H. E. SMITH.

APPARATUS FOR THE PRODUCTION OF WATER GAS.

APPLICATION FILED NOV. 12, 1909.

Patented Feb. 14, 1911.

984,447.

2 SHEETS—SHEET 1.

FIG 1.

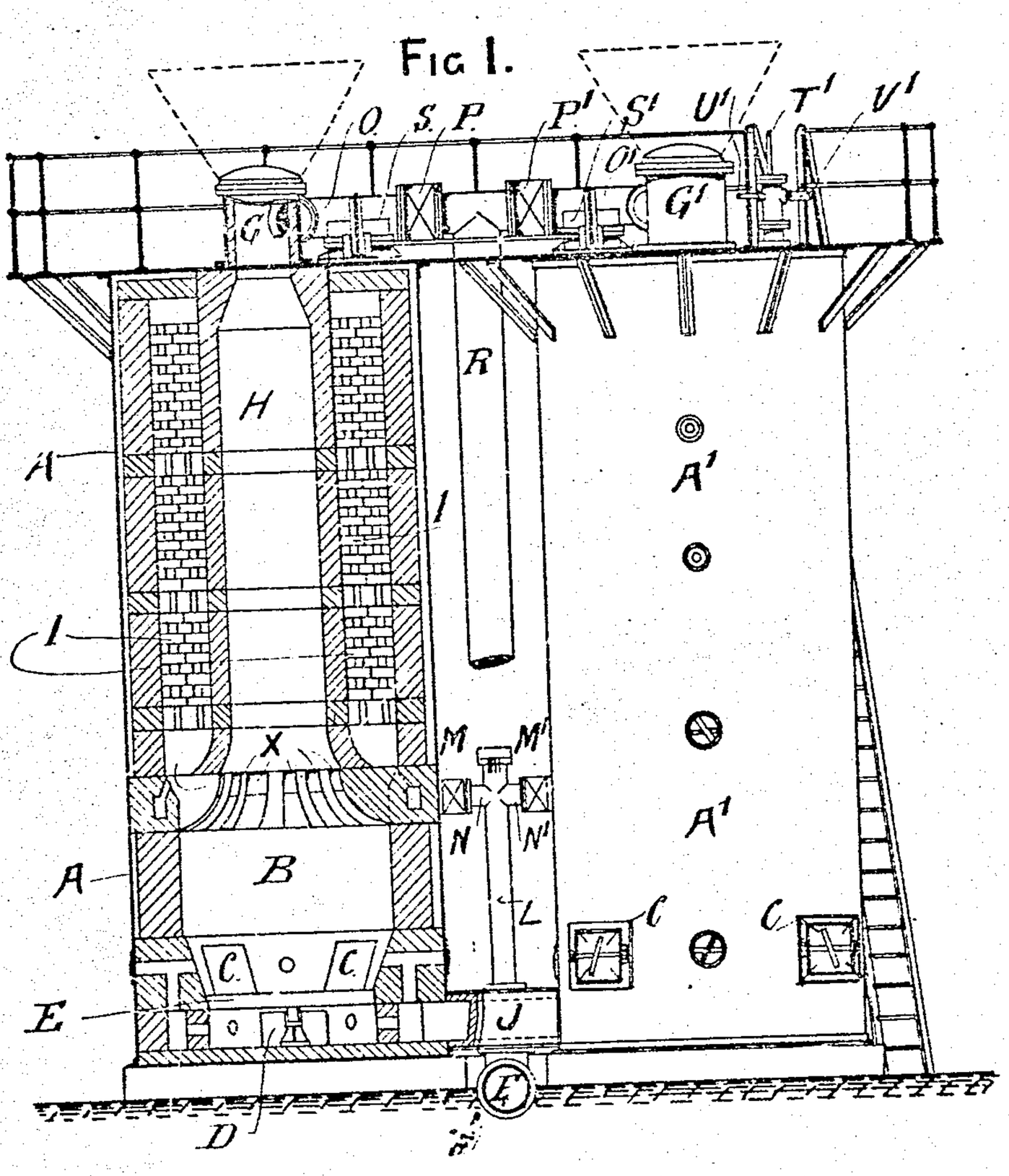
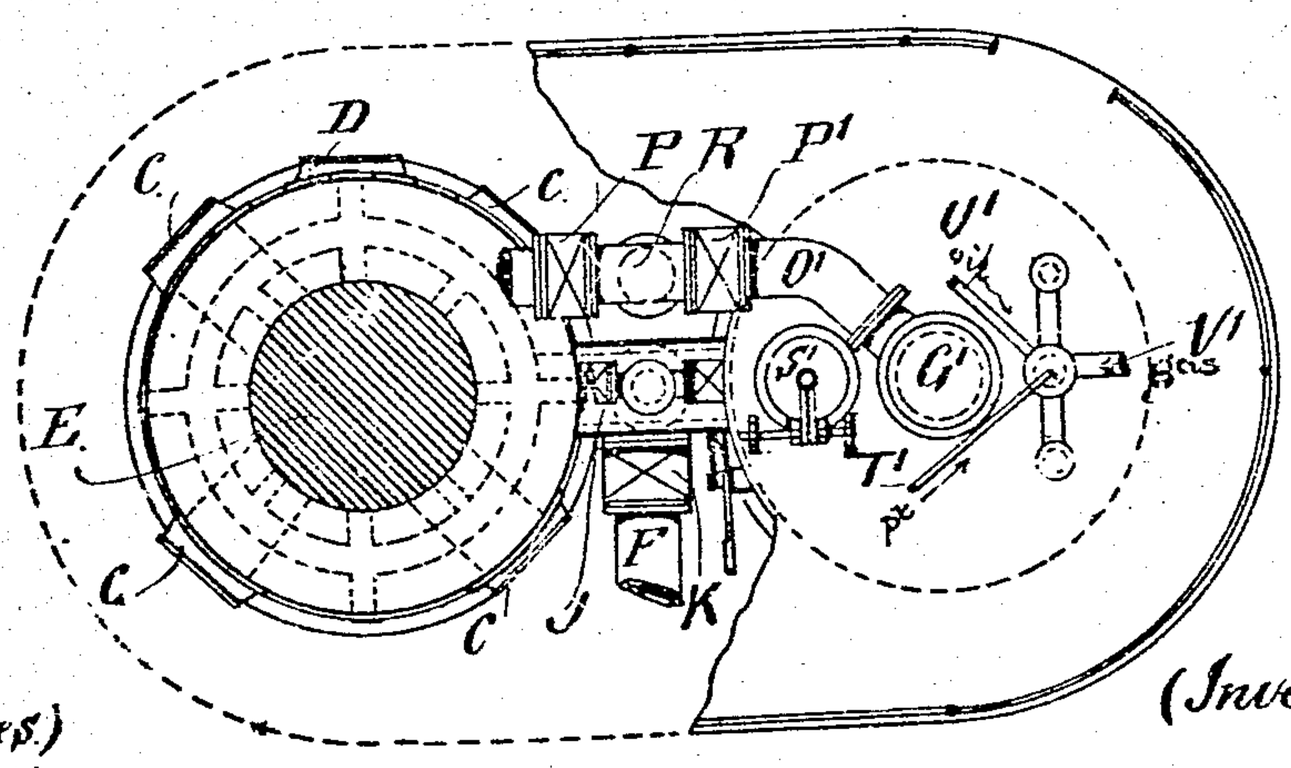


FIG 2.



(Witnesses.)

(Inventor)

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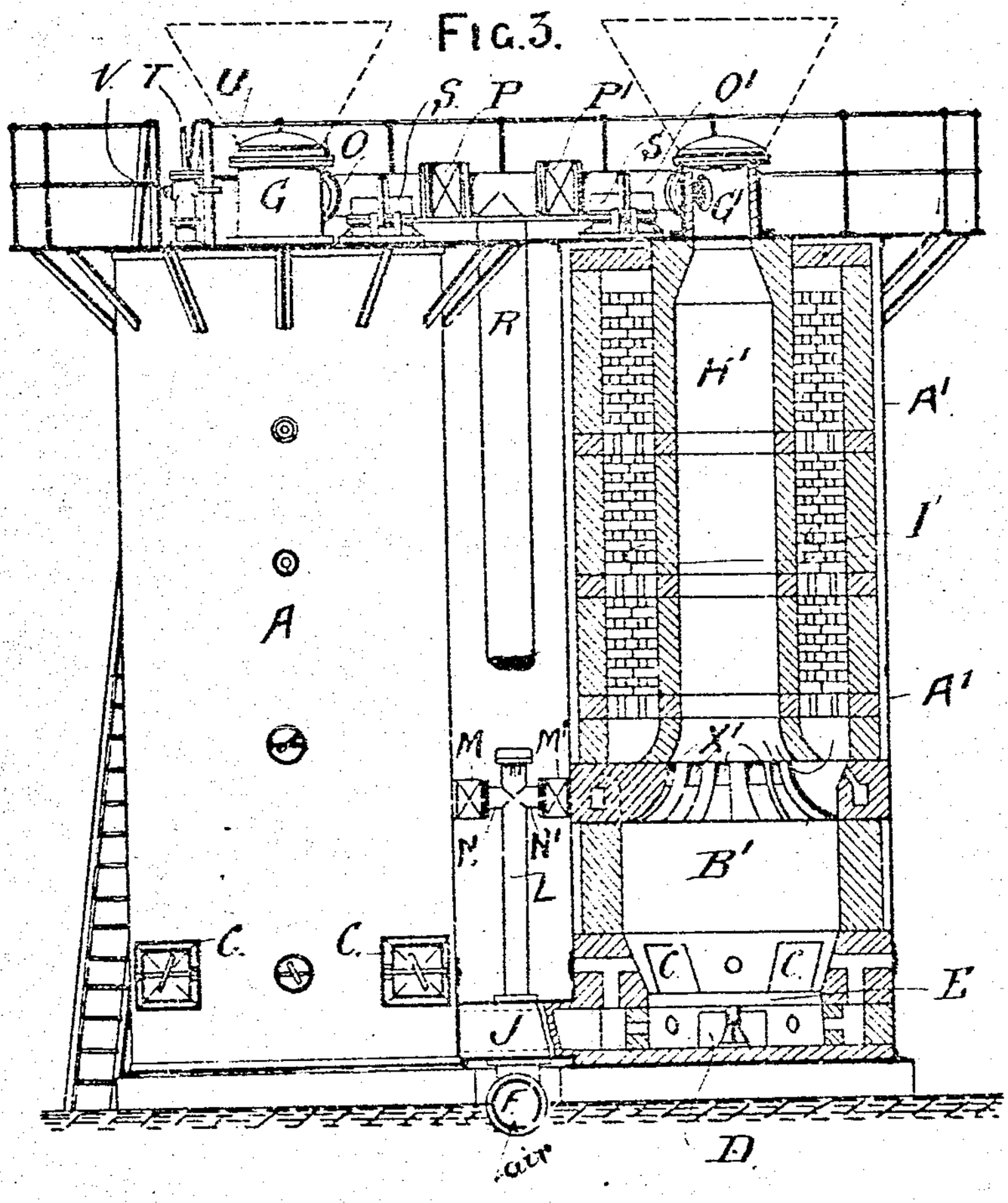
2 SHEETS—SHEET 2

FIG.3.



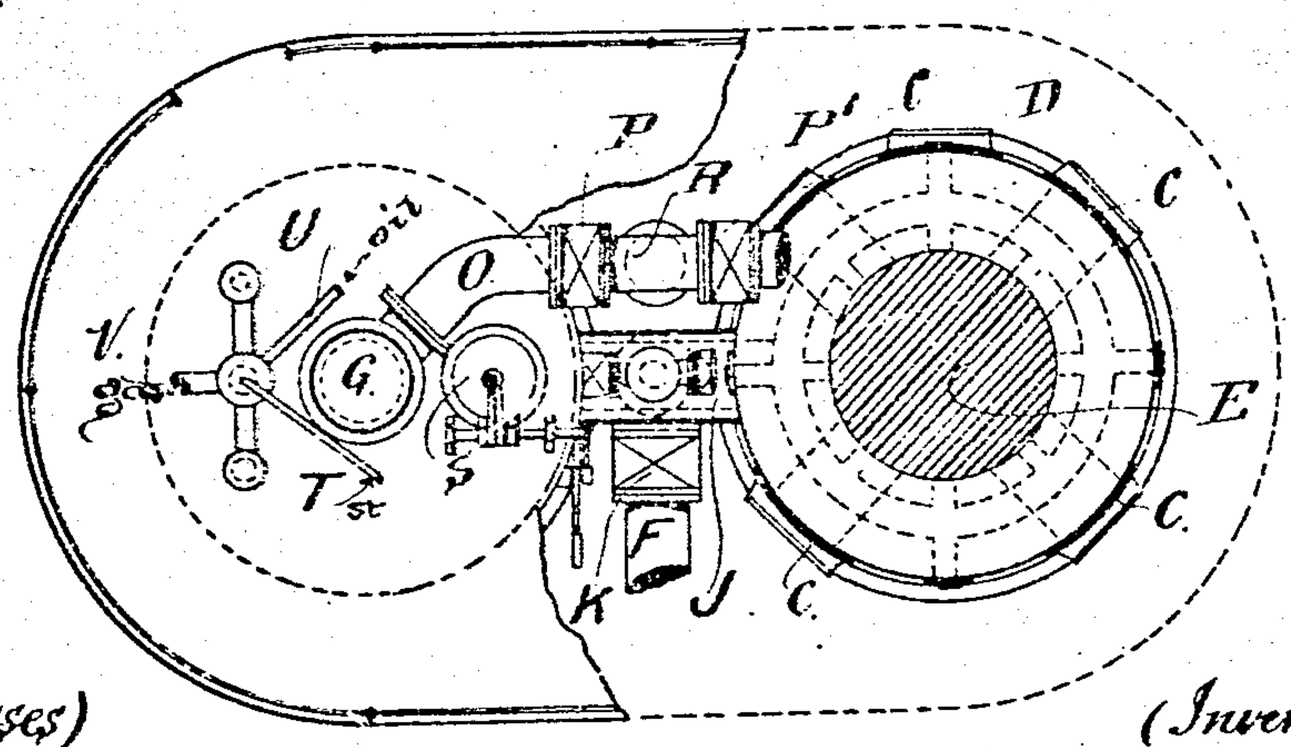


FIG4.

(Witnesses)

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UNITED STATES PATENT OFFICE.

HERBERT EDMUND SMITH, OF WESTMINSTER, ENGLAND.

APPARATUS FOR THE PRODUCTION OF WATER-GAS.

984,447. Specification of Letters Patent. **Patented Feb. 14, 1911.**

Application filed November 12, 1909. Serial No. 527,598.

To all whom it may concern:

Be it known that I, HERBERT EDMUND SMITH, of 39 Victoria street, Westminster, in the county of London, England, having invented a new and useful Form of Apparatus for the Production of Water-Gas and Carburation by Means of Oil or other Heavy Hydrocarbons, (for which I have obtained a patent in Great Britain, No. 24,893, dated November 19, 1908,) do hereby declare that the following is a full, clear, and exact description of same.

This invention relates to an improved form of apparatus for the production of carbureted-water-gas in a most economical manner, by securing the utmost heat efficiency from the fuel consumed in the apparatus. The principle of the arrangement is such that the heat produced during the period of blowing up, called "the blow" is stored in two sets of baffle brickwork, arranged about deep fuel feed chambers which supply two connected generators and serve as gas ouiet and mixing chambers, the baffle brickwork chambers being used alternately as steam superheater and carbureter, the acknowledged effect of this being that any carbon deposit thrown down from the carbureting material injected into the carbureter during the period of gas-making, called "the run", is highly heated during the blow following, and, in the next run, the steam passing through in a direction opposite to that of the previous run converts any of such deposit into water-gas, thus preventing any accumulation of solid matter in the checker brickwork, in addition to which the connecting and injection pipes are cleansed by the steam in its passage through them.

A further feature of the system is the arrangement whereby a stream of gas is made to reënter at the top of the carbureting chamber, and thus insure thorough circulation and blending of the gases.

It is a well known fact that a shallow fuel bed is more advantageous for water-gas plants during the blow, as the necessary high temperature can be obtained in a considerably shorter period, and with less consumption of fuel than otherwise; while, for the run a deep fuel bed is best, owing to the longer contact of the steam with the incandescent fuel. These advantages are embodied in this system, while the whole apparatus is assembled as to obviate the necessity of employing water cooled valves or valved passages between the steam superheater, generators, carbureting chamber and hot coke mixing chamber. Also, owing to the complete combustion of the carbon monoxid by means of a secondary air supply from the blast main, (which carbon monoxid would otherwise be blown into the air) the heat produced is stored in the alternate superheaters and carbureters as hereinafter described, and is used for the purpose of superheating the incoming steam and to carburet the outgoing stream of water-gas in addition to heating the fuel contained in the deep fuel feed chambers, which effect the mixing of the stream of carbureted-water-gas with the straight-water-gas as they pass up through same. At the end of each run of gas-making the process is reversed *i. e.* the carbureter of one run becomes the superheater of the next run.

The accompanying drawings show a form of my apparatus.

Figures 1 and 3 represent a part elevation and section, while Figs. 2 and 4 show a portion of the apparatus in plan and a section above the clinkering doors C.

In carrying my invention into effect, I employ two cylindrical fireclay lined vessels A and A′ placed side by side, in the lower portion of each of which is formed a water-gas generator B and B′ fitted with the necessary clinkering doors C, ash doors D, firebars E, blast inlet pipe F, connection being made in the center of generator crown to charging hoppers G and G′ at the top of steel vessel by means of fireclay channels H and H′. Above the crown of generator chambers is arranged a system of checker brickwork I and I′ filling up the space between the charging passages H and H′ and the outer lining of the shells A and A′. This brickwork will be arranged so as to insure uniform heat throughout and long travel of the hot gases which will enter from suitable openings X and X′ formed in the outer circumference of aforesaid generator crown at which points the secondary air supply will be admitted. Between and at the base of the vessels A and A′ and opening into same is arranged a fireclay lined connecting pipe J provided with a branch on which will be fixed the primary air valve K, and a vertical pipe L will be carried up to give

the secondary air supply to complete combustion of gases coming from the generator chambers B and B′ during the blow, suitable valves M and M′ being placed in the secondary air supply pipes N and N′. At the side of each charging hopper G and G′ a branch O and O′ will be formed provided with suitable valves P and P′ to control gas outlet between the same and main outlet tee piece R.

The mode of operation is as follows:— The fuel, which may be either coke, coal, wood or other carbonaceous matter, is fed in, automatically or otherwise, from the charging hoppers G and G′ to the full depth of cylinders, and both fires are raised simultaneously to a state of incandescence up to the level of the openings X and X′ leading from generators B and B′ into baffle brickwork chambers I and I′, by opening main blast valve K, secondary air valves M and M′ also being opened, the baffle brickwork chambers I and I′ are highly heated by the complete combustion of the gases, the products of which escape through the open stack valves S and S′ situated at the top of steel cylinders A and A′ and directly connected with baffle brickwork chambers I and I′. When the generators and baffle brickwork chambers have attained a suitable temperature for gas-making, the blast is shut off by closing valves K and M and M′, also the two stack valves S an S′ are closed, one of the gas valves say P′ is then opened, steam is admitted through pipe T to the superheating baffle brickwork chamber I in the other cylinder A, and the carbureting material is admitted by pipe U′ to the carbureting baffle brickwork chamber I′ together with a stream of gas introduced through pipe V′, which gas is re-passed from outlet main or any convenient source. The steam on admission travels through the highly heated baffle brickwork chamber I and is highly superheated thereby, while any carbon deposited from previous carburation is converted into water-gas which is carried with the steam to the incandescent fuel in generator B down which they travel, the steam being utilized for the production of water-gas according to the usual re-action. The resultant gases now pass through fireclay lined connecting pipe J and up through the incandescent fuel in generator B′, the long travel being most effective in the reduction of the amount of carbon dioxid present. At the crown of the incandescent fuel of generator B′ the hot water-gas comes into contact with the gas generated from the carbureting material together with the circulating stream of gas both of which have traveled down the carbureting chamber I′, the resultant carbureted-water gas passes away up the connecting chamber II′ between feeding hopper and generator and through branch pipe O′ attached to the side of charging hopper G′, thence through the open gas valve P′ to the usual condenser and scrubber.

When the test flame shows indications that the heats are getting low, oil and circulating gas valves attached to pipes U′ and V′ are closed, steam supply T is next closed, and finally gas valve P′ is shut. The stack valves S and S′ are then opened and fires are again raised to a suitable state of incandescence by opening blast valves K, M and M′, these valves are then closed and the stack valves S and S′ are also closed, and the sequence of operations for the next run is reversed. The gas valve P is then opened. steam is admitted through pipe T′ to the superheating baffle brickwork chamber I′ in the other vessel A′, and the carbureting material is admitted by pipe U to the carbureting baffle brickwork chamber I together with a stream of gas introduced through the pipe V, which gas re-passes from outlet main or any convenient source. The steam on admission travels through the highly heated baffle brickwork chamber I′ and is highly superheated thereby, while any carbon deposited from previous carburation is converted into water-gas, which is carried with the steam to the incandescent fuel in generator B′ down which they travel, the steam being utilized for the production of water-gas, as aforesaid, the resultant gases now pass through fireclay lined connecting pipe J and up through incandescent fuel in generator B. At the crown of the incandescent fuel of generator B the hot water-gas comes into contact with the gas generated from the carbureting material together with the circulating stream of gas, both of which have traveled down the carbureting chamber I, the resulting carbureted water-gas passes away up the connecting chamber II and through branch pipe O attached to the side of charging hopper G thence through the open valve P to the usual scrubber and condenser. Gas-making is continued until a further blow is necessary, when the sequence of operations is again reversed.

In the arrangement of the apparatus, I fit all valves with safety inter-locking gear of suitable type in order to prevent the possibility of them being worked out of proper rotation.

Claims:

1. In a plant for the production of water-gas, substantially as described, two similarly constructed vessels, a fire-clay lined pipe connecting said vessels at their base; primary and secondary air blast connections for said vessels, each vessel having in the lower portion a fireclay lined water-gas generator and in the upper portion an annular baffle brickwork carbureting and steam superheating chamber with an outlet at top of

each vessel—such outlets being open to the atmosphere and fitted with coupled stack valves—means for admitting a carbureting fluid and steam respectively to said carbureting and superheating chamber, through the center of which chamber and making direct connection between the charging hopper above and generator below, is formed of fireclay a combined deep fuel charging chute and gas mixing chamber at the top of which is secured the aforesaid charging hopper having a gas outlet branch attached thereto.

2. In a plant for the production of water-gas, substantially as described, two similarly constructed vessels, a fireclay-lined pipe connecting said vessels at their base; primary and secondary air blast connections for said vessels, each vessel having in the lower portion a fireclay lined water-gas generator, and in the upper portion is arranged about a deep central fuel feed chamber an annular baffle brickwork carbureting and steam superheating chamber, means for admitting a carbureting fluid and steam respectively to said carbureting and superheating chamber, and provided with ports for the admission of secondary air, and having in direct connection therewith and attached to the top of each vessel a common inlet for the admission alternately of steam, and carbureting material with circulating stream of gas.

3. In a plant for the production of water-gas, substantially as described, two similarly constructed vessels connected at base by fireclay lined valveless connecting piece having attached thereto the primary and secondary air supply connections for generators and baffle brickwork chambers respectively, each vessel having in the lower portion a fireclay lined water-gas generator, and in the upper portion an annular baffle brickwork carbureting and steam superheating chamber provided with common inlet for the admission of steam carbureting material and circulating stream of gas together when stack valve for the emission of blast products at the top of vessel, through the center of which chamber is arranged a deep fuel charging chute and gas-mixing chamber between combined charging hopper and gas outlet above and crown of water-gas generator below, such gas outlet being provided with branch to which is attached reversing valved connections.

Dated this fifth day of November, 1909.

HERBERT EDMUND SMITH.

Signed in the presence of—

HENRY J. BOXER,

GEO. J. MOULDER.