

PRODUCTION COSTS OF CO + H₂ MIXTURES FOR DIFFERENT METHODS OF
GASIFICATION WITH OXYGEN AND VARIOUS FUELS

by

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INTRODUCTION

Gasification of coal has for many years been used for the production of heating gas in industrial plants mostly in connection with the production of metals and manufacturing plants of the metal industry. Gasification with air in a shaft-producer with a fixed fuel bed may be considered as the primary stage of gasification technology. A high content of nitrogen (45 to 55 percent) and a relatively low heating value are the main features of this so-called producer-gas.

Because of the need for a gas of a higher heating value and for hydrogen for chemical synthesis purposes, several methods of gasification were developed in which a nitrogen-free gas is produced by the reaction of carbon and steam. This endothermic reaction requires a large amount of heat. In the intermittent water-gas process, this heat is obtained by regenerative heating of the introduced steam as well as of the fuel bed by combustion of part of the carbon with air. In other methods, the reaction zone is operated continuously, and the heat required for the water-gas reaction is obtained either by the outside heating of a retort with combustion gas or by highly superheating the steam introduced into the fuel bed. Sometimes, part of the gas is recirculated through the heater and the fuel bed to increase the heat available for the water-gas reaction.

Recently a few of the recycling processes have used some oxygen to overcome the difficulty of heating large quantities of gas to high temperatures or circulating this gas with high velocity through a disintegrating fuel (as in the Schmalfeldt-Wintershall process).

Compared with the continuously-operated gas producer, all of these methods are complicated in operation and equipment. The only way of avoiding these complications is the separation of the nitrogen from the combustion air. For some time, therefore, the use of pure oxygen for gasification has been investigated by gasification engineers, but only recently could the oxygen be produced cheaply enough for use in gas production. As regards operating costs and utilization of inexpensive fuels, the superiority of gasification with oxygen proved to be so great that this method is considered the most important one for large-scale hydrogen-carbon monoxide production. Many processes have been developed, depending on the technical experience of the developing engineers, the special character of the fuel, and the required composition of the gases.

A rather complete description of the various methods of gasification which have been used in industry or tried in larger-scale experimental work is found in a report of L. L. Newman* to which reference may be made for details. For the purpose of this paper, the figures of Newman's report are checked with the author's experience and with regard to further improvement and the gasification of fuels which are best suitable for this special method of gasification. Based on these figures, the economical value of the various methods is compared.

* L. L. Newman. Oxygen Production and Utilization in Gas Making Processes, 1946. Report of the Gas Production Committee of the American Gas Association.

As the chemical and physical properties of a fuel are most important for the gasification methods used for the production of liquid fuels as well as for the results of gasification in each of the various methods, these methods are also compared with regard to the coal resources which for economical reasons are most favorable for such an industry.