PATENT SPECIFICATION

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PROVISIONAL SPECIFICATION

A Process for the Production of Water Gas and like Synthesis Gases

I, MICHAEL STEINSCHLAEGER, of no nationality, formerly of Russian nationality, of 60, Portsea Hall, Connaught Square, London, W.2, do hereby declare the nature of this invention to be as follows:—

This invention relates to a process for the production of water gas and like synthesis gases, all of which are hereinafter referred to as water gas.

In the discontinuous process of producing water gas a large amount of time and a high proportion of high quality fuel is used for heating the generators to the temperature required for the process.

If on the other hand a continuous process is used with re-cycling of gases to bring the generator bed to the required temperature the gases which leave the generator have a very high temperature particularly if such fuels as high temperature coke are employed and very large volumes of gas must be re-cycled.

It is an object of the present invention to overcome these disadvantages.

With this object in view the present invention provides a process for the manufacture of water gas wherein a regenerator is heated by gas from a producer gas plant, whereafter a mixture of water gas and steam is passed through the said regenerator and then passed to a water gas generator, the passage of the mixture of steam and water gas through the regenerator heating the mixture to the temperature required for the reaction in the generator.

In order to avoid too high a waste gas temperature the generator is subjected to a blowing period from time to time which produces the additional heat necessary for the endothermic reaction in the generator and to provide for heat losses.

The fuel employed in the generator is coal, coke or other solid carbonaceous fuel, preferably high temperature coke. The producer gas plant may use fuel of the same type as the generator, or other solid, gaseous or liquid fuel may be used.

The following example illustrates how the process of the invention may be carried into effect:

0.5 Kgms. of steam having a temperature of about 150° C. was mixed with 2 cubic metres of water gas and the mixture was superheated in a regenerator the temperature of which had been raised to 1100° C. by burning producer gas generated in a producer gas plant. The mixture of steam and water gas was then introduced into a generator to produce water gas. The generated and the recycled water gas (3 cubic metres in all) left the generator at a temperature of 450° C. and was then cooled to 150—200° C. (the heat extracted was used for producing steam and electric current for the process) and 2 cubic metres of the water gas were re-cycled.

It was found that the consumption of coke of a size above 1½" was 265 kgms. in addition to 235 kgms. of coke of a size under 1" per 1000 cubic metres of water gas produced whilst the output of the generator per unit of time was considerably increased.

The invention has a number of advantages.

Thus, for example:

1. The process uses less fuel.

2. It is possible to use a part of the fuel in the form of low quality fuel (such as coke of smaller size).

3. The production capacity of the water gas generator is considerably increased owing to the shorter blowing times and the longer time during which the temperature in the water gas generator is high enough to allow of the making of gas.

Dated this 15th day of September, 1941.

ELKINGTON & FIFE,
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Agents for the Applicant.

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COMPLETE SPECIFICATION

A Process for the Production of Water Gas and like Synthesis Gases

I, MICHAEL STEINSCHLAEGER, of no nationality, formerly of Russian nationality, of 50, Portsea Hall, Connaught Square, London, W.2, 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:—

This invention relates to a process for the production of water gas and like synthesis gases, all of which are hereinafter referred to as water gas.

In the discontinuous process of producing water gas a large amount of time and a high proportion of high quality fuel are used for heating the generator during the blowing period to the temperature required for the reaction and, to make the process practically possible, an extensive decrease of temperature in the generator bed must take place.

If on the other hand a continuous process is used with re-cycling of gases to bring the generator bed to the required temperature the gases which leave the generator have a very high temperature, particularly if such fuels as high temperature coke are employed and very large volumes of gas must be re-cycled and a considerable amount of high quality coke is not converted into water gas and is found in the ash.

It is an object of the present invention to overcome these disadvantages.

With this object in view the present invention provides a discontinuous process for the manufacture of water gas wherein the heat necessary for the reaction with the solid fuels in the generator and to compensate for heat losses is obtained partly by using a regenerator which is heated by blow gases or gas from a producer gas plant or other source, whereafter a mixture of water gas with or without coke oven gas or other gas rich in methane and steam and/or carbon dioxide is passed through the said regenerator and then passed to a water gas generator, the passage of the said mixture through the regenerator heating the mixture to a pre-determined temperature, and partly by subjecting the generator to blowing from time to time with oxygen, air or other oxygen-containing gases.

It will be understood that any other gases necessary for the reaction may be added to the mixture. Furthermore if a normal blue water gas or a water gas more rich in hydrogen is to be produced steam will be a necessary ingredient with or without carbon dioxide whilst if the water gas to be produced is to be rich in carbon monoxide, carbon dioxide will be a necessary ingredient with or without steam.

It will be seen from the above that by allowing the same temperature decrease as is usual in the well known discontinuous processes a considerable increase in the time of the "gas making" period is obtained, for this reason it is possible to allow in the process of the present invention a smaller decrease in the temperature in the generator bed and resulting from this a considerable increase in the capacity of the generator can be achieved in practice.

The fuel employed in the generator is coal, coke or other solid carbonaceous fuel, preferably high temperature coke, if desired mixed with a liquid carbonaceous fuel. The producer gas plant may use fuel of the same type as the generator, or other solid, gaseous or liquid fuel may be used.

The following modifications of the usual process which are of considerable value can be effected by using the process of the present invention.

1. If a higher temperature is desirable in the generator and the blow gases contain a very high proportion of carbon monoxide these blow gases can be used to heat the regenerator.

2. If it is desirable to use still less coke of a larger size the blowing of the generator can be effected with a mixture of producer gas or other available gases and air or pre-heated air and the blow gases which will be in this case rich in carbon monoxide can be utilised for heating the regenerator.

3. Should it be necessary by using normal temperature in the generator to cool the ash the re-cycle gases with the addition of the steam necessary for the reaction can be brought into the generator above the grate. This procedure will in any case be necessary in the period of "up" gas making if high temperatures are to be avoided on the grate.

4. If a generator system is used in which the ash leaves the generator in a fluid condition (by using very high temperatures in the generator) the blow gases contain a very high proportion of carbon monoxide and are used for heating the regenerator. In this case the capacity of the generator is very high and the blow

gases are sufficient to provide the greater part of or all the heat necessary for the heating of the regenerator. Should the blow gases have too low a calorific value for the achieving of the high temperature required some water gas or other gases of high calorific value can be added to the blow gases or a part of the heat can be taken from the generator bed.

In this case not much of the fuel of low calorific value can be used but the total fuel consumption of coke is less than by the well known processes. This form of producing the gases is most suitable for production of synthesis gases from methane-containing gases.

5. If not very high temperatures are desirable in the regenerator a part of the heat to pre-heat the re-cycle gases can be taken from the generator bed, on the other hand it may be advantageous to blow the generator at a lower temperature than the temperature of the re-cycle gases, or it may be desirable to change the temperature of the re-cycle gases within a gas making period so as to achieve the most advantageous temperatures in the regenerator.

6. If oxygen is used for the production of water gas or synthesis gases by blowing with oxygen or an oxygen-containing gas such as air the application of the above mentioned process results in a saving of oxygen.

7. It is possible by the application of the process of this invention advantageously to produce such gases as carburetted water gas, carbon monoxide-rich, hydrogen-rich, nitrogen-rich etc. gases and also gases with very low content of inert constituents, because of the great flexibility of the process of the invention.

The following examples illustrate how the process of the invention may be carried into effect:

1. 0.45 Kgms. of steam having a temperature of about 120° C. was mixed with 2.5 cubic metres of water gas and the mixture was pre-heated in a heat exchanger (which was heated by re-cycle gases coming from the generator) and then passed to a regenerator the temperature of which had been raised to 1300° C. by burning producer gas generated in a producer gas plant. The mixture of steam and water gas was then introduced into a generator to produce water gas. The generated and the re-cycled water gas (3.5 cubic metres in all) left the generator at a temperature of 750° C. and was then cooled to 150° C. (the heat extracted was used for pre-heating the re-cycle gases and steam) and 2.5 cubic metres of the water gas were re-cycled. During the blowing period 0.6 cubic metres of air was employed per cubic metre of water gas produced.

It is to be noted that by using a producer gas plant the producer gas is used as it comes from the plant with a high temperature and the air used in the producer plant and in the combustion in the regenerator was pre-heated with the waste gases from the combustion process. The same procedure can be applied by using other gases. In that case the gas and the air used for combustion are then pre-heated with the waste gases.

It was found that the consumption of coke of a size above 1½" (calorific value 7150 k. cal. per kgm.) was 310 kgms. in addition to 210 kgms. of coke of a size under 1" (calorific value 5400 k. cal. per kgm.) per 1000 cubic metres of blue water gas produced whilst the output of the generator per unit of time was considerably increased.

2. 0.5 Kgm. of steam having a temperature of about 150° C. was mixed with 2 cubic metres of water gas and the mixture was superheated in a regenerator the temperature of which had been raised to 1100° C. by burning producer gas generated in a producer gas plant. The mixture of steam and water gas was then introduced into a generator to produce water gas. The generated and the re-cycled water gas (3 cubic metres in all) left the generator at a temperature of 450° C. and was then cooled to 150—200° C. (the heat extracted was used for producing steam and electric current for the process) and 2 cubic metres of the water gas were re-cycled. During the blowing period 0.45 cubic metres of air was used per cubic metre of water gas produced.

It was found that the consumption of coke of a size above 1½" was 265 kgms. in addition to 285 kgms. of coke of a size under 1" per 1000 cubic metres of water gas produced whilst the output of the generator per unit of time was considerably increased.

The invention has a number of advantages.

Thus, for example:

1. The process uses less fuel.

2. It is possible to use a part of the fuel in the form of low quality fuel (such as coke of smaller size).

3. The production capacity of the water gas generator is considerably increased owing to the shorter blowing times and the longer time during which the temperature in the water gas generator is high enough to allow of the making of gas.

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. A discontinuous process for the manufacture of water gas wherein the heat necessary for the reaction with the solid fuels in the generator and to compensate for heat losses is obtained partly by using a regenerator which is heated by blow gases or gas from a producer gas plant or other source, whereafter a mixture of water gas with or without coke oven gas or other gas rich in methane and steam and/or carbon dioxide is passed through the said regenerator and then passed to a water gas generator, the passage of the said mixture through the regenerator heating the mixture to a predetermined temperature, and partly by subjecting the generator to blowing from time to time with oxygen, air or other oxygen-containing gases.

2. A process for the manufacture of water gas substantially as described with reference to the examples given.

3. Water gas when manufactured by the process claimed in any one of the preceding Claims.

Dated the 5th day of March, 1942.

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