PATENT SPECIFICATION

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PROVISIONAL SPECIFICATION

Improvements in the Manufacture of Water Gas or Gas Consisting largely of Carbon Monoxide and Hydrogen

We, HUMPHREYS & GLASGOW LIMITED, of Humglas House, Carlisle Place, in the City of Westminster, a British Company and NORMAN HENRY WILLIAMS, of the same address, a British Subject, do hereby declare the nature of this invention to be as follows:—

This invention has reference to the manufacture of water-gas or a gas consisting largely of carbon monoxide and hydrogen by a cyclic process in which the air and steam and/or other gases supplied to the fuel bed are preheated, and in particular to such a process in which some or all of the air is preheated in a recuperative heat exchanger by the gaseous products of its passage through the generator, with or without secondary combustion of these gases prior to their passage through the heat exchanger, and some or all of the steam is preheated in the same heat exchanger by the hot water-gas and undecomposed steam resulting from the passage of the steam through the generator. Other gases, such as hydrocarbon containing gases, which it is desired to subject to reaction or thermal treatment in the fuel bed may also be supplied to the generator with or without preheating in the said heat exchanger and with or without admixture with steam.

According to this invention in apparatus for carrying out such a process there is provided in the gas path between the water gas generator and the hot gas inlet to the heat exchanger a regenerator, whereby cyclic fluctuations in the temperature of the gaseous products and undecomposed steam passisng therethrough to the heat exchanger are reduced in extent and rapidity and more constant conditions are ensured at the hot end of the heat exchanger, thereby reducing troubles arising from continual cyclic thermal expansion and contraction. More constant temperature of the air and steam and any other gases preheated in the heat exchanger are also secured.

Moreover, by providing a sufficient mass of heat storing refractory material within the regenerator, steam which is required to flow through the generator in the reverse direction to the steam and air preheated in the heat exchanger, for example steam for down-running, may if desired be preheated by passage through the part of the heat storage mass nearest to the generator, instead of in the heat exchanger, without directly cooling the portion of the regenerative mass adjacent to the heat exchanger; or any gas, for example, hydrocarbon-containing gas, which it is desired to subject to thermal treatment in the fuel bed of the generator by its passage, in the downward direction, through the fuel bed may also be preheated in this way. For the removal of gases formed by downward flow through the fuel bed, a valved offtake is provided from the bottom of the generator to the wash box. In cases in which it is desired to recover the heat from gases leaving the generator through this offtake, they may be led through a waste-heat boiler or a recuperative heat exchanger or one of a pair of regenerative heat exchangers, through which recuperative heat exchanger or one or other of which regenerative heat exchangers, steam or gas may be passed for preheating on its way to the apparatus.

Suitable valves and connections may also be provided to permit any steam or hydrocarbon-containing or other gas which it is desired to pass in a downward direction through the fuel bed to be preheated in the heat exchanger, and the products formed by their passage through the fuel bed to flow through the recuperative heat exchanger and/or regenerative heat storage vessel. The connections and hot gas valves needed to achieve this complicate the apparatus however and we prefer to preheat such downwardly

[Price 2/-]

supplied steam or gas in the manner already described.

Provision may be made for regulating the degree of preheating of the air and/or steam. For example, means may be provided for enabling part of the hot gases or part of the air and steam to by-pass the whole or part of the heat exchanger or regenerator, or both.

Any sensible or potential heat remaining in the blast gases and/or any sensible heat remaining in the water gas leaving the recuperator may be recovered in a waste heat boiler after, if desired, the completion of combustion of the blast gases with added air.

Dated this 17th day of January, 1946.

For the Applicants,
LLOYD WISE & CO.,
10, New Court, Lincoln's Inn London, W.C.2,
Chartered Patent Agents.

COMPLETE SPECIFICATION

Improvements in the Manufacture of Water Gas or Gas Consisting largely of Carbon Monoxide and Hydrogen

We, HUMPHREYS & GLASGOW LIMITED, of Humglas House, Carlisle Place, in the City of Westminster, a British Company and NORMAN HENRY WILLIAMS, of the same address, a British Subject, 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 has reference to the manufacture of water-gas or a gas consisting largely of carbon monoxide and hydrogen by a cyclic process of the type in which the air and steam and/or other gases passed upwardly through the fuel bed are preheated, and in which some or all of the air is preheated in a recuperative heat exchanger by the gaseous products of its upward passage through the generator, with or without secondary combustion of these gases prior to their passage through the heat exchanger, and some or all of the steam passed upwardly through the fuel bed is preheated in the same heat exchanger by the hot water-gas and undecomposed steam resulting from the passage of the steam through the generator. In such processes other gases, such as hydrocarbon containing gases, which it is desired to subject to reaction or thermal treatment in the fuel bed may also be supplied to the generator with or without preheating in the said heat exchanger and with or without admixture with steam.

According to this invention whereof two arrangements are diagrammatically illustrated in Figs. 1 and 2 of the accompanying drawings in apparatus for carrying out the process referred to there is provided in the gas path between the top of the water gas generator 1 and the hot gas inlet 2 to the heat exchanger 3 a regenerator 4, whereby cyclic fluctuations in the temperature of the gaseous products and undecomposed steam passing to the heat exchanger are reduced in extent and rapidity and more constant conditions are ensured at the hot end of the heat exchanger, thereby reducing troubles arising from continual cyclic thermal expansion and contraction. More constant temperature of the air which is supplied through the valves 6, 8 and steam for the uprun supplied through the valves 7, 8 and any other gases preheated in the heat exchanger are also secured.

Moreover, by providing a sufficient mass of heat storing refractory material 5, 5^a within the regenerator 4, steam which is required to flow through the generator 1 in the reverse direction to the air and steam preheated in the heat exchanger 3, for example steam for down-running, may upon opening valve 9 be preheated by passage through the part 5 of the heat storage mass nearest to the generator, without passing through the heat exchanger 3, without directly cooling the portion 5^a of the regenerative mass adjacent to the heat exchanger 3; the gaseous products always flow through the uncooled portion 5^a in the same direction and relatively constant temperature is maintained at the hot end of the heat exchanger. Any gas, for example, hydrocarbon-containing gas, supplied through valve 10, which it is desired to subject to thermal treatment in the fuel bed of the generator by its passage, in the downward direction, through the fuel bed may also be preheated in this way. For the removal of gases formed by downward flow through the fuel bed, an offtake 11 including valves 12, 13 is provided from the bottom of the generator to the wash box 14. In cases in which it is desired to recover the heat from gases leaving the generator through this offtake they may upon closing valve 13 and opening another valve 15, Fig. 1 be led to the wash box 14 through a waste-heat boiler 16. Again, as shown in Fig. 2, gases

formed by downward flow through the fuel bed and leaving the generator from the bottom by way of an offtake 11ª, may pass through a recuperative heat exchanger 3ª, thence to the wash box 14 or waste heat boiler 16 as in Fig. 1. In such modified arrangement steam or gas or both may be supplied to the heat exchanger 3ª by way of either valve 9, valve 10 or both, and valve 17 there to be preheated and then passed through the upper part of the regenerator 4 for further preheating in the checkerwork 5 on their way to the generator.

Provision may be made for regulating the degree of preheating of the air and/or steam. For example, means, such as valves 8, 19, 18 and 24 in Figure 1, and 8, 19, 18, 24, 17, 20, 12 and 21 in Figure 2 may be provided for enabling part of the hot gases and/or part of the air and/or steam to bye-pass either or both of the heat exchangers 3 and 3ª or means, not shown, may be provided to enable part of the heat exchangers to be bye-passed by the hot gases and/or air and/or steam.

Any sensible or potential heat remaining in the blast gases and/or any sensible heat remaining in the water gas leaving the heat exchanger may be recovered in a waste heat boiler after, if desired, the completion of combustion of the blast gases with added air. 22 is a valve for controlling supply of tertiary air to gases entering waste heat boiler 16. 23 is the customary valve controlling the air supply for secondary combustion to the regenerator. 25 is the usual stack pipe with the usual outlet valve 26.

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. In a cyclic process of gas manufacture of the kind herein referred to, in which air and steam and, if desired, other gases passed upwardly through the generator, are preheated in a heat exchanger by the gaseous products of their respective upward passage through the generator, reducing in extent and rapidity cyclic fluctuations in the temperature of the gaseous products and undecomposed steam passing from the top of the generator to the heat exchanger and ensuring more constant conditions at the hot end of the heat exchanger by passing the uprun gaseous products from the generator first through a regenerator in a constant direction and then through the heat exchanger.

2. A cyclic process of gas manufacture as claimed in claim 1 in which steam for example required for down-running, or other gas desired to be thermally treated by passage in downward direction through the generator is preheated by passage through part of the regenerator heat storage mass nearest the generator without directly cooling the portion of the heat storage mass adjacent to the heat exchanger, with or without preliminary preheating of said steam or other gas in a heat exchanger transverse by the products of the downward passage of the steam or other gas through the generator.

3. Apparatus for carrying out the process of gas manufacture herein claimed substantially as illustrated in Fig. 1 or in Fig. 2 of the accompanying diagrammatic drawings.

Dated this 18th day of December, 1946.

For the Applicants,
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10, New Court, Lincoln's Inn London, W.C.2.

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

Fig. 1.

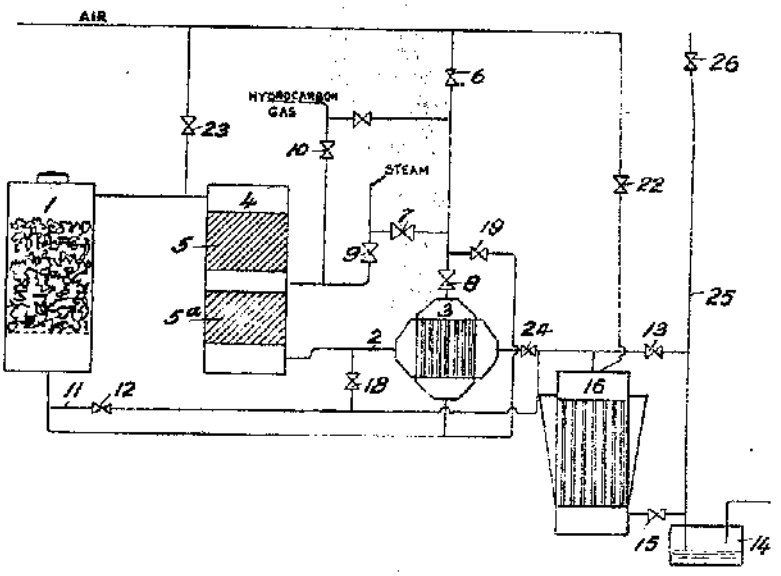

Fig. 2.