# PATENT SPECIFICATION

Convention Date (Germany): Nov. 15, 1928.

343,160

Application Date (in United Kingdom): Nov. 15, 1929. No. 34,993/29.

Complete Accepted: Feb. 16, 1931.

903

COMPLETE SPECIFICATION.

## Improved Process for the Production of a Mixed Gas Containing Carbon Monoxide and Hydrogen.

We, GUTEHOFFNUNGSHÜTTE OBERHAUSEN AKTIENGESELLSCHAFT, of Oberhausen, Rheinland, Germany, a German Company, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

The proportion of carbon monoxide and hydrogen such as is formed in the production of water gas is not convenient for all purposes of application. For example, if the gas is to be used for the synthesis of hexane according to the equation

$$6CO + 13H_2 = C_6H_{14} + 6H_2O$$

the volume ration of $CO : H_2$ must be approximately 1 : 2, whereas actually it is about 1 : 1.

In the process according to the present invention, mixed gases are produced which consist substantially of carbon monoxide and hydrogen, one having to a very large extent however the power of varying the quantity ratio of the two gases during the production.

If, for example, electric currents of very high frequency (above 50,000 cycles/sec.) and high tension (e.g. above 30,000 volts) are passed through a column of coke or other carbonaceous material inserted between the poles of a high frequency-current generator so that luminous discharges are also formed thereby, and water or water vapour is allowed to stream through the coke at the same time, then the coke or other material, acting as resistance to the current, warms up and a combustible gas mixture is formed. The latter had, for example, the following composition:

| | A | B | C |
|---|---|---|---|
| $Co_2$ | 12.0% | 7.8% | 9.2% |
| $CnHm$ | 1.2 | 0.1 | 1.1 |
| $O_2$ | 0.0 | 0.6 | 3.4 |
| CO | 19.6 | 30.2 | 26.0 |
| $H_2$ | 56.0 | 53.8 | 55.0 |
| $CH_4$ | 7.5 | 0.6 | 1.7 |
| $N_2$ | 3.7 | 6.9 | 3.5 |

These gas mixtures were obtained at the following voltages and frequencies: A, 60,000 volts and 150,000 periods; B, 80,000 volts and 300,000 periods; C, 80,000 volts and 400,000 periods; the current strength, of course, was extremely small and scarcely measureable.

As these examples show it is possible substantially to vary the composition of the gas which is formed. This is attained by effecting variations in the frequency and tension of the current and in the streaming velocity of the water or water vapour. This is of importance, for example, for the technics of the synthesis of benzene from carbon monoxide and hydrogen. Since in the gas C of the above table, for instance, the ratio of $CO : H_2$ is equal to 1 : 2, the two reactants are obtained forthwith in a stoichiometric ratio advantageous for the synthesis.

Of course, a gas mixture corresponding to the normal water gas may also be produced.

The process herein described may be carried out uninterruptedly.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. Process for producing a mixed gas containing carbon monoxide and hydrogen from coke or other carbonaceous substances and water or water vapour, characterised by the feature that the mixed gas is produced by subjecting a column of the carbonaceous material to luminous discharges in an electric field produced between the poles of a generator of high frequency current of high tension.

2. Process as claimed in claim 1, characterised by the feature that the composition of the mixed gas which is formed, more particularly with respect to the content in carbon monoxide and hydrogen is varied by varying the frequency, tension, and streaming velocity of the water or water vapour.

3. The improved process for producing a mixed gas containing carbon monoxide and hydrogen, substantially as herebefore described.

Dated this 15th day of November, 1929.

MARKS & CLERK.

Redhill: Printed for His Majesty's Stationery Office, by Love & Malcomson, Ltd.—1931

[Price 1/-]