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Decrease in Coke Oven Heat Consumption by Means of Gas Flow Analysis

Tsuguhiko Nakagawa, Masatoshi Ichimiya, Shizuki Kasaoka, Kazumasa Ariyoshi

Synopsis :
For the purpose of decreasing heat consumption of coke ovens, uniform carbonization in ovens and improvement of thermal efficiency in combustion chambers have been intended by controlling gas flow in flues and evaluating the state of carbonization. The experimental results show; (1) control on the flue side brick opening area and elevation of top pressure are effective in uniform carbonization in the horizontal direction, and (2) elevation of combustion gas temperature is also found effective in improvement of heat efficiency. By application of the results, waste gas heat has been reduced due to improved thermal efficiency, and discharged coke temperature due to uniform temperature distribution. Through both the effects, heat consumption was decreased by about 40kcal/kg-coal. The result of gas distribution analysis in a combustion chamber shows more combustion gas flows in end flues than in any other flue.

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oven gas) combustion, and further discusses gas flowrate distribution and heat transfer distribution in the flues.

2 Method of Evaluation of Carbonization in a Coking Chamber

into consideration the distribution of charged coal, which is estimated from coke levels, this information is fed back to into the combustion adjustment and charging/leveling process.

2.2 Evaluation Index

Guide car dust density (C_t) at time t during coke

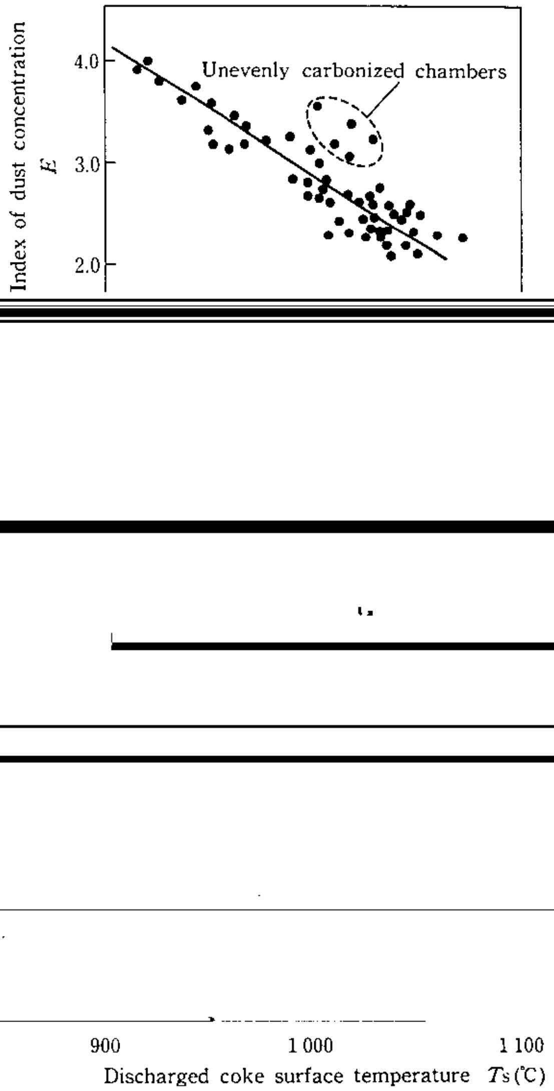
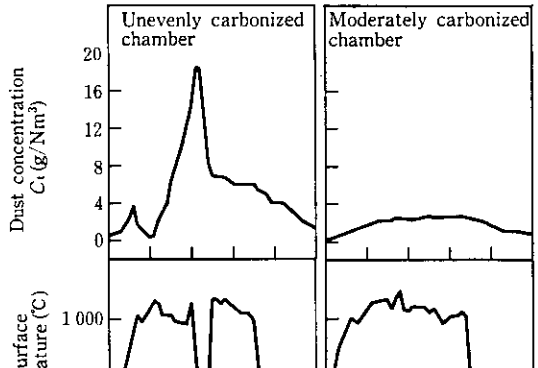


Fig. 4 Correlation between E and discharged coke surface temperature T_S



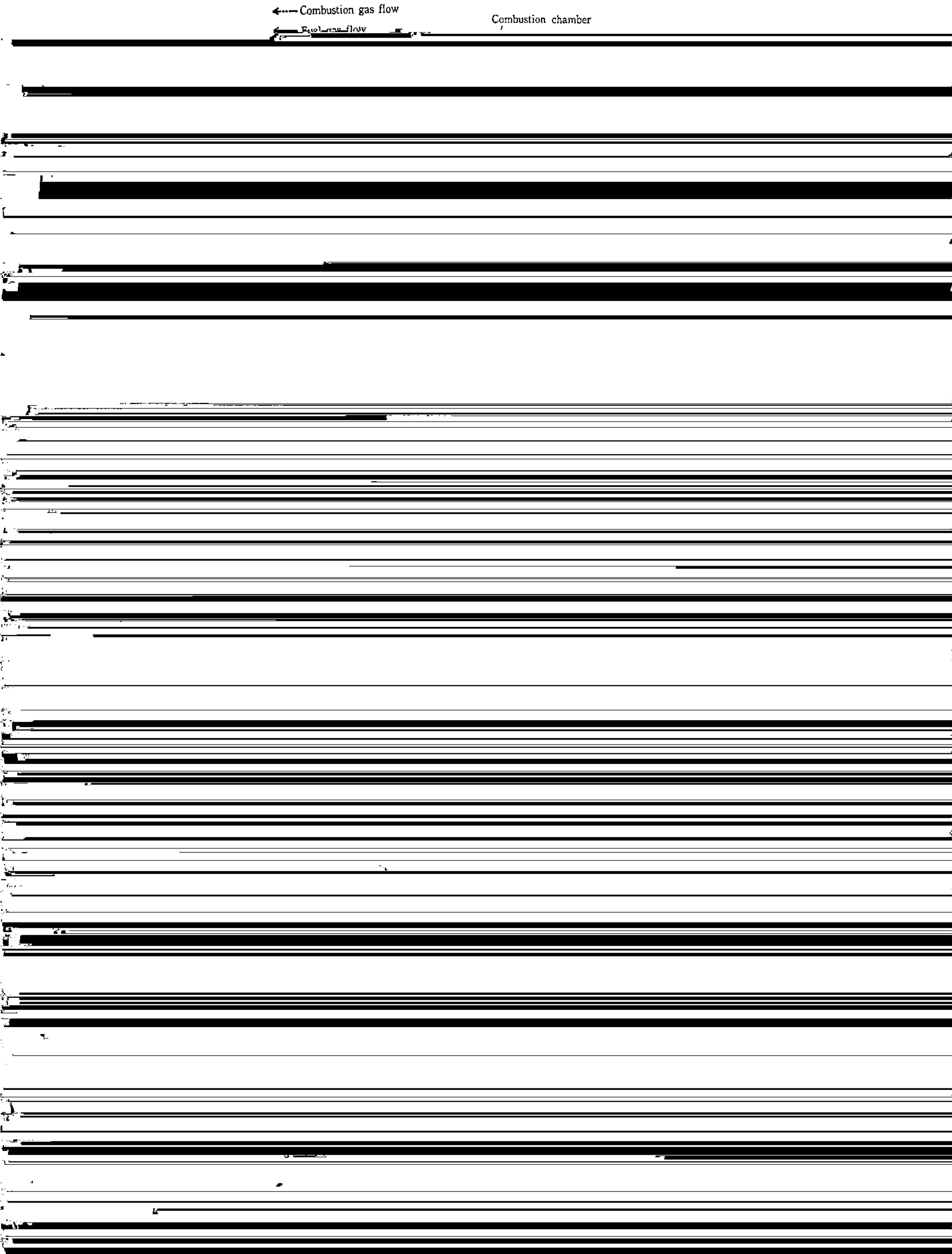
chamber-length direction.

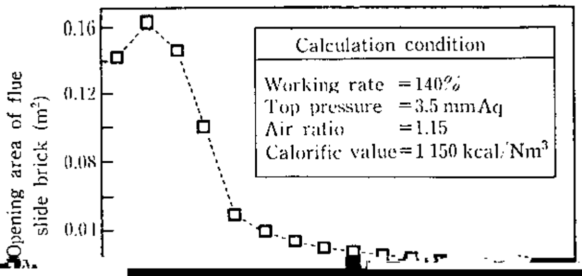
In order to rectify the discharged coke surface temperature distribution in the chamber-length direction, it is necessary to adjust the gas flow-rate distribution in a combustion chamber, as this significantly affects the distribution of heat transferred from the combustion chamber to the coking chamber.

Distribution in a Combustion Chamber

The channels of a combustion chamber and a regenerator in the Carl Still oven are exceedingly complicated. The flow of combustion air, M-gas, and combustion gas during M-gas combustion are shown in **Fig. 6**. When the channels of a combustion chamber and a regenerator are considered a piping network and the gas flow in the combustion chamber is assumed to be steady, the following Eqs. (3) to (8) are applicable to gas velocity (U), based on the mechanical energy balance of the fluid:[4]

$$\frac{P_{\mathrm{out}}-P_{\mathrm{in}}}{\rho}+\frac{U_{\mathrm{out}}^2-U_{\mathrm{in}}^2}{2\alpha}+\frac{\rho-\rho_{\mathrm{atm}}}{\rho}gZ + \sum H(U)=0 \cdots\cdots(3)$$


Combustion gas flow
Fuel gas flow
Combustion chamber



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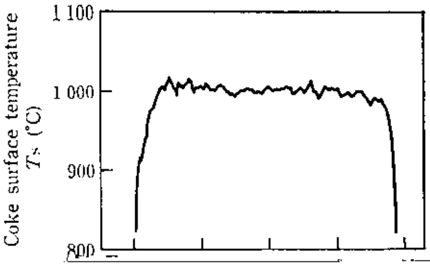
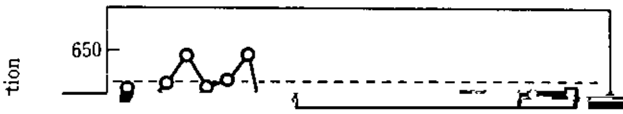


Fig. 11 Distribution of coke surface temperature after

making it possible to optimize gas distributions in the combustion chamber and regenerator.


1 250
1 240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