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(54) CARBURETTED WATER GAS MANUFACTURING PROCESS

(54) FABRICATION DE GAZ D'EAU CARBURE

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ABSTRACT:

CLAIMS: Show all claims

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This invention relates to a process and apparatus for the manufacture of carburetted water gas and like gases and it is an object of the present invention to provide an improved process for the manufacture of such gases and an apparatus for carrying out such processes.

With this object in view the present invention provides a discontinuous process for the manufacture of carburetted water gas, oil gases, blau gas or similar gases (all of which are hereinafter referred to as carburetted water gas); or water gas wherein a vessel containing checker bricks is heated by means of a hot gas to a predetermined temperature, tar or oil or hydrocarbon gases is introduced into the gases leaving the vessel which gases are at a temperature and have a sensible heat at least sufficient to crack the oil or tar or hydrocarbon gases and thus produce carburetted water gas or water gas.

It should be understood that more than one of the substances tar, oil and hydrocarbon gases may be used if desired and also that a mixture of steam and carbon dioxide may be used.

Preferably the heating of the vessel is effected by burning tar or gas therein but if desired other liquid, solid or gaseous fuels may be used for this purpose. If steam is used in the manufacture of the water gas in the vessel preferably excess steam is employed. The amount of excess steam used will depend upon the calorific value required in the gas to be produced. The tar or oil which is introduced into the vessel may be pre-heated if desired and various kinds of oils or tars may be used such as crude oils, fuel oils, boiler oils,

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low or high temperature tars, pitch and water gas tar which can be obtained in the process. Furthermore the steam or carbon dioxide employed may be pre-heated.

Preferably two vessels are employed in conjunction with each other, one vessel being heated whilst the other vessel is being used for gas making.

In addition to the production of carburetted water gas, the process also produces as a by-product a certain amount of tar and this tar is precipitated from the gas produced, for example electrostatically. Preferably the sensible heat, and if desired at least a part of the potential heat, of the gases produced is used for steam generation or power generation, in gas turbines.

As indicated above the temperature of the gases leaving the vessel must be sufficiently high to crack the oil or tar or hydrocarbon gases injected for carburetting the gas and this cracking can be accomplished in more than one stage at different temperatures, for example a part of the oil or tar or hydrocarbon gases may be introduced into the gases which are at a temperature of for example 1100°C. to 1200°C., whereby cracking is effected at a temperature of about 1000°C., and thereafter further oil or tar or hydrocarbon gases may be introduced into the gas which is now at a temperature of 1000°C. so that cracking takes place at about 750°C.

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It will be understood that a different grade of oil or tar or hydrocarbon gas or different kind of oil or tar or hydrocarbon gas may be used in the two stages of the cracking referred to above, and the gases leaving the vessel may be divided into a plurality of streams, each being treated separately and afterwards, if desired, again mixed.

The tar obtained in the cracking process may be partly or wholly re-cycled and in this way it is possible by effecting the cracking at suitable temperatures to produce valuable products such as toluene, benzene and other liquid and gaseous hydrocarbons such as olefines which may be extracted from the gas before it is used. The extraction may be effected by compression and washing out with solvent. The manufactured gases may be freed from undesirable compounds such as hydrogen sulphide and carbon dioxide in known manner.

Preferably the tar or oil for burning will be sprayed into the vessel and for this purpose a part of the energy in the gases produced can be used, or steam, carbon dioxide, or air or other gas or vapour may be used for this purpose.

The calorific value of the gas produced can be regulated by the temperature employed for water gas production in the vessel; by the proportion of steam, carbon dioxide and the like used; by the cracking temperature chosen; and by the nature and amount of the oil or tar or hydrocarbon gas employed for the carburetted water gas or water gas production.

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The process may be operated under pressure and cracking catalysts may be employed in one or more stages of the process.

Some embodiments of the invention will now be described by way of example, with reference to the accompanying drawings, in which Figs. 1 to 3 show diagrammatically three embodiments of apparatus for carrying into effect the processes of the invention.

Referring to Fig. 1 of the drawings, a pair of vessels 1 and 1' containing checker brickwork is provided, each being used alternately. The vessel 1 is provided with a burner 2 controlled by a valve 2a, a conduit 3 controlled by a valve 3a for the admission of oil or tar and a conduit 4 controlled by valve 4a for the admission of steam or carbon dioxide. The vessel 1 is also provided with an outlet conduit 5 controlled by a valve 5a with an inlet conduit 6 having an atomiser or spray nozzle controlled by the valve 6a for the admission of oil or tar for carburetting the gas formed. The vessel 1' is provided with similar conduits and valves 7, 8, 9, 10 and 11 and 7a, 8a, 9a, 10a and 11a. The apparatus also comprises a manifold 12, additional conduit 13 with spray nozzle or atomiser controlled by valve 13a for admitting further oil or tar, heat exchangers 14 and 15, conduits 16 and 17 controlled by valves 16a and 17a respectively, cooler and precipitator 18, conduits 19 and 20 controlled respectively by valves 19a and 20a, compressor 21, conduits 22, 23 and 24 controlled respectively by valves 22a, 23a and 24a, turbines 25 and 26 and conduits 27 and 28 controlled respectively by valves 27a and 28a.

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In operation, vessel 1 is heated by air and fuel admitted through the burner 2, and the vessel 1', which has been heated in a similar manner in a previous operation, is used for gas making. Oil or tar is admitted through line 8 and steam or carbon dioxide through line 9, the water gas formed leaving through the line 10. Oil or tar for carburetting the water gas is admitted through the spray producer or atomiser of the conduit 11, the carburetted gas passing along the manifold 12. Further oil or tar is admitted through the spray producer or atomiser of the conduit 13 and the product passes through the heat exchanger 14, giving up part of its heat, and thence proceeds via the conduit 16 and heat exchanger 15, where it gives up more heat, and conduit 17 to the cooler and precipitator 18, where tar is precipitated and removed via the conduit 20. The gas is passed via the conduit 19 to the compressor 21 from whence normally liquid hydrocarbons and normally gaseous hydrocarbons and other gases which are liquefied under the pressure prevailing are removed via the conduit 23. The compressed gas leaving the compressor 21 through the conduit 24 absorbs heat from the heat exchanger 15 and is used to drive the turbine 25. The exhaust gases leaving the turbine 25 via the conduit 27 absorb heat from the heat exchanger 14 and are used to drive the turbine 23. The exhaust gases leaving this turbine can be sent to the consumer at the required pressure, and/or used for heating a boiler and/or heat exchanger, and/or used in the plant.

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Referring now to Fig. 2 of the drawings, a pair of vessels 28 and 29 containing checker brickwork is provided, each being used alternately. The vessel 28 is provided with a conduit 30 for compressed air, a fuel conduit 31, a conduit 32 for the admission of oil or tar and a conduit 33 for the admission of steam or carbon dioxide, controlled respectively by valves 30a, 31a, 32a and 33a. The vessel 29 is provided with similar conduits 34, 35, 36 and 37 controlled respectively by valves 34a, 35a, 36a and 37a. The conduits 30 and 34 are fed from the compressor 38 which is supplied with air via conduit 39 controlled by valve 39a. The compressed air is conveyed to the conduits 30 and 34 by conduit 40 controlled by valve 40a, the conduit passing through a heat exchanger 41. The conduits 30 and 31 and also the conduits 34 and 35 have outlets adjacent each other and constitute burners. In the description which follows it will be assumed that the vessel 28 is being heated and the vessel 29, which has been heated in the preceding cycle, is being used for gas making. Certain conduits and valves have been omitted from the drawing for the sake of clarity, as will be explained hereinafter. The apparatus is operated as follows:

The vessel 28 is heated by burning fuel admitted through conduit 31 by means of air admitted through conduit 30 which is supplied from the compressor 38 by conduit 40. The hot products of combustion under pressure leave the vessel 28 through conduit 42 controlled by valve 42a, and after passing through heat exchanger 43, pass through turbine 44, via conduit 45 controlled by valve 45a, through heat exchanger 46 to turbine 47 and thence via conduit 48, controlled by valve 48a, through heat exchanger 49. At the same time there is introduced into vessel 29, which has been heated in a previous operation, oil or tar through conduit 36 and steam or carbon dioxide through conduit 37 to produce a fuel gas

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which leaves the vessel 29 via conduit 50 controlled by valve 50a. The gas is carburetted by the injection of oil or tar through conduit 51 controlled by valve 51a and provided with an atomiser or spray producer, further oil or tar being injected in a similar manner via conduit 52 controlled by valve 52a. The hot gas is then cooled by passage through the heat exchanger 41 and leaves via conduit 53 controlled by valve 53a, whence it can be delivered to the consumer with or without passing through a cooler or condensation plant for the removal of liquids or easily liquefied gases. Alternatively the whole or a part of the gases leaving the vessel 29 may take the path shown in broken lines, namely, via the conduit 54 controlled by valve 54a through the heat exchanger 46, conduit 55 controlled by valve 55a, through heat exchanger 43 and thence by conduit 56 controlled by valve 56a to the consumer. It will be understood that in the succeeding cycle the functions of the vessels 28 and 29 will be reversed and each vessel will be provided with the necessary conduits and valves to enable it to be connected to the appropriate turbines, heat exchangers and the like, these additional connections being omitted from the drawings for the sake of clarity.

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Referring to Fig. 3 of the drawings, this shows a further embodiment, in which two vessels are used alternately. According to this embodiment, air is supplied through conduit 77 controlled by valve 77a and compressed in the compressor 78 from whence it proceeds via conduit 79 controlled by valve 79a and is heated in the heat exchanger 80. It then proceeds through the turbine 81 and thence by the conduit

82 controlled by valve 82a to the heat exchanger 83 where it is again heated, and thence through turbine 84 and conduit 85 controlled by valve 85a to one or other of the vessels 86 and 87, each containing checker brickwork. The vessel 86 is provided with a conduit 88 controlled by valve 88a for the admission of the compressed air and conduit 89 controlled by valve 89a for the admission of oil or tar, the outlets of the conduits 88 and 89 being adjacent each other to constitute a burner. The vessel 86 is also provided with a conduit 90 controlled by valve 90a for the introduction of steam or carbon dioxide. The vessel 87 is provided with similar conduits 91, 92 and 93 controlled respectively by valves 91a, 92a and 93a.

In the following description it will be assumed that the vessel 86 is being heated by the admission of air and oil or tar, whilst the vessel 87 which has been heated in a previous cycle has admitted thereto oil or tar and steam or carbon dioxide. The gases produced leave the vessel 87 by the conduit 94, controlled by valve 94a, oil or tar for carburetting the gas being admitted through conduit 95 controlled by valve 95a, which is provided with an atomiser or spray producer. Part of the gas is sent to the consumer via conduit 96 controlled by valve 96a, the remainder proceeding via conduit 97 controlled by valve 97a into which further oil or tar is injected by the conduit 98 controlled by valve 98a, which is also provided with an atomiser or spray producer. After the gas has thus been further carburetted it is cooled in the heat exchanger 83 and proceeds via conduit 99 controlled by valve 99a through the heat exchanger 80, in which it is

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further cooled, and is then sent to the consumer via the conduit 100 controlled by valve 100a, with or without passing through the cooler or condenser. It will be understood that the vessel 86 will likewise be provided with conduits and valves connecting it with conduit 97, and also with a conduit for the introduction of oil or tar into the gas produced, but these have been omitted from the drawings for the sake of clarity.

It will be understood that the oil, tar, steam, carbon dioxide, air or oxygen used may be so admitted to the various vessels that the steam, carbon dioxide, air or oxygen atomise the oil or tar used for heating the vessels, or some of the gas manufactured in the process may be used for this purpose.

Furthermore, the precipitator used may be electrostatic precipitator.

The term "oil" as used in the appended claims refers to hydrocarbon oils, tars, and hydrocarbon gases or mixtures thereof.

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I CLAIM:

1. A discontinuous process for the manufacture of carburetted water gas which comprises heating a vessel containing checker bricks to a predetermined temperature by means of a hot gas, introducing oil and at least one substance selected from the group consisting of steam and carbon dioxide into the heated vessel to produce water gas, allowing the gases produced to leave the vessel and introducing oil into said gases leaving the vessel, the said gases being at a sufficiently high temperature and having a sufficiently high sensible heat to crack the oil and produce carburetted water gas.

2. A process for the manufacture of carburetted water gas which comprises heating a vessel containing checker bricks to a predetermined temperature by burning a fuel therein, introducing oil and at least one substance selected from the group consisting of steam and carbon dioxide into the heated vessel to produce water gas, allowing the gases produced to leave the vessel and introducing oil into said gases leaving the vessel, the said gases being at a sufficiently high temperature and having a sufficiently high sensible heat to crack the oil and produce carburetted water gas.

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3. A process for the manufacture of carburetted water gas which comprises heating a vessel containing checker bricks to a predetermined temperature by means of a hot gas, introducing oil and at least one substance selected from the group consisting of steam and carbon dioxide into the heated vessel to produce water gas, allowing the gases produced to leave the vessel, introducing oil into said gases leaving the vessel,

the said gases being at a sufficiently high temperature and having a sufficiently high sensible heat to crack the oil and produce carburetted water gas, and using at least a part of the heat of the carburetted water gas thus produced to generate steam.

4. A process for the manufacture of carburetted water gas which comprises heating a vessel containing checker bricks to a predetermined temperature by means of a hot gas, introducing oil and at least one substance selected from the group consisting of steam and carbon dioxide into the heated vessel to produce water gas, allowing the gases produced to leave the vessel, introducing oil into said gases leaving the vessel, the said gases being at a sufficiently high temperature and having a sufficiently high sensible heat to crack the oil and produce carburetted water gas, and passing the carburetted water gas thus produced through a gas turbine to generate power.

5. A process for the manufacture of carburetted water gas which comprises heating a vessel containing checker bricks to a predetermined temperature by means of a hot gas, introducing oil and at least one substance selected from the group consisting of steam and carbon dioxide into the heated vessel to produce water gas, allowing the gases produced to leave the vessel, introducing oil into the gases leaving the vessel in a plurality of stages, the said gases being at a different temperature in each of said stages but in each stage the said gases being at a sufficiently high temperature and having a sufficiently high sensible heat to crack the oil and produce carburetted water gas.

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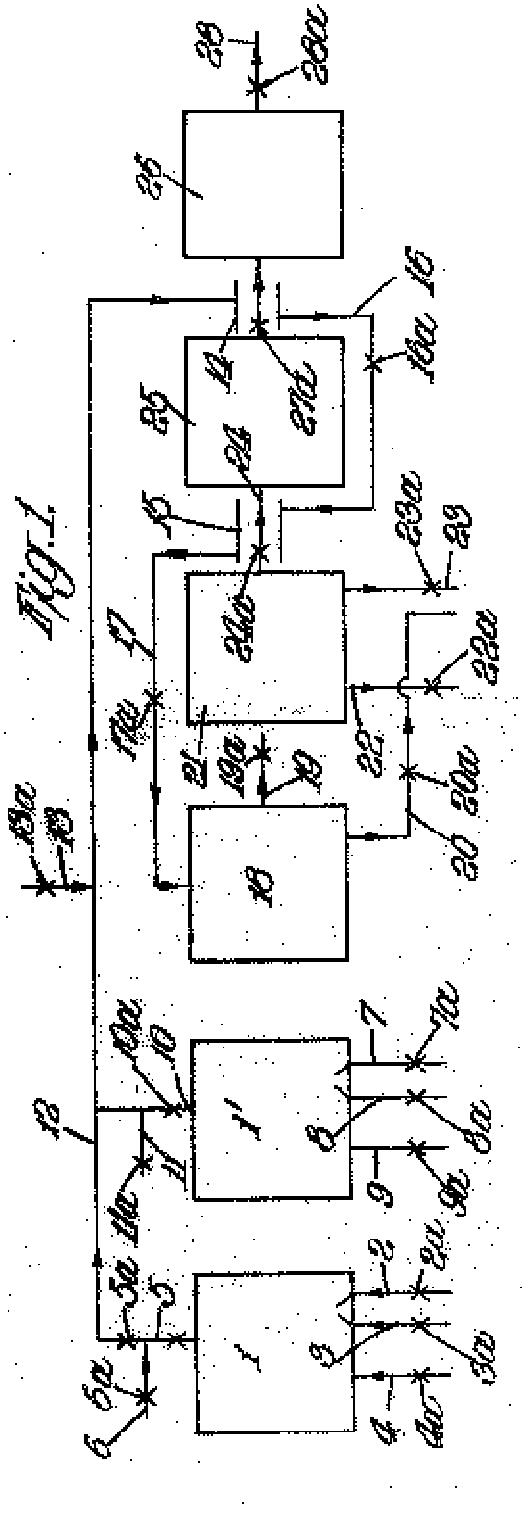

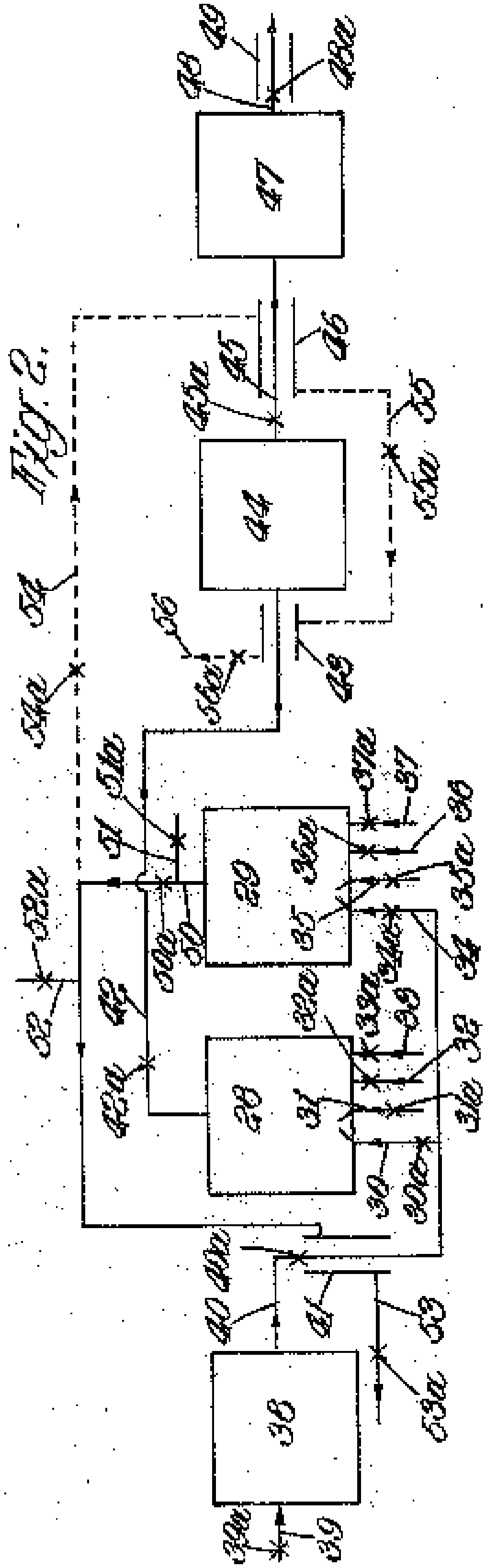

Certified to be the Drawings referred to in the Specification hereunto annexed.
Montreal, April 6, 1944.

Inventor
M. Steinschlaeger
by [signature]
Attorney.

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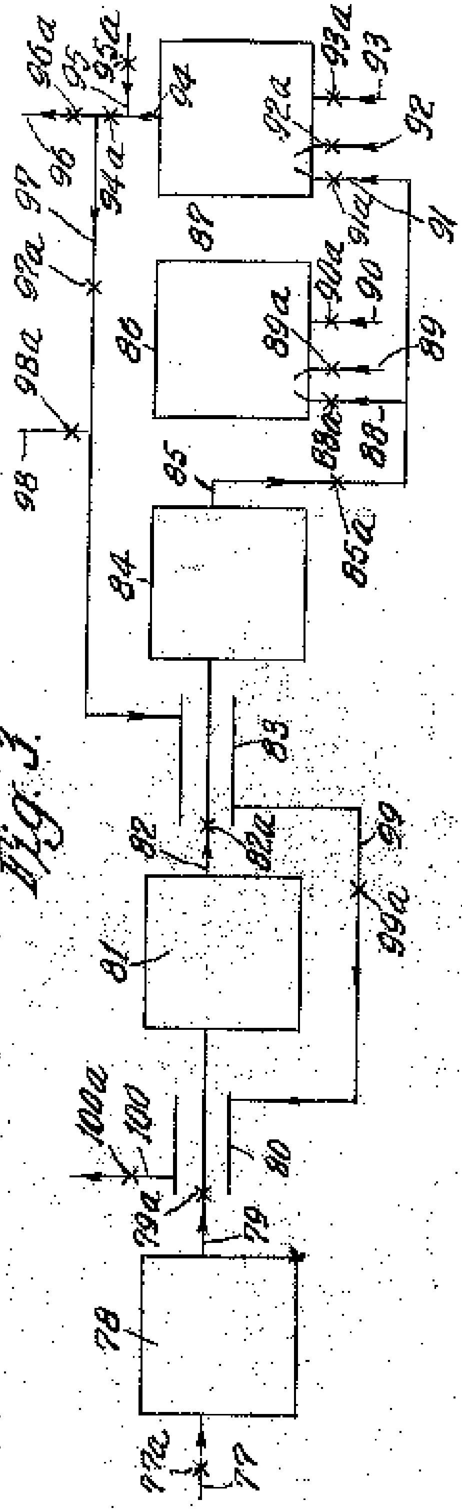

Fig. 3

Certified to be the Drawings
referred to in the Specifica-
tion hereunto annexed.
Montreal, July 23, 1945

Inventor
M. Steinschlaeger

by

Attorney