[0028]

A carbon-free fuel supply unit 16C according to a third provision mode is configured integrally with a start-up burner to be described later and supplies ammonia, which is a carbon-free fuel, from above the fluidized layer A downward toward a surface (upper surface) of the fluidized layer A. The ammonia supplied from the carbon-free fuel supply unit 16C is mixed with a fluid material, a solid fuel, and pressurized air fluidized on the surface of the fluidized layer A and is efficiently combusted. Herein, by a combination of at least two of the carbon-free fuel supply unit 16A that supplies ammonia from below the fluidized layer A, the carbon-free fuel supply unit 16B that supplies ammonia from the side of the fluidized layer A, and the carbon-free fuel supply unit 16C that supplies ammonia from above the fluidized layer A, the ammonia can be jetted to the fluid material, the solid fuel, and the pressurized air fluidized at each part of the fluidized layer A from different directions and be efficiently mixed, so that ammonia known to be flame-retardant can be efficiently combusted at each part of the fluidized layer A.

[0029]

The carbon-free fuel supply unit 16C includes a carbon-free fuel storage unit 161C that stores ammonia in a non-solid state

such as a gas and a liquid and a jetting device 162C that jets the ammonia stored in the carbon-free fuel storage unit 161C in a non-solid state such as a gas and a liquid into the furnace 11. Herein, the jetting device 162C also functions as a start-up burner to be described later and is provided to be inclined downward to be capable of directly heating the surface of the fluidized layer A with flame jetted from a tip thereof. Although a specific configuration will be described later, the CFB boiler is generally provided with a start-up burner for start-up, and the existing start-up burner can also be used as the carbon-free fuel supply unit 16C for ammonia supply in the present embodiment.

[0030]

A position of the jetting port that is the tip of the jetting device 162C of the carbon-free fuel supply unit 16C is determined by a position of the existing start-up burner. For example, a typical height of the start-up burner is approximately 2.0 m in a case where the height of the furnace 11 is approximately 30 m and is positioned above the fluidized layer A having a height of approximately 1.5 m. The carbon-free fuel supply unit 16C may be provided separately from the start-up burner, or the height of the jetting port of the jetting device 162C in this case can be freely set. For example, it is preferable that the jetting port of the jetting device 162C is

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 a sand-like 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 does not contain carbon into the combustion chamber.

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, further comprising:

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

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

wherein the carbon-free fuel supply unit supplies the carbon-free fuel to the fluid material on the fluid permeation portion and supplies the carbon-free fuel, which is the fluid, together with the air into the combustion chamber via the fluid permeation portion.

7. 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.

8. The combustion device according to claim 7,

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.

9. The combustion device according to claim 8,

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

10. The combustion device according to claim 8,

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

11. 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.

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

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

13. The combustion device according to claim 12,

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

14. 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.

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

wherein the combustion device is a circulating fluidized bed boiler.

16. 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 does not contain carbon into the combustion chamber; and

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

17. 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 does not contain carbon into the combustion chamber.