agglomeration of a fluid medium (for example, bottom ash) to prevent poor flow from occurring, and enable smooth and stable operation. However, it is not easy to constantly control the temperature of the fluidized bed to 600 to 750°C. In addition, since the shape of the fluid medium still tends to be large even when the present technique is used, a considerable amount of supply of a new fluid medium such as sand is required. Therefore, there is still room for improvement in terms of cost from the viewpoint of the fluid medium.

[0007]

The technique of PTL 2 includes a cooling water tank that separates deposits from a fluid medium by charging a fluid medium such as bottom ash extracted from the fluidized bed of a combustion furnace into water and cooling the fluid medium. Although it is possible to efficiently separate the deposits from the fluid medium by this technique, there is still room for improvement from the viewpoint of efficiently suppressing poor flow of the highly alkaline-containing biomass fuel.

[0008]

Embodiments of the present invention provide a fluid medium regeneration device, a combustion system, and a combustion method of a fluidized bed combustion furnace capable of efficiently separating a coating layer from a

fluid medium in order to solve the above-described problems.

Solution to Problem

[0009]

That is, embodiments of the present invention are as shown below.

[0010]

According to a first aspect of the present invention, there is provided a fluid medium regeneration device for a fluidized bed, including: a cooling unit that is supplied with at least, a fluid medium recovered from the fluidized bed of a fluidized bed combustion furnace is supplied, cools the fluid medium by being brought into contact with a liquid medium having a boiling point of −20°C or lower under 1 atmospheric pressure, and separates a coating layer from the fluid medium.

In an embodiment of the above aspect of the fluid medium regeneration device, the liquid medium is at least one of liquid air, liquid nitrogen, and liquid oxygen.

In an embodiment of the above aspect, the fluid medium regeneration device further includes: sorting means that sorts the fluid medium exhausted from the cooling unit, and the coating layer.

In an embodiment of the above aspect of the fluid medium regeneration device, a temperature of the fluid medium recovered from the fluidized bed of the fluidized bed combustion furnace is equal to or lower than a melting point of the coating layer.

In an embodiment of the above aspect of the fluid medium regeneration device, the cooling unit includes an intermediate cooling unit that further cools the fluid medium, and brings the fluid medium cooled by the intermediate cooling unit into contact with the liquid medium.

In an embodiment of the above aspect of the fluid medium regeneration device, a return unit that recovers the fluid medium from which the coating layer has been separated, and returns the fluid medium having a particle size adjusted to 50 to 1,000 μm to the fluidized bed is further provided.

According to a second aspect of the present invention, there is provided a combustion system including: a fluidized bed combustion furnace; and the fluid medium regeneration device for a fluidized bed according to the first aspect.

According to a third aspect of the present invention, there is provided a combustion method of a fluidized bed combustion furnace using an alkaline-containing fuel, the

combustion method including: recovering the fluid medium from the fluidized bed of the fluidized bed combustion furnace, cooling the fluid medium recovered from the fluidized bed by being brought into contact with a liquid medium having a boiling point of −20°C or lower under 1 atmospheric pressure, and separating a coating layer from the fluid medium.

In an embodiment of the above aspect of the combustion method, the liquid medium is at least one of liquid air and liquid nitrogen.

In an embodiment of the above aspect of the combustion method, the fluid medium and the coating layer are sorted.

In an embodiment of the above aspect of the combustion method, a temperature of the fluid medium recovered from the fluidized bed of the fluidized bed combustion furnace is equal to or lower than a melting point of the coating layer.

In an embodiment of the above aspect of the combustion method, the fluid medium is cooled by an intermediate cooling unit and then brought into contact with the liquid medium.

In an embodiment of the above aspect of the combustion method, the fluid medium from which the coating layer has been separated is recovered, and the fluid medium having a

particle size adjusted to 50 to 1,000 μm is returned to the fluidized bed.

Advantageous Effects of Invention

[0011]

According to embodiments of the present invention, it is possible to provide a fluid medium regeneration device, a combustion system, and a combustion method of a fluidized bed combustion furnace capable of efficiently separating a coating layer from a fluid medium.

Brief Description of Drawings

[0012]

Fig. 1 is a schematic view showing a combustion system including a fluid medium regeneration device for a fluidized bed according to a first embodiment of the present invention.

Figs. 2A and 2B are schematic views for describing a mechanism for forming agglomerates, Fig. 2A is a schematic view showing a coating induction mechanism by agglomerates, and Fig. 2B is a schematic view showing an agglomerate melting induction mechanism.

Fig. 3 is a K_2O–SiO_2 state diagram.

Fig. 4 is a schematic view showing a combustion system including a fluid medium regeneration device for a

sorting device 12 may be composed of either a single stage or a multi-stage.

[0040]

The return mechanism 13 is a mechanism that recovers the fluid medium Fa from which the coating layer has been separated and returns the fluid medium Fa to the fluidized bed. In addition, the return mechanism 13 is provided with a particle size adjusting device 13A and a return line 13B that adjust a particle size of the fluid medium Fa.

[0041]

The sorted fluid medium Fa conveyed from the sorting device 12 to the return mechanism 13 is first supplied to the particle size adjusting device 13A. A sieve is installed in the particle size adjusting device 13A as particle size adjusting means, and the particle size of the fluid medium Fa is adjusted. The particle size adjusting device 13A can adjust the particle size of the fluid medium Fa to, for example, 50 to 1,000 μm from the viewpoint of further removing foreign matter from the fluid medium Fa and increasing the purity (quality) of the fluid medium Fa returned into the combustion furnace 2.

[0042]

The mesh size of the sieve provided in the particle size adjusting device 13A is not particularly limited, but in order to remove foreign matter having a size of 1,000 μm

between the coating layer and the fluid medium Fa. In particular, the present invention can be suitably applied to a case where a fuel containing a highly alkaline component is used.

[0065]

In addition, the above-described intermediate cooling unit is not limited to the cooling medium flow path 23 described in the second embodiment, and may have an aspect of cooling the fluid medium Fa by, for example, air cooling. In addition, the heat recovered in the cooling medium flow path 23 may be used in other facilities. In addition, the return line 13B does not necessarily have to be provided.

[0066]

Further, in the combustion systems of the first and second embodiments, the configuration in which the liquid medium LM is supplied from the supply pipe 11A to the screw conveyance machine 11 and comes into contact with the fluid medium Fa in the screw conveyance machine 11 has been described, but the present invention is not limited to this aspect. For example, as in a fluid medium regeneration device 31 of a combustion system 30 shown in Fig. 6, a cooling unit 33 to which the liquid medium LM is separately supplied may be provided on the downstream side of a screw conveyance machine 32. The fluid medium regeneration device