High-efficiency pure oxygen circulation fluidized bed cogeneration technology

High-Efficiency Oxy-fuel Circulating Fluidized Bed Co-generation Boiler Technology

Patent title	Fluidized bed cogeneration technology using low-grade composite fuel	**Inventor**	Korea Institute of Energy Research/ Seon Do-won and ten more
Patent application No.	KR 10-2011-0084152 (11.08.23) / 10-1273312 (13.06.04)	**Authority status**	Registered

Technicality

Technology overview

The technology is a technology which provides the basis for designing a circulation fluidized bed boiler and an integrated package, and relates to a fluid bed combustion device, and in which in order to prevent particles injected into a solid fuel reactor from flowing backwards without being compressed with each other, the quantitative supply is possible by using a screw feeder. Stable and efficient mixing and combustion of a solid fuel and fluidized air according to the design of a stair-type combustion furnace are possible.

Development background and problem to be solved

- Because the inside of a reactor of an internal circulation fluidized bed induces the circulation of bed materials only by varying the flow rate of the fluidized bed, a circulation rate is low, and a heat recovery rate after combustion is lowered. Thus, since there is a problem that the efficiency of a combustion furnace is degraded, an air distribution system capable of simultaneously performing even mixing of a gas and a solid in a fluidized bed process is required.
- In order to provide a stair-type combustion furnace to prevent unnecessary deposits sinking to the top of multiple stairs, provided is a fluidized bed combustor by which air is sprayed from various locations and thus stable and efficient combustion in the combustion furnace is achieved.

Excellence and discrimination of technology

▶ Excellence of technology

- The feeding and bottom ash discharge problems are resolved to facilitate fuel introduction, and thus it is possible to resolve problems caused by the introduction and discharge of a solid fuel (biomass, solid waste).
- A multi-layered, stair-type structure enables active mixing and smooth discharge of incombustibles through fluidized air in the side and downward directions by an air distribution nozzle and an air nozzle cap.
- Stable and efficient combustion is promoted by precisely adjusting the amount of fuels discharged.
- The localization of technologies imported from overseas is possible, and it is possible to save about KRW 50 billion per 10MWe unit.

▶ Discrimination of technology

- By using a screw feeder which can supply a stable fuel, equipment reliability is improved by preventing backflow and bridges where solid fuel transfer is stagnant.
- A multi-layered stair-type structure is optimally designed to enable stable and efficient combustion by fluidizing a solid fuel and mixing the same with air.
- When waste is combusted, driving problems such as a large amount of clinkers are resolved, and a long-term driving technology is secured.
- There are alternative energy effects such as generation effect RDC and the like from solid fuels and biomass.

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Implementation method

According to the present invention,

- a solid fuel quantitative supply system using a screw feeder comprises a stirring blade, a transfer screw, a gas and air supply device, a raw material expansion duct, and a discharge adjustment device.
- The stirring blade prevents the flow of solid fuels from being lowered. The backflow of a solid fuel is prevented by preventing the tangling of compressible raw materials transferred by a transfer screw, and gas or compressed air supply and fuel discharge amounts are adjustable.

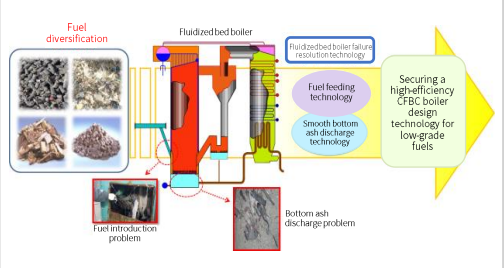

Figure 1 Structure diagram of a fluidized bed boiler failure resolution technology

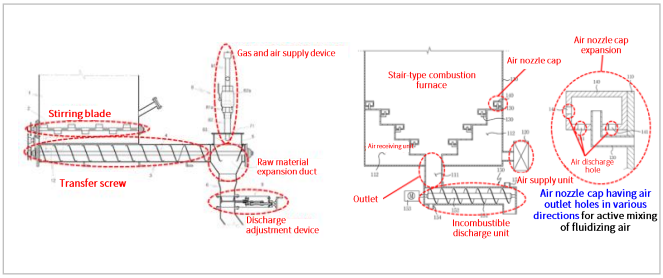

Figure 2 Solid fuel quantitative supply system and fluidized bed combustion device

Degree of technology completion (TRL)

Degree of technology completion: TRL7 (quasi-commercial product development stage)

TRL1	TRL2	TRL3	TRL4	TRL5	TRL6	TRL7	TRL8	TRL9
Technical principle presentation	Technology concept setting	Technology concept verification	Lab Scale prototype development	Implementation environment application experiment	Full Scale prototype development	Quasi-commercial product development	Commercial product development	Commercial product implementation

Utilization

Utilization field and applied product

Utilization field

- Combustion furnace and circulation fluidized bed boiler
- Waste incineration facility

Figure 1 Waste incineration facility

Applied product

- Combustion furnace and circulating fluidized bed boiler
- Waste incineration facility

Figure 2 CFBC_Circulation fluidized bed boiler

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Technology trend

- Unlike existing boilers, circulating fluidized bed boilers have the advantage of reducing combustion of various fuels such as coals and biomass from waste fire and emission of environmental pollutants through continuous heat circulation.
- The initial installation of energy conversion facilities by waste incineration were constructed with source technologies introduced from Europe and Japan. However, the level of localization is high thanks to the participation of a large number of domestic companies in construction, the securing of operation experiences, and continuous technology development.
- Globally, Chalmers University of Technology in Sweden (Professor Bo Reckner), Tsinghua University in China (Professor Hairui Yang), China Coal Pingshuo Group in Shanxi, China (test operation of the world's largest capacity (660MW) power plant), and Tauron Group in Poland, and domestically, Hyundai Heavy Industries Power Systems, Samsung Heavy Industries, POSCO E&C, and the like applied living/business site waste and waste biomass, which can be exported overseas by introducing and localizing overseas source technologies. Also, it is necessary to secure high-efficiency and high-performance power generation technologies.

Family patent status

Application nation	Application No. (Application date) / Registration No.	Title of the invention
KOR	KR 10-2007-0026017 (2007.03.16) / 10-0873658(2008.12.05)	Quantitative supply system for solid raw materials using screw feeder
KOR	KR 10-2005-0109232 (2005.11.15) / 10-0699519 (2007.03.19)	Circulation fluidized bed boiler exclusive for waste and RPF combustion
KOR	KR 10-2011-0084149 (2011.08.23) / 10-1273311 (2013.06.04)	Fluidized bed combustion device with improved air distribution and ash discharge performance

Market prospect

Target market size and prospect

The global circulation fluidized bed market is expected to reach USD 970 million in 2026 from USD 950 million in 2020. In the market, China is the largest market for CFB because thermal power in China accounts for a significant portion of the total electricity demand. The domestic market for waste energy is expected to grow from KRW 20.5 trillion won in 2016 to KRW 26.9 trillion in 2021. In the market, the recycled waste energy resource conversion field is about KRW 5.6 trillion, and the service-related market such as waste energy supply is KRW 3.5 trillion, accounting for 60% or more. The overall business scale is at the level of small and medium-sized enterprises.

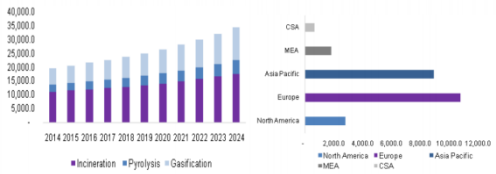

Figure Market size by waste energy technology and region

<Data:SMEs_TechnologyRoadmap(2018-2020)_Energy>

(Unit : 0.1 billion won, %)

Division	'16	'17	'18	'19	'20	'21	CAGR ('16~'21)
Domestic market	204,637	214,255	224,325	234,868	245,907	269,022	9.4

* Data : Environmental industry statistical survey report, Market forecast predicted by assuming 4.7% partially taken into account as the 2013-2015 growth rate based on the Ministry of Environment (2015, 2016)

Table Domestic market size of recycling waste energy separation and reuse facilities

<Data:SMEs_TechnologyRoadmap(2018-2020)_Energy>

Technology transfer query

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Technology transfer process