atmosphere to zero and capable of contributing to prevention of global warming.

Solution to Problem

[0006] According to a first aspect of the present invention, there is provided a treatment apparatus for a raw material, comprising: a fluidized-bed furnace having a pyrolysis chamber and a combustion chamber therein, the pyrolysis chamber and the combustion chamber being separated by a partition wall inside the fluidized-bed furnace; an electrolysis device configured to electrolyze water to generate hydrogen and oxygen; a methanation reactor configured to produce methane from carbon dioxide discharged from the combustion chamber and the hydrogen; a first fluidizing-gas supply line configured to supply a first fluidizing gas to the pyrolysis chamber; and a second fluidizing-gas supply line configured to introduce a second fluidizing gas to the combustion chamber, the second fluidizing gas including the oxygen and a part of the carbon dioxide; a hydrogen holder configured to store the hydrogen generated by the electrolysis device, wherein the hydrogen holder is arranged between the electrolysis device and the methanation reactor; a hydrogen flow-rate control valve located between the hydrogen holder and the methane reactor; an oxygen holder configured to store the oxygen generated by the electrolysis device, wherein the oxygen holder is arranged between the electrolysis device and the combustion chamber; an oxygen flow-rate control valve located between the oxygen holder and the combustion chamber; a controller configured to regulate an opening degree of the hydrogen flow-rate control valve based on a measured value of the flow rate of the carbon dioxide flowing into the methanation reactor to thereby control a flow rate of the hydrogen delivered to the methanation reactor, wherein the controller is further configured to regulate an opening degree of the oxygen flow-rate control valve and thus a flow rate of the oxygen to the combustion chamber so as to maintain a temperature in the combustion chamber within a predetermined range.

[0006A] There is disclosed a treatment apparatus for a raw material, comprising: a fluidized-bed furnace having a pyrolysis chamber and a combustion chamber formed therein, the pyrolysis chamber and the combustion chamber being separated by a partition wall inside the

fluidized bed furnace; an electrolysis device configured to electrolyze water to generate hydrogen and oxygen; a methanation reactor configured to produce methane from carbon dioxide discharged from the combustion chamber and the hydrogen; a first fluidizing-gas supply line configured to supply a first fluidizing gas to the pyrolysis chamber; a second fluidizing-gas supply line configured to introduce a second fluidizing gas to the combustion chamber, the second fluidizing gas including the oxygen and a part of the carbon dioxide; an oxygen holder configured to store the oxygen generated by the electrolysis device, the oxygen holder being arranged between the electrolysis device and the combustion chamber; an oxygen flow-rate control valve located between the oxygen holder and the combustion chamber; and a controller configured to regulate an opening degree of the oxygen flow-rate control valve and thus a flow rate of the oxygen to the combustion chamber so as to maintain a temperature in the combustion chamber within a predetermined range.

[0007] In an embodiment, the electrolysis device is electrically connected to a CO_2-free power generator.

In an embodiment, the first fluidizing-gas supply line comprises an oxygen-free-gas supply line configured to supply oxygen-free gas as the first fluidizing gas into the pyrolysis chamber.

In an embodiment, the treatment apparatus further comprises a hydrogen holder configured to store the hydrogen generated by the electrolysis device, wherein the hydrogen holder is arranged between the electrolysis device and the methanation reactor.

In an embodiment, the treatment apparatus further comprises an oxygen holder configured to store the oxygen generated by the electrolysis device, wherein the oxygen holder is arranged between the electrolysis device and the combustion chamber.

[0008] In an embodiment, there is provided a method of treating a raw material using a fluidized-bed furnace having a pyrolysis chamber and a combustion chamber therein, the pyrolysis chamber and the combustion chamber being partitioned by a partition wall, said method comprising: electrolyzing water to generate hydrogen and oxygen; supplying a first fluidizing gas to the pyrolysis chamber, while moving a fluidized medium in the

CLAIMS

[Claim 1] A treatment apparatus for a raw material, comprising:

a fluidized-bed furnace having a pyrolysis chamber and a combustion chamber therein, the pyrolysis chamber and the combustion chamber being separated by a partition wall inside the fluidized-bed furnace;

an electrolysis device configured to electrolyze water to generate hydrogen and oxygen;

a methanation reactor configured to produce methane from carbon dioxide discharged from the combustion chamber and the hydrogen;

a first fluidizing-gas supply line configured to supply a first fluidizing gas to the pyrolysis chamber; and

a second fluidizing-gas supply line configured to introduce a second fluidizing gas to the combustion chamber, the second fluidizing gas including the oxygen and a part of the carbon dioxide;

a hydrogen holder configured to store the hydrogen generated by the electrolysis device, wherein the hydrogen holder is arranged between the electrolysis device and the methanation reactor;

a hydrogen flow-rate control valve located between the hydrogen holder and the methane reactor;

an oxygen holder configured to store the oxygen generated by the electrolysis device, wherein the oxygen holder is arranged between the electrolysis device and the combustion chamber;

an oxygen flow-rate control valve located between the oxygen holder and the combustion chamber;

a controller configured to regulate an opening degree of the hydrogen flow-rate control valve based on a measured value of the flow rate of the carbon dioxide flowing into the methanation reactor to thereby control a flow rate of the hydrogen delivered to the methanation reactor,

wherein the controller is further configured to regulate an opening degree of the oxygen flow-rate control valve and thus a flow rate of the oxygen to the combustion chamber so as to maintain a temperature in the combustion chamber within a predetermined range.

[Claim 2] The treatment apparatus according to claim 1, wherein the electrolysis device is electrically connected to a CO_2-free power generator.

[Claim 3] The treatment apparatus according to claim 1, wherein the first fluidizing-gas supply line comprises an oxygen-free-gas supply line configured to supply oxygen-free gas as the first fluidizing gas into the pyrolysis chamber.

[Claim 4] The treatment apparatus according to claim 1, further comprising:

a product-gas delivery line coupled to a product-gas outlet of the pyrolysis chamber; and

a product-gas return line extending from the product-gas delivery line to the first fluidizing-gas supply line.

[Claim 5] The treatment apparatus according to claim 1, further comprising:

a methane delivery line configured to deliver the methane produced by the methane reactor; and

a methane return line extending from the methane delivery line to the first fluidizing-gas supply line.