[Second Edition.]

PATENT SPECIFICATION

Application Date: Aug. 24, 1927. No. 22,275/27. **300,328**

Complete Left: May 21, 1928.

Complete Accepted: Nov. 15, 1928.

PROVISIONAL SPECIFICATION.

An Improved Process for the Production of Mixtures of Hydrogen and Carbon Monoxide.

I, JAMES YATE JOHNSON, a British subject, of 47, Lincoln's Inn Fields, in the County of London, Gentleman, do hereby declare the nature of this invention (which has been communicated to me from abroad by I. G. Farbenindustrie Aktiengesellschaft, of Frankfort-on-Main, Germany, a joint stock company organized under the laws of Germany) to be as follows:—

It is already known that gaseous or vapourised liquid hydrocarbons may be converted into mixtures of hydrogen and carbon monoxide, accompanied by the deposition of carbon, when passed in conjunction with steam or oxygen, or both, through tubes raised to high temperatures by externally applied heat. It has also been proposed to produce a gas containing hydrogen and carbon monoxide, without the separation of carbon, by mixing hydrocarbons with oxygen and exploding such mixture.

My foreign correspondents have now found that mixtures of hydrogen and carbon monoxide with or without a content of nitrogen, may be produced from hydrocarbons, especially those of a gaseous nature, or from gases containing hydrocarbons by burning the said hydrocarbons with at least such an amount of oxygen as is necessary for converting all the carbon of the said hydrocarbons into carbon monoxide at temperatures above 1000° Centigrade, but preferably at temperatures between 1200° and 1500° Centigrade. The quantity of oxygen needed may be supplied in the form of pure oxygen or in the form of air or air enriched with oxygen.

Preferably the operation may be carried out by introducing vapourised hydrocarbons or the gases containing hydrocarbons into a chamber, tangentially and from below, and introducing sufficient oxygen or gases containing the same for partial combustion into the eddying, ascending gases through a plurality of nozzles, preferably disposed in a circle and preferably also introducing the said oxygen, or the like, tangentially.

The gases, such as methane, to be decomposed are forced tangentially into a fore-chamber and describe a gyratory movement round an iron tube which serves at the same time to support the upper part of the apparatus. The gases expand through a narrow annular passage into the combustion chamber, into which, at the same time, oxygen is blown in, tangentially, under pressure fron an annular tube through a plurality of water-cooled nozzles. The rotational velocity of the already gyrating gas is further increased by the admitted oxygen and the gas is thereby intimately mixed with the oxygen, combustion taking place simultaneously at high temperature. No more oxygen is admitted than is just sufficient to produce the desired temperature of combustion namely about 1500° Centigrade. In this manner, the methane is completely converted into hydrogen, carbon monoxide and a very small amount of carbon dioxide, without any separation of carbon.

The following example will further illustrate the nature of the said invention which however is not limited thereto.

EXAMPLE.

The combustion of 150 cubic metres of coal gas, which has been preheated on the regenerative principle and contains CO_2, 2 per cent.; C_nH_{2n}, 3 per cent.; CO, 6 per cent.; H_2, 52 per cent.; CH_4, 31 per cent.; and N_2 6 per cent., in the furnace described and in presence of about 50 cubic metres of oxygen, furnishes a gas mixture of the following composition: CO_2, 2.8 per cent.; CO, 28.7 per cent.; H_2, 64.1 per cent.; CH_4, 0.2 per cent. and N_2, 4.2 per cent.

Dated this 24th day of August, 1927.

JOHNSONS & WILLCOX,
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[Price

Price

COMPLETE SPECIFICATION.

An Improved Process for the Production of Mixtures of Hydrogen and Carbon Monoxide.

I, JAMES YATE JOHNSON, a British subject, of 47, Lincoln's Inn Fields, in the County of London, Gentleman, do hereby declare the nature of this invention (which has been communicated to me from abroad by I. G. Farbenindustrie Aktiengesellschaft, of Frankfort-on-Main, Germany, a joint stock company organized under the laws of Germany) and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement :—

The present invention relates to the production of gas mixtures containing hydrogen and carbon monoxide, with or without other gases. In particular, the invention relates to the production of mixtures of hydrogen and carbon monoxide with or without a content of nitrogen, from hydrocarbons, especially those of a gaseous nature, or from gases containing hydrocarbons without any substantial separation of carbon by burning the said hydrocarbons with at least such an amount of oxygen as is necessary for converting all the carbon of the said hydrocarbons into carbon monoxide at temperatures above 1000° Centigrade, but preferably at temperatures between 1200° and 1500° Centigrade without the use of water vapour and catalysts. The expression " burning " is according to the present invention not intended to include " explosion." The quantity of oxygen needed may be supplied in the form of pure oxygen or in the form of gases containing oxygen such as air or air enriched with oxygen but water vapour should not be added.

According to this invention the operation is carried out by introducing vapourised hydrocarbons or gases containing hydrocarbons into a chamber, tangentially and from below, and introducing sufficient oxygen or gases containing the same for partial combustion into the eddying, ascending gas through a plurality of nozzles, preferably disposed in a circle and preferably also introducing the said oxygen, or the like, in a tangential direction.

The invention will be further illustrated with reference to the accompanying diagrammatic drawing which illustrates by way of example one form of apparatus suitable for carrying out the invention, but the invention is not restricted thereto.

In the drawing Figure 1 represents a vertical section and Figure 2 a horizontal cross section through the apparatus.

The gases, such as methane, to be decomposed are forced at *d* tangentially into a fore-chamber *a* and pass in a gyratory movement round an iron tube *i* which serves at the same time to support the upper part of the apparatus. The gases expand through a narrow annular passage *g* into a combustion chamber *b*, into which, at the same time, oxygen is blown in, tangentially, under pressure from an annular tube *h* through a plurality of water-cooled nozzles *e*. The rotational velocity of the already gyrating gas is further increased by the admitted oxygen, and the gas is thereby intimately mixed with the oxygen, combustion taking place simultaneously at high temperature. No more oxygen is admitted than is just sufficient to produce the desired temperature of combustion namely about 1500° Centigrade. In this manner, the methane is completely converted into hydrogen, carbon monoxide and a very small amount of carbon dioxide, without any separation of carbon.

The following example will further illustrate how the said invention may be carried out in practice but it is not limited thereto.

EXAMPLE.

The combustion of 150 cubic metres of coal gas, which has been preheated on the regenerative principle and contains CO_2, 2 per cent.; C_nH_{2n}, 3 per cent.; CO, 6 per cent.; H_2, 52 per cent.; CH_4, 31 per cent.; and N_2 6 per cent., in the furnace described and in the presence of about 50 cubic metres of oxygen, furnishes a gas mixture of the folowing composition: CO_2, 2.8 per cent.; CO, 28.7 per cent.; H_2, 64.1 per cent.; CH_4, 0.2 per cent. and N_2, 4.2 per cent.

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

1. The method of carrying out the process hereinbefore referred to, which consists in introducing vapourised hydrocarbons or gases containing hydrocarbons into a chamber tangentially and from

below, and introducing sufficient oxygen or gases containing the same for partial combustion into the eddying, ascending gases through a plurality of nozzles, preferably disposed in a circle and preferably also introducing the said oxygen, or gases containing oxygen, in a tangential direction.

2. The method of producing mixtures of hydrogen and carbon monoxide substantially as described in the foregoing example.

3. Mixtures of hydrogen and carbon monoxide, with or without a content of nitrogen, when obtained in accordance with the foregoing claiming clauses.

4. The improved apparatus for carrying out the process hereinbefore referred to substantially as hereinbefore described with reference to the accompanying drawing.

Dated this 21st day of May, 1928.

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2nd Edition

Fig. 1

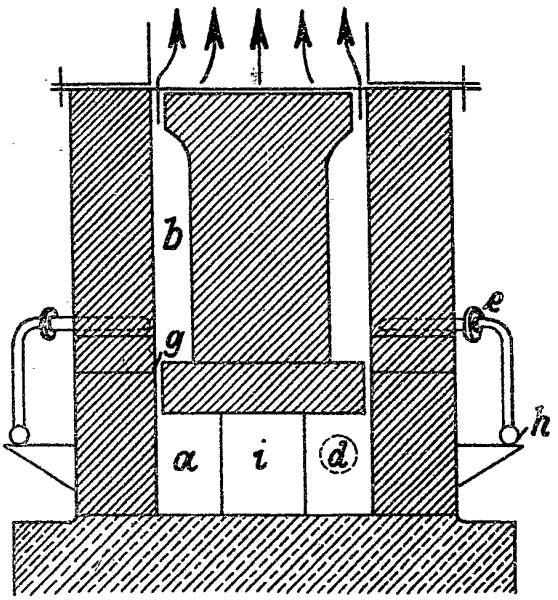
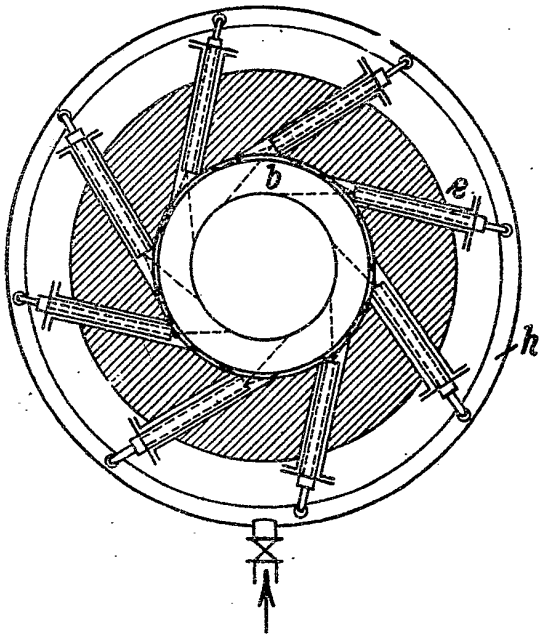


Fig. 2



[This Drawing is a reproduction of the Original on a reduced scale.]

Charles & Read Ltd. Photo Litho.