Embodiments of the present invention provide a combustion device and a boiler that can reduce generation of greenhouse gases.

Solution to Problem

[0006]

According to a first aspect of the present invention, there is provided a combustion device that supplies a fuel into a combustion chamber in which a fluid material is fluidized and that combusts the fuel, the device including: a carbon-free fuel supply unit that supplies a carbon-free fuel which is a fluid and does not contain carbon into the combustion chamber; a solid fuel supply unit that supplies a solid fuel into the combustion chamber; a fluid permeation portion that is provided at a bottom portion of the combustion chamber and through which a fluid permeates; a fluidizing fluid supply unit that supplies air which fluidizes the fluid material and the solid fuel into the combustion chamber via the fluid permeation portion, wherein the carbon-free fuel supply unit supplies the carbon-free fuel, which is the fluid, together with the air supplied by the fluidizing fluid supply unit into the combustion chamber via the fluid permeation portion.

[0007]

According to a second aspect of the present invention, there is provided a boiler comprising: a combustion section that supplies a fuel into a combustion chamber in which a fluid material is fluidized and that combusts the fuel; a carbon-free fuel supply unit that supplies a carbon-free fuel which is a fluid and does not contain carbon into the combustion chamber; a solid fuel supply unit that supplies a solid fuel into the combustion chamber; a fluid permeation portion that is provided at a bottom portion of the combustion chamber and through which a fluid permeates; a fluidizing fluid supply unit that supplies air which fluidizes the fluid material and the solid fuel into the combustion chamber via the fluid permeation portion; and a vapor generation section that generates vapor from water with heat generated by the combustion section, wherein the carbon-free fuel supply unit supplies the carbon-free fuel, which is the fluid, together with the air supplied by the fluidizing fluid supply unit into the combustion chamber via the fluid permeation portion.

[0007a]

According to a third aspect of the present invention, there is provided a combustion method of supplying a fuel into a combustion chamber in which a fluid material is fluidized and combusting the fuel, the method including: a carbon-free fuel supply step of supplying a carbon-free fuel that is a fluid and does not contain carbon into the combustion chamber; a solid fuel supply step of supplying a solid fuel into the combustion chamber; and a fluidizing fluid supply step of supplying air which fluidizes the fluid material and the solid fuel into the combustion chamber via a fluid permeation portion, the fluid permeation portion being provided at a bottom portion of the combustion chamber and through which a fluid permeates, wherein the carbon-free fuel supply step supplies the carbon-free fuel, which is the fluid, together with the air supplied by the fluidizing fluid supply step into the combustion chamber via the fluid permeation portion.

[0008]

Any combination of the components described above and substitutions of expressions of the present invention between methods, devices, systems, recording media, computer programs, and the like can also be effective as aspects of the present invention.

Advantageous Effects of Invention

[0009]

According to embodiments of the present invention, generation of greenhouse gases can be reduced by supplying the carbon-free fuel.

Brief Description of Drawings

[0010]

Fig. 1 shows an overall configuration of a circulating fluidized bed boiler (CFB boiler).

Fig. 2 schematically shows a configuration example of a start-up burner that is a hybrid fuel supply unit.

Description of Embodiments

[0011]

Hereinafter, an embodiment for carrying out the present invention will be described in detail with reference to the drawings. In the description and drawings, the same or equivalent components, members, and processing will be assigned with the same reference symbols, and

The mode switching unit 166C switches to the second mode when the CFB boiler is started up and switches to the first mode after the start-up of the CFB boiler. When the CFB boiler is started up, a fluid material such as silica sand for forming the fluidized layer A is supplied from the fluid material supply unit 14 into the furnace 11. In this case, a solid fuel such as coal may be supplied from the solid fuel supply unit 15 together into the furnace 11, or a carbon-free fuel such as ammonia and hydrogen may be supplied from the carbon-free fuel supply units 16A, 16B, and 16D, excluding the carbon-free fuel supply unit 16C, together into the furnace 11. The jetting device 162C that operates in the second mode when the CFB boiler is started up heats the fluid material supplied from the fluid material supply unit 14 with flame caused by combustion of heavy oil. Herein, since the jetting device 162C is provided to be inclined downward, the surface of the fluidized layer A formed by the fluid material is directly heated, and temperatures of the fluidized layer A and the inside of the furnace 11 efficiently increase. In this manner, the start-up burner 16C is also called an on-sand burner since the sand-like fluidized layer A is heated from above.

[0039]

CLAIMS

1. A combustion device that supplies a fuel into a combustion chamber in which a fluid material is fluidized and that combusts the fuel, the device comprising:

a carbon-free fuel supply unit that supplies a carbon-free fuel which is a fluid and does not contain carbon into the combustion chamber;

a solid fuel supply unit that supplies a solid fuel into the combustion chamber;

a fluid permeation portion that is provided at a bottom portion of the combustion chamber and through which a fluid permeates;

a fluidizing fluid supply unit that supplies air which fluidizes the fluid material and the solid fuel into the combustion chamber via the fluid permeation portion,

wherein the carbon-free fuel supply unit supplies the carbon-free fuel, which is the fluid, together with the air supplied by the fluidizing fluid supply unit into the combustion chamber via the fluid permeation portion.

2. The combustion device according to claim 1, further comprising:

a carbon containing fuel supply unit that supplies a carbon containing fuel which contains carbon into the combustion chamber.

3. The combustion device according to claim 2,

wherein the carbon-free fuel supply unit and the carbon containing fuel supply unit are configured as an integral hybrid fuel supply unit, and

the hybrid fuel supply unit includes a carbon-free fuel receiving unit that receives the carbon-free fuel and a carbon containing fuel receiving unit that receives the carbon containing fuel.

4. The combustion device according to claim 3,

wherein the hybrid fuel supply unit further includes a mode switching unit that switches between a first mode in which the carbon-free fuel is supplied into the combustion chamber and a second mode in which the carbon containing fuel is supplied into the combustion chamber.

5. The combustion device according to claim 4,

wherein the mode switching unit switches to the second mode when the combustion device is started up and switches to the first mode after the start-up of the combustion device.

6. The combustion device according to any one of claims 1 to 5,

wherein the carbon-free fuel supply unit supplies the carbon-free fuel from a side of the fluid material of a bottom portion of the combustion chamber.

7. The combustion device according to claim 6,

wherein the carbon-free fuel supply unit is a burner that combusts the carbon-free fuel on a side of the fluid material of the bottom portion of the combustion chamber.

8. The combustion device according to claim 7,

wherein the burner is provided at a height of less than 1.5 m from a bottom surface of the combustion chamber.

9. The combustion device according to claim 7,

wherein the burner is provided at a height of 1.5 m or more from a bottom surface of the combustion chamber.

10. The combustion device according to any one of claims 1 to 5,

wherein the carbon-free fuel supply unit supplies the carbon-free fuel to a plurality of positions having different heights in the combustion chamber.

11. The combustion device according to any one of claims 1 to 5,

wherein the carbon-free fuel is a non-solid fuel.

12. The combustion device according to claim 11,

wherein the non-solid fuel is at least one of ammonia and hydrogen.

13. The combustion device according to any one of claims 1 to 5, further comprising:

a fluid material circulation section that collects the fluid material which has come out of the combustion chamber and that returns the fluid material into the combustion chamber.

14. The combustion device according to any one of claims 1 to 5,

wherein the combustion device is a circulating fluidized bed boiler.

15. A boiler comprising:

a combustion section that supplies a fuel into a combustion chamber in which a fluid material is fluidized and that combusts the fuel;

a carbon-free fuel supply unit that supplies a carbon-free fuel which is a fluid and does not contain carbon into the combustion chamber;

a solid fuel supply unit that supplies a solid fuel into the combustion chamber;

a fluid permeation portion that is provided at a bottom portion of the combustion chamber and through which a fluid permeates;

a fluidizing fluid supply unit that supplies air which fluidizes the fluid material and the solid fuel into the combustion chamber via the fluid permeation portion; and

a vapor generation section that generates vapor from water with heat generated by the combustion section,

wherein the carbon-free fuel supply unit supplies the carbon-free fuel, which is the fluid, together with the air supplied by the fluidizing fluid supply unit into the combustion chamber via the fluid permeation portion.

16. A combustion method of supplying a fuel into a combustion chamber in which a fluid material is fluidized and combusting the fuel, the method comprising:

a carbon-free fuel supply step of supplying a carbon-free fuel that is a fluid and does not contain carbon into the combustion chamber;

a solid fuel supply step of supplying a solid fuel into the combustion chamber; and

a fluidizing fluid supply step of supplying air which fluidizes the fluid material and the solid fuel into the combustion chamber via a fluid permeation portion, the fluid permeation portion being provided at a bottom portion of the combustion chamber and through which a fluid permeates,

wherein the carbon-free fuel supply step supplies the carbon-free fuel, which is the fluid, together with the air supplied by the fluidizing fluid supply step into the combustion chamber via the fluid permeation portion.