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Advanced Heating Technologies Applying Regenerative Heat Exchange Systems to Energy Saving

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Synopsis :

For the prevention of global warming and the improvement of quality of steel products, Kawasaki Steel has developed a regenerative burner and heating technologies by the use of regenerative heat exchanger system. A regenerative radiant tube burner was developed first. A direct-fired regenerative burner heating system was developed and applied to a reheating furnace for a wide flange beam mill, which was the first application for a large scale industrial furnace in the steel industry in Japan, and it has spread to reheating furnaces for hot strip mills, plate mills and seamless pipe mills. A non-oxidizing heating system using high temperature nitrogen jet, a ladle heating system synchronized with the steelmaking converter operation, and a rotary regenerator adopted heating system were also developed. These systems were applied to tundishs of continuous casting machines, to steelmaking converters and to continuous annealing lines respectively. Total energy saving of 733924GJ is achieved, that is equivalent to 94513t of CO<sub>2</sub> reduction a year, and improvement of steel product quality was achieved as well.

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## Advanced Heating Technologies Applying Regenerative Heat Exchange Systems

### to Energy Saving\*



Kazunari Andachi



Tsuguhiko Nakagawa

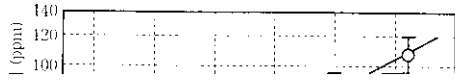
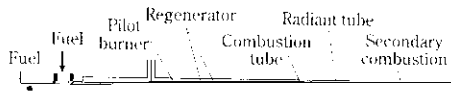


Masamitsu Obashi

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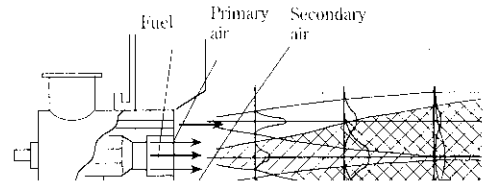
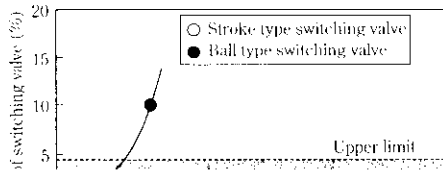
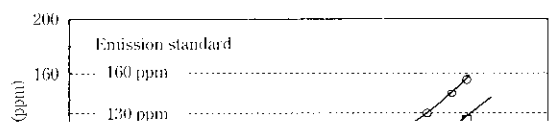


Fig. 9 Life of switching valve

restricted and the number of burners is large, it is necessary to employ the compact switching valve and also to reduce the total installation number. For these reasons, stroke type hexagonal valves were adopted. The stroke type switching valves and ball type switching valves

Fig. 10 Concept of NO<sub>x</sub> reduction of applied burner



Cycle time 60 s

Ordinary

Low turndown

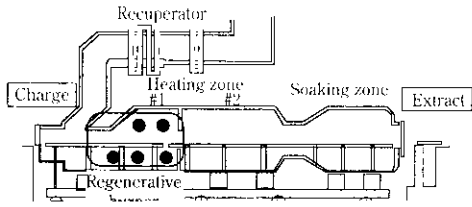
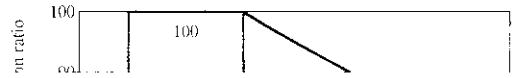


Table 1 Comparison of available heat (GJ/h)

	Conventional burner	Regenerative burner
Combustion heat of fuel	120	120
Sensible heat of fuel	5	5
Sensible heat of air	25	52
Total heat	150	177

Fig. 14 Setting position of regenerative burner









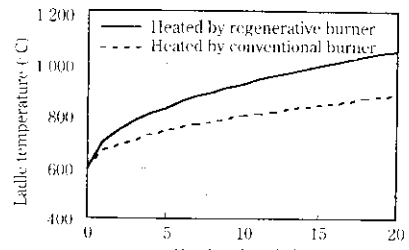
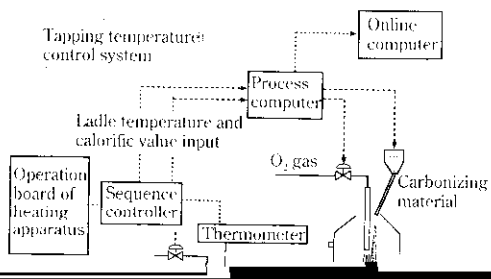
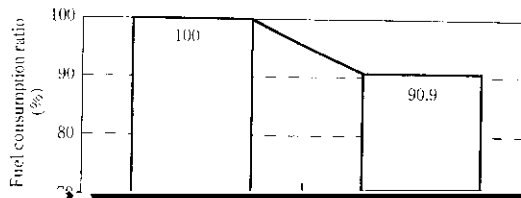


Fig. 23. By virtue of rapid on-line ladle heating, the ladle temperature rose to approximately 1 000°C from

Exhaust gas Purge air  
Regenerator including



of 733 924 GJ/y or 94 513 t/y as converted of CO<sub>2</sub> emission amount has been achieved and at the same time, is also contributing toward improving the quality of products.

The technologies described in this article are considered extremely effective for reduction of the environ-