying drawings. FIG. 1 is a perspective view of the embodiment of the invention and FIG. 2 is a sectional view of the embodiment of the invention. As shown, the combustion device 2 of the invention comprises a case type main body 10, a porous plate 12 or grate placed horizontally in the lower part of the main body 10, and a first air supply section 18 formed beneath the porous plate 12 through which the outer air inflows. A fan or blower may be connected to the first air supply section 18 to supply the air into the main body 10. An ignition section 20 is formed above the first air supply section 18, or right above the porous plate 12. A proper ignition means may be attached to this ignition section 20 such as a gas torch or an electrical heater.

[0014] A fuel injection section 14 is formed on one side of the upper portion of the main body 10. This fuel injection section 14 may have various structures, but it is preferable to have space between the inlet of the fuel injection section 14 and the main body 10, so a lengthy tubular fuel injection section is desirable. A backfire prevention air injection hole 15 is formed in the periphery of the fuel injection section 14. This backfire prevention air injection hole 15 is connected to the fuel injection section 14 so as to direct the air toward the main body 10. Accordingly if the pressured air is injected into the backfire prevention air injection hole 15, the flame in the main body 10 is prevented from backfiring through the fuel injection section 14.

[0015] A cylindrical flame discharge section 24 extends from on the other side of the main body 24. This flame discharge section 24 discharges the flame and heat created in the main body 10 during the combustion of the fuel and introduces them to necessary utilities or a heat exchanger. In this preferred embodiment, a short cylindrical cyclone section 30 is formed at the middle portion of the flame discharge section 24, which expands in a radial direction from the periphery of the flame discharge section 24. Due to this cyclone section 30, the exhausting sectional area of the flame discharge section 24 is enlarged in a short distance. And a second air supply section 32 is formed on the periphery of the cyclone section 30, which communicates with cyclone section 30 in a tangential direction. A fan or blower may be connected to the second air supply section 32 to supply strong air flow. As a result, the strong circulating air flow is formed inside the cyclone section 30.

[0016] According to the above structure of the cyclone section 30, even though sufficient air may be supplied powerfully from the first air supply section 18 to the main body 10 for sufficient oxygen, and it may cause the unburned fuel particles and the soot of the incompletely burned fuel to be discharged from the flame discharge section 24, the centrifugal force due to the circulating air created in the cyclone section 30 due to the air flow from the second air supply section 32 will induce them toward the periphery of the cyclone section 30, and those fuel particles or soot will be retained and circulate in the cyclone section 30 and will be secondly burned with the refilled fresh air supplied from the second air supply section 32. Therefore, the unburned fuel particles or the soot of the incompletely burned fuel may not be discharged directly from the flame discharge section 24, but they will be burned out secondly by the additional fresh air from the second air supply section 32, which will result in the almost complete combustion of the burner and the least emission of air polluting particles such as unburned fuel particles or soot of the incompletely burned fuel.

[0017] According to the invention, the flame discharge section 24 is provided with a tapered inner portion 34 at the inner side of the cyclone section 30 facing the main body 10 to restrict the backward air flow. The tapered inner portion 34 reduces the sectional area of the flame discharge section 21 gradually from the main body 10 to the inlet of the cyclone section 30, so that when the circulating air exits from the cyclone section 30, the exiting air may be restricted to flow backwardly into the main body 10, but it may be smoothly introduced to flow toward the outside of the flame discharge section 24.

[0018] And, plural small holes 31 are formed on the periphery of the cyclone section 30, which enable the ashes created during the secondly burning of the unburned fuel particles or incompletely burned fuel in the cyclone section 30 by the additional fresh air from the second air supply section 32 to be emitted from the cyclone section 30. Therefore, the burned residuals such as ashes may not remain in the cyclone section 30.

[0019] In addition, the fuel injection section 14 is formed in the shape of a tube, and a backfire prevention air injection hole 15 is formed on the periphery of the fuel injection section 14. The backfire prevention air injection hole 15 is connected to the fuel injection section 14 inclining toward the main body 10. By injecting the pressured air, the flame in the main body 10 is prevented from backfiring through the fuel in the tubular fuel injection section 14. Preferably regulating valves may be attached

at the first air supply section 18, the second air supply section 32 and the backfire prevention air injection hole 15 to control the volume of the air flow.

[0020] FIG. 3 shows the example of the hot air generator 1 which uses the combustion device of the invention as heat source. The hot air exhausted from the combustion device 2 of the invention is induced through the heat exchanger 4 comprising of fin tubes and delivered to demanding facilities. The invention may be applied as various uses such as a hot air generator, a boiler, heater, stove and others.

[0021] As described above, the invention has been described with respect to particularly preferred embodiments. However, the invention is not limited to the above embodiments, and it is possible for one who has an ordinary skill in the art to make various modifications and variations, without departing off the spirit of the invention. Thus, the protective scope of the invention is not defined within the detailed description thereof but is defined by the claims to be described later and the technical spirit of the invention.

Claims

1. A combustion device comprising a main body having a porous plate which is formed inside and on which injected fuel is stacked; a fuel injection section communicating with one side of the upper portion of the main body; a first air supply section communicating with the lower portion of the porous plate of the main body and supplying air; an ignition section formed to be adjacent to the porous plate and igniting the fuel; a flame discharge section extending from the other side of the upper portion of the main body and discharging the flame and heat caused by the combustion; a cyclone section formed in the shape of a short cylinder and expanding in a lateral direction from the periphery of the flame discharge section so as to partially expand the path of the flame discharge section; and a second air supply section communicating with one side of the periphery of the cyclone section and supplying air to the cyclone section in a tangential direction.

2. The combustion device of claim 1, wherein the flame discharge section has a tapered inner portion between the main body and the cyclone section to restrict the backward air flow.

3. The combustion device of claim 1 or 2, wherein the fuel injection section is formed in the shape of a tube, and a backfire prevention air injection hole is formed on the periphery of the fuel injection section.

4. The combustion device of claim 1 or 2, wherein small holes are formed on the periphery of the cyclone section to exhaust the ash generated after combustion.

FIG.1

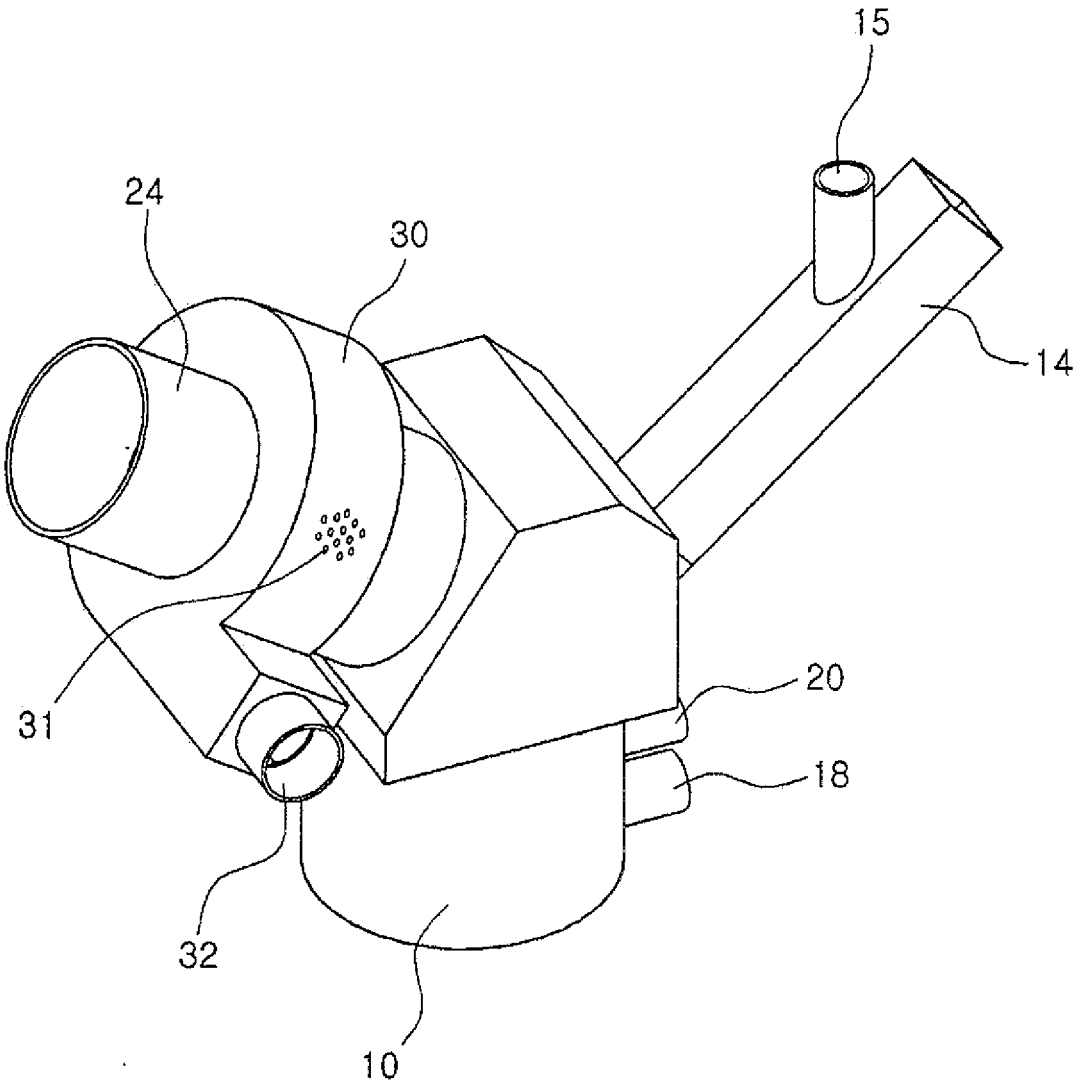


FIG.2

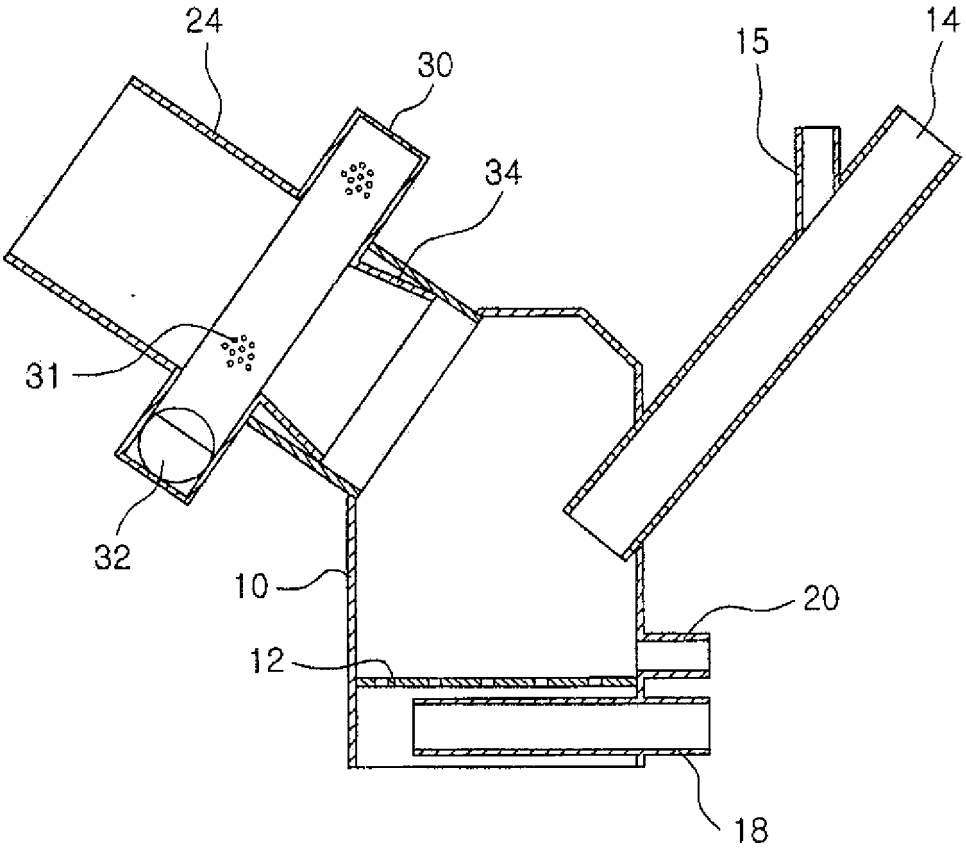
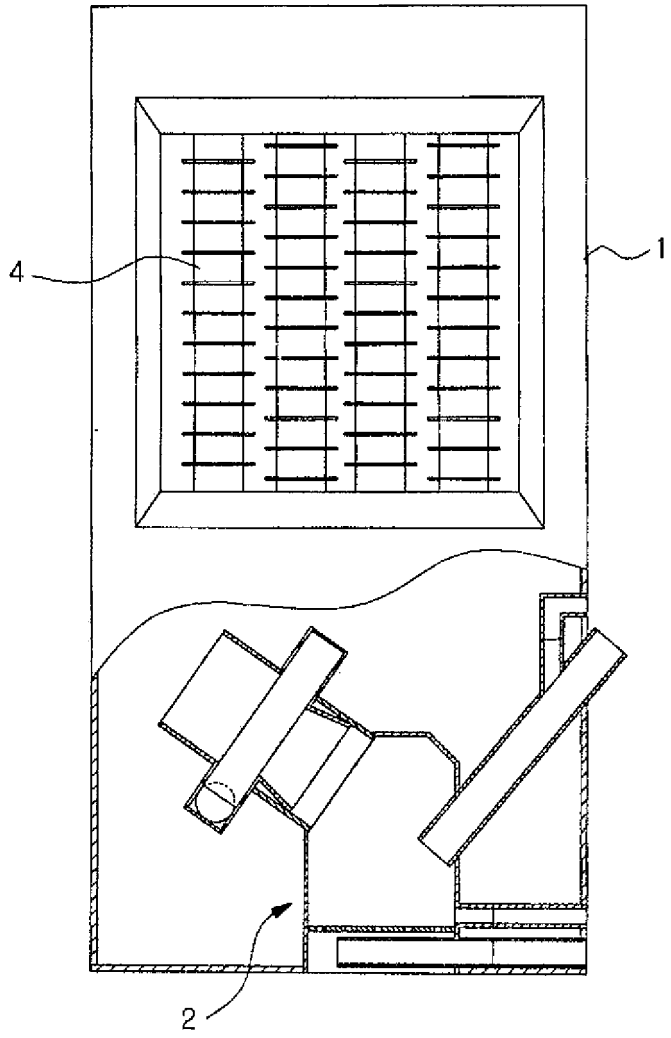


FIG.3



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2011/007335

A. CLASSIFICATION OF SUBJECT MATTER

F23B 90/00(2011.01)i, F23D 1/02(2006.01)i, F23L 1/00(2006.01)i, F23L 9/00(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)

F23B 90/00; F24B 1/00; F23G 5/00; F23C 1/02; F24B 13/00

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: IPC as above
Japanese Utility models and applications for Utility models: IPC as above

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

eKOMPASS (KIPO internal) & Keywords: "cyclone", "back fire", "perforate plate"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	KR 10-0765689 B1 (CHAE, HYUK) 12 October 2007 See figures 2, 3.	1-4
Y	JP 2005-155982 A (WAKO KIKAI KOGYO KK) 16 June 2005 See paragraph [39], figures 1-3.	1-4
A	JP 2007-178057 A (KANEKO AGRICULT MACH CO LTD) 12 July 2007 See figure 1.	1-4

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"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
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12 JUNE 2012 (12.06.2012)	**12 JUNE 2012 (12.06.2012)**
Name and mailing address of the ISA/KR Korean Intellectual Property Office Government Complex-Daejeon, 139 Seonsa-ro, Daejeon 302-701, Republic of Korea Facsimile No. 82-42-472-7140	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/KR2011/007335

Patent document cited in search report	Publication date	Patent family member	Publication date
KR 10-0765689 B1	12.10.2007	NONE	
JP 2005-155982 A	16.06.2005	JP 4618580 B2	26.01.2011
JP 2007-178057 A	12.07.2007	JP 4588628 B2	01.12.2010

Form PCT/ISA/210 (patent family annex) (July 2009)