PATENT SPECIFICATION

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COMPLETE SPECIFICATION

Improvements in the Production of Gaseous Mixtures Containing Carbon Monoxide and Hydrogen in Run-off Gas Producers

We, BADISCHE ANILIN- & SODA-FABRIK (I.G. FARBENINDUSTRIE AKTIENGESELLSCHAFT "IN AUFLOSUNG"), a Company recognised under German Law, of Ludwigshafen on Rhine, Germany, do hereby declare the invention, for which we pray that patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a method for producing gaseous mixtures containing carbon monoxide and hydrogen in run-off gas producers.

It has already been proposed to burn gaseous hydrocarbons, if desired together with other gases or vapours, incompletely with oxygen by leading them into the fuel bed of a gas producer with liquid slag withdrawal (so-called "run-off gas producers") in order to obtain a mixture of carbon monoxide and hydrogen, i.e. the so-called synthesis gas. The common practice in carrying out this process is to lead the gaseous hydrocarbons through the hottest layer of the run-off gas producer which is brought to high temperatures by blowing in oxygen or air or air enriched with oxygen. The conversion rate so obtained has been 95 per cent, or 99 per cent at the highest, so that the resulting gases still had too high a percentage of methane for many synthesis purposes. Attempts have been made to avoid these difficulties by leading the hydrocarbon-containing gas through two consecutive combustion zones. Even with this method of working, however, it is not possible to achieve the desired low methane content of about 0.0 to 0.2 per cent in the synthesis gas, such as is obtained for example with water-gas producers operated on coke.

We have now found that the said drawbacks can be obviated and that a synthesis gas which is practically free of hydrocarbons can be obtained in a run-off gas producer operated in the usual way on coke by introducing gaseous, liquid or solid carbonaceous material of which the two latter are in a state of fine division together with a gasifying agent containing free oxygen by means of one or more burners through which both carbonaceous material and gasifying agent are led in one and the same burner, into the fuel bed of the gas producer, and by selecting such a mixing ratio for the carbonaceous material and gasifying agent, in particular by providing for a high oxygen content such that a temperature of at least 1300° C., but preferably not higher than 1800° C., is attained in the fuel bed. The carbonaceous material may be gaseous or liquid hydrocarbons or fuel dust. The oxygent needed to maintain the desired temperature is supplied to the burner in the form of a gas containing oxygen, in particular air, or air enriched with oxygen, or pure oxygen. This gasifying agent may also contain gases or vapours exerting an endothermic reaction, such as steam or carbon dioxide. The burner may consist of two concentric supply tubes tapering at the outlet ends, the oxygen-containing gasifying agent preferably being supplied to the inner tube and the carbonaceous material, as for example gaseous hydrocarbons, such as methane, which may also contain vapourised hydrocarbons which are liquid at ordinary temperature, being supplied to the flame forming at the outlet end. It is advantageous, however, to use a burner in which an intimate mixing of the gas containing oxygen with the carbonaceous material already takes place in the interior of the burner.

When fuel dusts are used, which may moreover be partly replaced by gaseous or

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liquid hydrocarbons, preference should be given to those having a better reactivity than the granular fuel of the gas producer. Fuel dusts contemplated for use primarily are those of brown coal, brown coal low temperature carbonisation coke, suitable mineral coals, as for example bituminous coals, and low temperature carbonisation coke.

A burner suitable for carrying out the process of the present invention is shown in section in the accompanying drawing. Oxygen, air or air enriched with oxygen enters at 1 and the hydrocarbon or the fuel dust at 2. The gasifying agent passes through a nozzle insert 3 into a mixing chamber 4, and the mixture flows through a nozzle insert 5 into the gas producer. The speed of flow in the mixing chamber 4 between the nozzles 3 and 5 is chosen such as to be appreciably higher than the speed of the flame so that ignition of the mixture in the mixing chamber 4 cannot occur. The nozzle inserts 3 and 5 can be drawn rearwardly from the positions shown during the operation so that the gas openings can be enlarged and the loading of the burner and consequently that of the gas producer can be increased if need be.

The ignition of the flame occurs immediately after the entry of the mixture of gaseous or liquid hydrocarbon or fuel dust and oxygen into the run-off gas producer. In this way, even when the gas producer is highly loaded with gaseous or liquid hydrocarbons or fuel dust, a hydrocarbon content of from 0.0 to 0.2 per cent in the synthesis gas can be achieved with certainty and without trouble.

The speed in the mixing chamber of the burner should be so high that the poker used for cleaning the nozzle mouth and which becomes incandescent at its end does not make the flame strike back when withdrawn through the mixing chamber.

When working with fuel dust it is possible to gasify considerable amounts of the same, while at the same time the gasification of the high-quality coke comprising the fuel bed can be so strongly suppressed that the process to a great extent takes on the character of a process for gasifying fuel dust. Contrary to expectation, there may be used for the process varieties of coal which yield tar and hydrocarbons, without the resulting gas containing troublesome amounts of hydrocarbons, such as methane, so that the said gas is very well suited for synthesis purposes. The process is carried out at temperatures at which the gasification or incomplete combustion of the fuel dust to carbon monoxide and hydrogen takes place with liquefaction of the ash particles, so that the fused ash particles collect together with the liquid slag of the solid fuel at the bottom of the gas producer, from which the liquid slag can then be withdrawn as usual without the risk that by reason of the simultaneous reduction in the throughput of coke solidification will occur. The fused ash of the pulverulent fuel acts in most cases as a flux which promotes the fusion of the slag, so that the usual fluxes which are otherwise introduced with the granular fuel in order to facilitate the fusion may be reduced in quantity.

The following examples will further illustrate the invention but the invention is not restricted thereto.

EXAMPLE 1.

A run-off gas producer which has an internal diameter of 3 metres in the upper shaft section and of 1.8 metres in the lower part and a height of the inner free space of 4.5 metres is provided in the lower part of the furnace with twelve burners of the kind shown in the drawing, all arranged at the same height. 3000 cubic metres of coke-oven gas together with 6500 cubic metres of air and 100 cubic metres of 98 per cent oxygen are supplied per hour through these burners to the gas producer. Per hour there is added to the gas producer 0.955 metric ton of metallurgical coke as well as a flux consisting of a little lime and slags such as are obtained from gas producers operating with brown coal briquettes. There are obtained per hour 10900 cubic metres of a gas having the composition:—

1.6 per cent of CO_2, 23.0 per cent of CO, 25.0 per cent of H_2, 0.2 per cent of CH_4 and 50.2 per cent of N_2.

If on the other hand the gasification is carried out by loading eight burners with 6500 cubic metres of air and 100 cubic metres of 98 per cent oxygen and four burners with 1240 cubic metres of coke-oven gas, the gaseous hydrocarbons contained in the coke-oven gas were converted only to some 60 per cent which comes up to a methane content in the resulting gas of 2.1 per cent. In order under these conditions to reduce the methane content of the final gas to 0.2 per cent, the loading of the gas producer must be reduced to about 250 cubic metres of coke-oven gas per hour, so that in the run-off gas producer it is now mainly coke that is gasified.

EXAMPLE 2

Commercially pure methane is worked up in the gas producer described in Example 1. The eight burners are charged hourly with 1650 cubic metres of methane, 5500 cubic metres of air and 1050 cubic metres of 98 per cent oxygen, the gases being mixed prior to their exit from the burners. 11300 cubic metres per hour of a final gas of the following composition are obtained:—

1.5 per cent of CO_2, 0.3 per cent of O_2, 34.1 per cent of CO, 24.8 per cent of H_2, 0.2 per cent of CH_4 and 39.1 per cent of N_2. The simultaneous consumption of coke per hour amounts to 1.485 metric tons.

Example 3

Into a run-off gas producer operated on metallurgical coke there is introduced by means of a burner dust of a Rhinish brown coal with a moisture content of 15.5 per cent together with air rich in oxygen, the proportions being 0.415 cubic metre of oxygen and 0.735 cubic metre of air for each kilogram of fuel dust. For each kilogram of fuel dust, 0.275 kilogram of coke is gasified and there are formed 2.5 cubic metres of a gas having the composition:—

2.5 per cent of CO_2, 52.5 per cent of CO, 21.5 per cent of H_2, 0.2 per cent of CH_4 and 23.3 per cent of N_2 which is eminently suitable as an initial gas for the synthesis of ammonia.

What we claim is:—

1. A process for the production of gaseous mixtures containing carbon monoxide and hydrogen in run-off gas producers operated on coke, which consists in introducing gaseous liquid or solid carbonaceous material of which the two latter are in a state of fine division together with a gasifying agent containing oxygen by means of burners through which both carbonaceous material and gasifying agent are led in one and the same burner into the fuel bed of the gas producer the oxygen content of the introduced gases being so high that a temperature of at least 1300° C. is produced in the fuel bed.

2. A process as claimed in Claim 1 wherein the temperature in the fuel bed is not allowed to exceed 1800° C.

3. A process as claimed in Claim 1 or 2 wherein the burners used are provided with nozzle inserts for the gasifying agent and for the mixture of the same with the carbonaceous material, the said inserts being capable of rearward and forward displacement.

4. A process as claimed in any of Claims 1 to 3 wherein gaseous or liquid hydrocarbons are used as the carbonaceous material.

5. A process as claimed in any of the Claims 1 to 3 wherein fuel dust is used as the carbonaceous material.

6. A process as claimed in Claim 5 wherein the fuel dust used has a better reactivity than the coke of the run-off gas producer.

7. The process for the production of gaseous mixtures containing carbon monoxide and hydrogen substantially as described in the first paragraph of Example 1, or Example 2 or 3.

8. Gaseous mixtures containing carbon monoxide and hydrogen when obtained by the process claimed in any of Claims 1 to 7.

9. A burner for use in the process of any of Claims 1 to 7 constructed, arranged and adapted to be operated substantially as herein described with reference to the accompanying drawing.

Dated this 26th day of July, 1950.

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1 SHEET *This drawing is a reproduction of the Original on a reduced scale.*