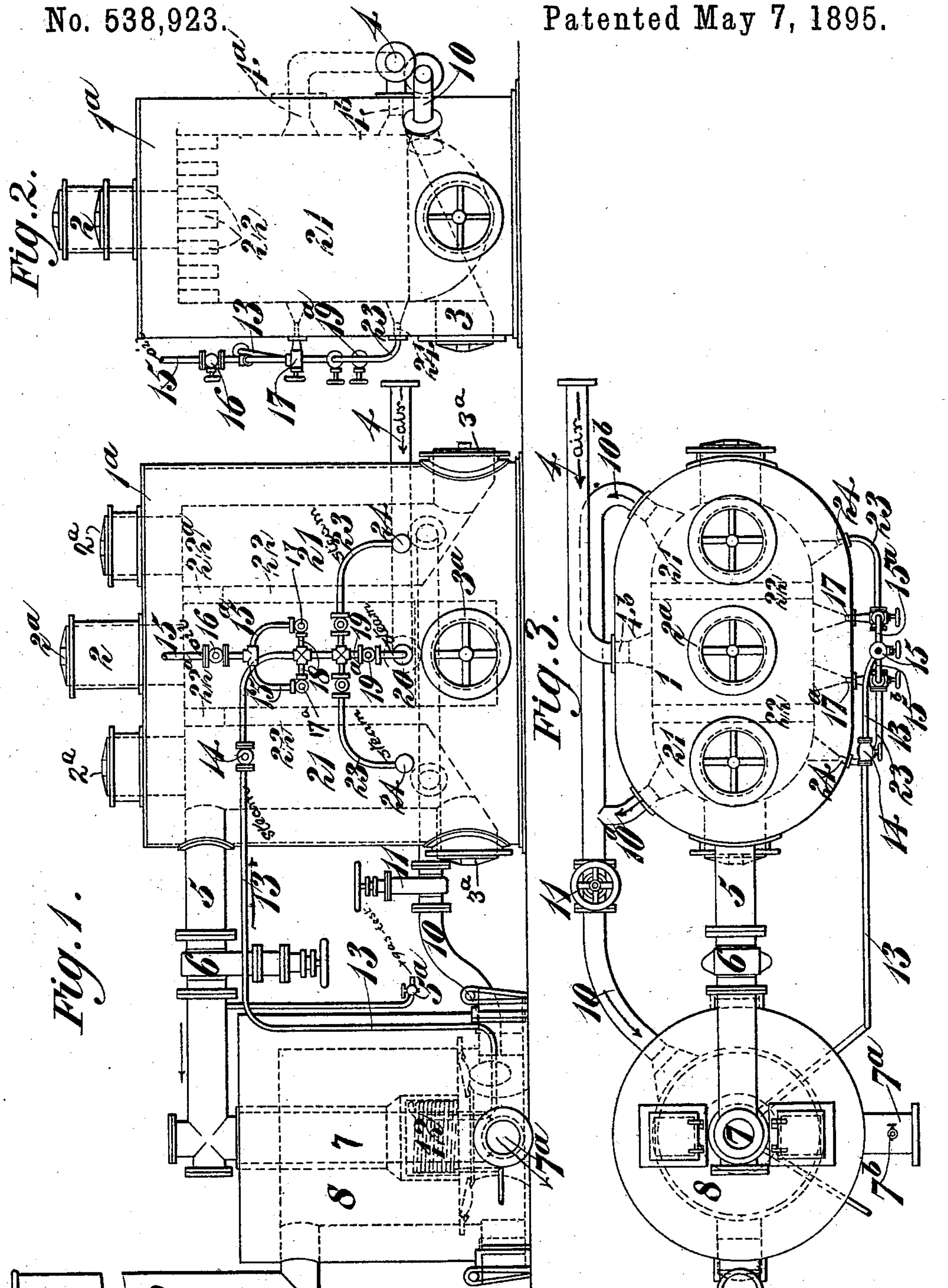
(No Model.)

V. B. LEWES.

APPARATUS FOR MANUFACTURE OF GAS.

No. 538,923. Patented May 7, 1895.



Witnesses
Edmund S. Snewin
Percy E. Mattocks

Inventor
Vivian Byam Lewes
by O. E. Duffy atty

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UNITED STATES PATENT OFFICE.

VIVIAN BYAM LEWES, OF GREENWICH, ENGLAND.

APPARATUS FOR MANUFACTURE OF GAS.

SPECIFICATION forming part of Letters Patent No. 538,923, dated May 7, 1895.

Application filed December 9, 1892. Renewed January 30, 1895. Serial No. 536,725. (No model.)

To all whom it may concern:

Be it known that I, VIVIAN BYAM LEWES, a subject of the Queen of Great Britain and Ireland, residing at the Royal Naval College, Greenwich, in the county of Kent, England, have invented Improvements in Apparatus for the Manufacture of Gas, of which the following is a specification.

This invention relates to certain improvements in apparatus for the manufacture of gas.

The invention consists in certain novel features of construction and in combinations of parts more fully described hereinafter, and particularly pointed out in the claims.

In the accompanying drawings, Figure 1 is a side elevation, Fig. 2 an end elevation, and Fig. 3 a plan, of apparatus suitable for producing an illuminating-gas from hydrocarbon oils and hydrogen according to my invention.

Referring to Figs. 1, 2 and 3, 1 is a gas generator comprising an outer metal casing lined with refractory material and provided with inlets 2 for fuel, and outlets 3 for clinker, these openings being normally closed by doors 2^a and 3^a respectively. This generator 1, has the three internal chambers 21, 21, 21, formed by the two vertical partitions 22, 22, of refractory material in the generator. These partitions are so arranged that the three chambers communicate with each other at the top only. This can be accomplished, if desirable, by a series of transverse openings 22^a in the upper portions of the partitions.

4 is a pipe through which air can be blown into the lower end of the chamber 1 of the gas generator.

5 is pipe with valve 6 connecting the top of the chambers 21 of the gas generator with the top of an iron fixing retort 7 which may be used in connection with the gas generator 1. This fixing retort is located within a suitable furnace or combustion chamber 8 (hereinafter referred to as the superheater furnace) having an exit flue 9.

7^a is the outlet of the retort.

10 is a pipe provided with a valve 11 and opening into furnace 8, below the grate bars thereof and having branches 10^a and 10^b respectively, opening into the lower ends of the chambers 21.

12 is a steam superheating coil-like chamber or coil (hereinafter referred to as the superheater) that may be cast in the wall of the retort, or be embedded in a thick mass of iron or other suitable material to prevent its being burned. This superheater is connected with a suitable steam generator, not shown, and with a steam supply pipe 13 provided with a cock 14.

15 is a hydrocarbon supply pipe provided with a cock 16 and with branches 15^a and 15^b that are connected respectively with two injectors 17, 17^a. These injectors may advantageously be arranged to discharge liquid hydrocarbon into the incandescent fuel in the gas generator 1, at points about midway in the height of the said gas generator as shown. The steam supply pipe 13 is connected by branches 18 with the two injectors 17, 17^a. It is also connected by a branch 19, having a cock 19^a, with a nozzle at 20 located near the bottom of the chamber 1 of the gas generator.

Branches 23, having cocks extend from pipe 13 or some connection thereof and have nozzles at 24, into the lower portions of the chambers 21, respectively.

The chambers 21 contain iron or a suitable compound or compounds of iron, such as sulphate of iron or oxalate of iron that is or are capable of being readily decomposed by heat into oxide of iron.

The mode of working and the action of the apparatus are as follows: Carbonaceous fuel, such as coke, is introduced into the gas generator 1 and raised to incandescence by a blast of air forced through the pipe 4 from a suitable blower. The products of combustion, largely consisting of carbon monoxide and nitrogen, are led through the iron or compound or compounds thereof in the chambers 21, and then through the branches 10^b, and 10^a and the pipe 10 past the valve 11, which is then open, to the superheater furnace 8, the combustion of solid fuel in which is supplemented by the combustion of the carbon monoxide in the said products. By this means the fixing retort 7 and superheater 12 are heated to the required temperature, and the iron in the chambers 21, 21, will also be treated to the required temperature to decompose steam while if the iron be present as a compound of iron it will be decomposed and reduced to the metallic state. The air blast is then cut off, the valve 11 closed and the

steam and liquid hydrocarbon supply turned on. Steam under pressure is then driven through the superheater and into the pipe 13 whence it passes through the injectors 17, 17ª into the incandescent fuel in the gas generator, spraying in at the same time liquid hydrocarbon which is fed to the injectors through the supply pipe 15.

I have obtained satisfactory results by injecting hydrocarbons, such as crude petroleum and also tar, by means of steam at a pressure of about one hundred and twenty pounds to the square inch, and heated to a temperature of about 400° centigrade. By thus injecting hydrocarbon into the mass of incandescent fuel, it is "cracked" to gas, any carbon, pitch, or the like that may be produced merely adding to the fuel in the gas generator, while "overcracking" is prevented by the simultaneous generation of water-gas from the steam used in injecting. When steam is turned on through pipe 13 it also passes by branches 19 and 23 into the heated iron in chamber 21, wherein the steam is decomposed, liberating hydrogen. The gas produced in chamber 1, flows from the top thereof into the chambers 21, where it meets the currents of hydrogen generated in chamber 21. The gas thus formed flows from the top of the generator through the pipe 5, the valve 6 in which is then open, to the fixing retort 7, and this being kept at an approximately constant high temperature of say about 1,000° centigrade, uniformly fixes the gas so as to produce a permanent illuminating gas. The resulting gas owing to the dilution by hydrogen and the interactions between carbon monoxide and the nascent hydrocarbons in the chamber 1, contains but a small and practically harmless percentage of carbon monoxide. Steam may from time to time be also injected through the nozzle 20 into the incandescent fuel in the gas producer 1 at a point below that at which the liquid hydrocarbons are being cracked, so that in case of over-heating and at the end of each run, or at other times as may be desired, the hydrocarbons in the gas generator may be swept out by an uprush of water gas produced by the decomposition of the steam thus injected.

To enable the fuel in the gas producer 1 to be raised to a suitable state of incandescence in a quicker and more uniform manner than has heretofore been usual, the said gas producer is or may be constructed with an air inlet 4ª, or there may be more than one, arranged at a point or points, above the inlet 4ᵇ at the bottom of the gas producer, so that two, or more, blasts of air can be injected into the fuel simultaneously at different points in its height. This arrangement of air blasts may advantageously be used in connection with gas producers for producing gas other than oil gas as for example water gas.

The relative quantities of the steam and hydrocarbon admitted through the injectors into the incandescent fuel should be so regulated that the gas generated in the fuel chamber 1 shall be of a brown color. This may be determined by providing the gas pipe 5 with a jet cock 5ª and the outlet 7ª with a jet cock 7ᵇ through either or each of which a small quantity of gas can be allowed to escape from time to time. If the gas thus allowed to escape through either jet cock be white, it indicates that the hydrocarbons are not sufficiently cracked, and the proportion of steam should be reduced. If the gas be black and "sooty" it indicates that they are being overcracked and the proportion of steam should be increased.

The production of carbureted hydrogen continues until the temperature of the fuel in the gas generator has fallen below the required point. The supply of steam and hydrocarbon is then shut off and the various connections are adjusted as before for the passage of an air blast or blasts any traces of hydrocarbon remaining in the said gas generator assisting the carbon monoxide to reduce to the metallic state the iron that has been oxidized in the chambers 21 by the steam, ready to repeat the foregoing operations.

The relative quantities of the steam and hydrocarbon admitted into the incandescent fuel should be determined in the manner hereinbefore explained.

I am aware that it has heretofore been proposed to produce illuminating gas from crude oil such as crude petroleum by injecting the oil by steam through red hot tubes, chambers or retorts, but this method has not been successful because the steam has injuriously attacked the oil, whereas by injecting the oil and steam into incandescent fuel, the steam attacks the incandescent carbon in the fuel in preference to the oil with the result that a permanent gas of high illuminating value can be obtained.

When carrying out the process on a large scale it may be made a continuous one by employing two sets of apparatus of the kind hereinbefore described so arranged and operated that illuminating gas will be produced in one apparatus while fuel is being raised to a state of incandescence in the other and vice versa.

What I claim is—

1. Apparatus for the manufacture or production of gas comprising a gas generator constructed to contain incandescent fuel, an injector connected with a steam and hydrocarbon supply pipe and constructed to inject hydrocarbon into the mass of said fuel, a steam supply pipe from which steam is also injected into said fuel, a blast pipe for admitting air to said gas generator one or more chambers constructed to contain iron and each of which is in connection at the top with the upper end of said gas generator and at the bottom with an outlet pipe provided with a valve, a retort in connection with the upper ends of said generator and chambers, a valve controlling said connection, a furnace for

heating said retort and a steam supply pipe for injecting steam into the lower part of each of said iron containing chambers, substantially as herein described for the purposes specified.

2. Apparatus for the manufacture of carbureted hydrogen comprising a gas generator constructed to contain incandescent fuel and provided with one or more combined hydrocarbon and steam injectors and with one or more air inlets, one or more hydrogen generating chambers constructed to contain iron, each of said chambers being in communication at the top with said gas generator and constructed at the bottom with an outlet pipe controlled by a valve, a steam pipe arranged to supply steam to said injectors and to the lower end of each of said hydrogen generating chambers, a retort in connection with the upper end of said gas generator and with the upper end of each of said hydrogen generating chambers, a valve controlling said connection, a furnace for heating said retort, a steam superheater in connection with said steam pipe, and a pipe with valve connecting the lower ends of said hydrogen generating chambers with said furnace substantially as described for the purpose specified.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

VIVIAN BYAM LEWES.

Witnesses:
EDMUND S. SNEWIN,
PERCY E. MATTOCKS,
Both of 2 Pope's Head Alley, Cornhill, London, E. C.