(No Model.)

W. R. ADDICKS.

CARBURETED WATER GAS APPARATUS.

No. 575,560. Patented Jan. 19, 1897.

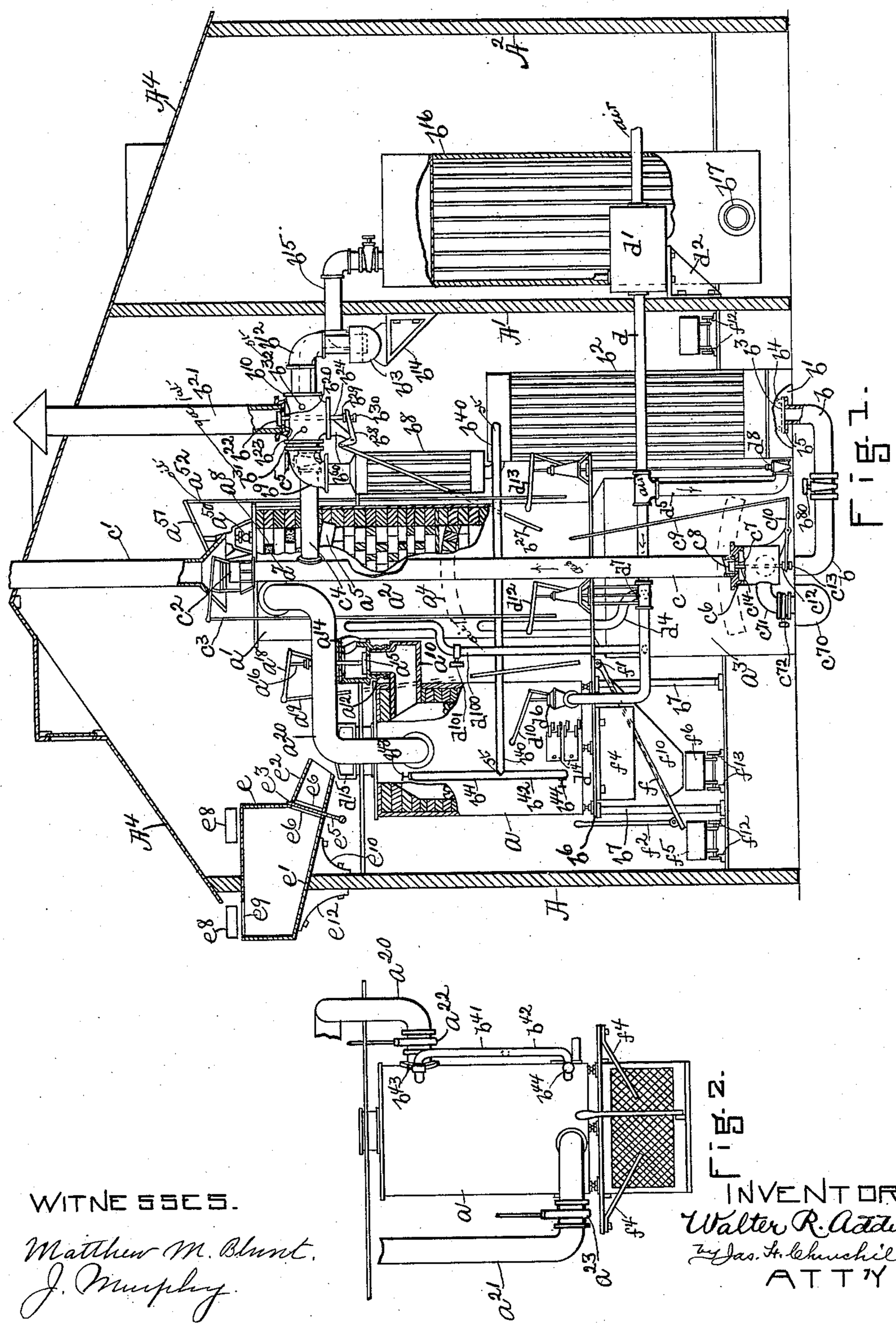

Fig. 1.

Fig. 2.

WITNESSES.

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CARBURETED-WATER-GAS APPARATUS.

SPECIFICATION forming part of Letters Patent No. 575,560, dated January 19, 1897.

Application filed November 15, 1895 Serial No. 569,040. (No model.)

To all whom it may concern:

Be it known that I, WALTER R. ADDICKS, a citizen of the United States, residing in Brookline, county of Norfolk, and State of Massachusetts, have invented an Improvement in Carbureted-Water-Gas Apparatus, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

This invention relates to an apparatus for manufacturing carbureted water-gas; and one feature of this invention consists in a novel construction and arrangement of apparatus by which the carbureted water-gas may be made after a manner as will be described. In accordance with this feature of the present invention the producer or gas-generator is connected to a structure having at its upper portion a hydrocarbon vaporizing and mixing chamber and at its lower portion a fixing-chamber, whereby the heavier hydrocarbons in the mixing-chamber may gravitate from said chamber and be subjected in the presence of the water-gas to a higher temperature than in the mixing-chamber, thereby utilizing these heavier hydrocarbons in the manufacture of fixed carbureted water-gas. The structure below the bottom of the mixing-chamber may and preferably will be subdivided by an open wall or arch to form a chamber intermediate of the mixing-chamber and the fixing-chamber, which intermediate chamber is directly connected to the gas-generator. The producer or gas-generator is connected to the intermediate chamber referred to in a novel manner, as will be described, to permit of expansion and contraction of the generator and intermediate chamber without destroying the said connection.

Another feature of this invention consists in providing the fixing-chamber with independent gas-outlets and connecting a boiler or other heating apparatus with one of said gas-outlets, so that normally the gases and products of combustion may be passed through the said boiler and be thereby utilized, and so that the said boiler may be quickly and easily cut off or disconnected from the fixing-chamber to enable it to be repaired or used alone for other purposes without interfering with the manufacture of the carbureted water-gas, which in this instance passes from the fixing-chamber through the other of the said gas-outlets.

The invention consists in a novel construction, as will be described, whereby danger of explosion is obviated or reduced to a minimum.

The construction of the fixing-chamber, the intermediate chamber, and the mixing-chamber in one structure and the connection of the producer or gas-generator to the intermediate chamber permits of the use of apparatus for handling the coal and ashes with increased facility, as will be hereinafter described. These and other features of this invention will be pointed out in the claims at the end of this specification.

Figure 1 represents in section and elevation, partially broken out, a carbureted water-gas-manufacturing plant or apparatus embodying this invention; and Fig. 2 a detail in elevation of the producer or generator shown in Fig. 1.

Referring to Fig. 1, A A′ A^2 represent the walls of a building or structure provided with a roof A^4, and within which is located a carbureted water-gas-manufacturing plant or apparatus embodying this invention. This plant or apparatus consists, essentially, of a water-gas producer or generator *a*, and a single structure comprising at least two, and preferably three, chambers—viz., a mixing-chamber *a′*, located at the top of the structure and in which the water-gas is enriched by hydrocarbons, either light or heavy oils; a chamber a^2, in which the mixture of water-gas and hydrocarbons is subjected to preferably a medium temperature, which chamber will be hereinafter referred to as the "intermediate" chamber, and a fixing-chamber a^3, in which the water-gas is fixed or rendered permanent for normal temperatures and pressures.

The fixing-chamber a^3, the intermediate chamber a^2, and the mixing-chamber *a′* are divided from one another, as herein shown, by open arches or perforated walls a^4 a^5, which may be of fire-brick and of any suitable construction or form, the arch a^4 dividing the fixing-chamber from the intermediate chamber and the arch a^5 dividing the intermediate chamber from the mixing-chamber.

The intermediate chamber and the fixing-chamber contain fire-brick or other refractory material, and for the best results the mixing-chamber also contains refractory and preferably non-absorbing material, such as bricks composed of plumbago, soapstone, a sand-core a^7, and a metal jacket a^8, or a crucible jacket and a metal core.

The intermediate chamber a^2 has connected to it the gas-generator or producer a, of any suitable or usual construction, preferably by an expansible joint or pipe connection, preferably consisting of a pipe-section a^{10}, connected to the producer or generator, a pipe-section a^{14}, communicating with the intermediate chamber a^2, and an intermediate corrugated pipe-section a^{12}, connected to a valve casing or fitting provided with a seat for a valve a^{15}, located therein, the said valve having its stem a^{16} extended through a removable cap on the valve-fitting, and in the present instance the said valve is shown as connected to a lever a^{18}, to which is attached an operating-rod a^{19}. These pipe-sections may be lined with fire-brick where required and which is not herein shown. The generator or producer a also communicates with the vaporizing and mixing chamber a', preferably by two pipes a^{20} a^{21}, provided with valves a^{22} a^{23}, (see Fig. 2,) the pipe a^{20} connecting the generator at one end of the fuel therein, herein shown as the upper end, with the vaporizing and mixing chamber, and the pipe a^{21} connecting the other end or lower portion of the generator below the usual grate-bars therein with the said vaporizing and mixing chamber, whereby the water-gas generated by passing steam through the generator in opposite directions may be admitted into the hydrocarbon vaporizing and mixing chamber a'. The mixing-chamber a' has communicating with it an oil-supply pipe a^{50}, controlled by a suitable valve, which may be operated by a lever a^{51} and a rod a^{52}.

The fixing-chamber a^3 may and preferably will be provided with a plurality of gas-outlets, and one of the said outlets, as b, leads from the bottom of the fixing-chamber a^3 to the ash-pit chamber or space b' of a boiler or steam-generator b^2, which latter is shown as a fire-tube boiler, but which may be of any desired or suitable type and which may be provided with the usual grate-bars.

One of the features of this invention consists in enabling the boiler b^2 to be disconnected or cut off from the gas producing and fixing portion of the apparatus, so that the boiler may be used after the manner of an ordinary boiler without interfering with the manufacture of the carbureted water-gas. This result is effected in part, preferably, by extending the gas-outlet pipe b into the space b' of the boiler and providing the said pipe with a cap or cover b^3, (represented by dotted lines, Fig. 1,) and which is normally removed from the pipe b when the said boiler is coupled to the fixing-chamber, but which, when the boiler is disconnected from the fixing-chamber, is secured gas-tight to the pipe b. The cap or cover b^3 in practice may be secured, as by threaded bolts or screws b^4, to a flange b^5 on the pipe b. Furthermore, this manner of connecting the boiler b^2 with the gas producing and fixing apparatus enables the boiler to be located on a level or substantially on a level with the fixing-chamber a^3, which latter in Fig. 1 is represented on the floor-line, while the gas producer or generator a is represented as supported upon a platform b^6, resting upon columns b^7. The pipe b is provided with a valve b^{80} to promptly cut off the boiler while the permanently-tight cap is being adjusted.

The boiler b^2 has preferably connected to it a feed-water heater b^8, of any usual or suitable construction, the said feed-water heater communicating with the boiler, so that the gases may pass from the boiler through the feed-water heater and may pass out from the feed-water heater through the pipe b^9 into a gas-tight fitting b^{10}, which communicates by pipe b^{12} with the hydraulic main b^{13}, herein represented as supported upon a bracket b^{14}, attached to the partition-wall A'.

The boiler b^2 is connected to the generator or producer for the admission of steam therein by the pipe b^{40} and branch pipes b^{41} b^{42}, communicating with the generator at the opposite ends of the fuel therein, and provided, respectively, with the valves b^{43} b^{44}, by which the admission of steam to the said generator may be controlled.

The hydraulic main b^{13} may be connected by a gas-outlet pipe b^{15} with a condenser b^{16}, of any usual or suitable construction, having a gas-outlet pipe b^{17} at its lower end, which may communicate with the usual scrubbers, purifiers, &c.

The fitting or valve-casing b^{10} may be provided with a port or opening b^{20}, which communicates with the atmosphere through a pipe or stack b^{21}, fitted substantially air-tight into the valve-casing b^{10}, the said pipe being represented as extended through the roof A^4 of the gas-house or building.

The port or opening b^{20} of the valve casing or fitting b^{10} is adapted to be opened and closed by a valve b^{22}, (represented in the present instance as a disk valve,) located within the pipe or stack b^{21} and resting upon an annular flange b^{23} on the interior of the valve fitting or casing b^{10}, which forms a seat for the said valve, the latter, as represented, being provided with a stem b^{24}, which is extended through the valve-fitting and is adapted to be operated from the platform b^6 by a rod b^{27}, connected to an elbow-lever b^{28}, having one arm in engagement with the collars b^{29} b^{30} on the valve-stem b^{24}, the elbow-lever b^{28} being represented in Fig. 1 as pivoted to a bracket or arm b^{60}, depending from the valve-casing b^{10}. The valve-casing b^{10} is preferably provided with a small port or opening b^{31}, through which gas may issue, the said gas in practice being designed to be maintained lighted when com-

bustible gases issue therefrom, as a guide for the workmen operating the gas-manufacturing apparatus. The valve-casing b^{10} is also preferably provided with a second port or opening b^{32}, which in practice communicates with a steam-supply, which may be the boiler b^2, by a suitable pipe, (not herein shown,) the purpose of the steam supplied to the valve-casing b^{10} being to kill any tendency of combustion of the gases in the pipe b^{21}, and thereby preventing explosions during the operation of the apparatus.

In order that the boiler b^2 may be cut off from the fixing-chamber without interrupting the process of manufacture of the carbureted water-gas, the said fixing-chamber may be provided with a gas-outlet pipe c, communicating with the fixing-chamber a^3, near the bottom of the same, and preferably extended up to near the stack c', which communicates with the atmosphere, the said gas-outlet pipe being provided with a valve c^2, adapted to be operated by the rod c^3 from the platform b^6.

The pipe c near its upper end may be connected by a branch pipe c^4 with the hydraulic main b^{13}, and the said branch pipe may be provided with a cut-off valve c^5, which may be of any desired or suitable construction. The gas-outlet pipe c may include as a part of it a valve casing or fitting c^6, provided with a port-opening c^7, controlled by the valve c^8, which may be similar in construction to the valve b^{22}, and which is adapted to be operated from the platform b^6 by the rod c^9, connected to the lever c^{10}, which is adapted to engage collars c^{12} c^{13} on the valve-stem c^{14}, the said valve being normally seated, as represented in Fig. 1, to cut off communication between the pipe c and the fixing-chamber a^3 when the boiler b^2 is connected to the fixing-chamber for the passage of the gases through it.

The fixing-chamber a^3 may and preferably will have communicating with it an auxiliary hydraulic main c^{70}, herein shown as connected to the valve-casing c^6 by a pipe c^{71}, provided with a valve c^{72}, for a purpose as will be described.

The gas-generator a and the fixing-chamber a^3 may be supplied with air by means of an air-supply pipe d, which may pass through a steam-box or blast-heater d', (represented as supported upon a bracket d^2,) secured to the wall A', the said air-supply pipe being in practice connected to a suitable air-forcing apparatus. (Not herein shown.) The air-supply pipe d is represented as communicating directly with the gas-generator a and as communicating with the fixing-chamber a^3 by a branch pipe d^4, and as communicating with the chamber b' of the boiler b^2 by the branch pipe d^5, and the said air-supply pipe may also be connected to the intermediate chamber by a pipe d^{100} for cleaning purposes, the pipe d^{100} being provided with a valve d^{101}. The admission of air into the generator a may be controlled by the valve d^6 in the supply-pipe d, and into the chamber a^3 and the boiler b^2 by the valves d^7 d^8 in the branch pipes d^4 d^5, these valves being adapted to be operated from the platform b^6 by the levers d^{10} d^{12} d^{13}, respectively.

The gas-generator a is provided with the usual doors d^{14} and with the fuel-inlet d^{15}.

The operation of the apparatus herein shown may be briefly described as follows:

The condition of the apparatus at the moment previous to starting is as follows: The air-blast valves d^6 d^7 d^8 are closed, the valves a^{22} a^{23} closed, the steam-valves b^{43} b^{44} closed, the oil-controlling valve a^{50} closed, the valves c^2 c^8 closed, the valve b^{22} open, the valve a^{15} open, the cap or cover b^3 removed, and the door d^{14} of the producer open. Combustion is started within the producer a and is carried on by natural draft, the products passing from the producer or generator a through the pipes a^{10} a^{14} into the intermediate chamber a^2, and from the intermediate chamber the products pass down through the fixing-chamber a^3 and the pipe b into the boiler b^2, thence through the boiler, feed-water heater b^8, and pipe b^9 into the valve-casing b^{10}, from which the products pass through the port b^{20} into the stack or pipe b^{21}, and thence to the atmosphere. After the coal in the generator or producer a has been brought to an incandescent state and the refractory material in the intermediate chamber a^2 and fixing-chamber a^3 has been brought to an appropriate temperature by natural draft the door d^{14} of the generator is closed and the blast-valve d^6 opened to admit a blast of air into the generator or producer a. The air supplied to the generator or producer a causes active though incomplete combustion in the bed of fuel in the generator, and the products of combustion thus created by the air-blast, which I shall designate as the "producer-gas," pass from the generator to the stack or pipe b^{21}, as above described. The producer-gas heats the fire-brick or other refractory material in the chamber a^2 by imparting a portion of its specific heat thereto, and on its passage through the fixing-chamber a^3 the said producer-gas meets a supply of air, admitted by opening the air-blast valve d^7, and further or complete combustion takes place in the fixing-chamber a^3, thereby highly heating the refractory material in said fixing-chamber. The highly-heated producer-gases pass through the pipe b into the boiler b^2, and through the said boiler and feed-water heater b^8 into the valve-case b^{10}, from which they pass to the atmosphere through the pipe or stack b^{21}. These highly-heated gases on their passage through the boiler b^2 are utilized and generate steam, which is employed for making the water-gas, as will be described, but which may also be utilized for any desired purpose. The highly-heated producer-gases on their passage through the feed-water heater b^8 heat the water therein and place it

in a condition to be readily converted into steam when admitted to the boiler b^2. The producer-gas admitted into the chamber b' of the boiler b^2 may be further supplied with air by opening the air-blast valve d^8, if so desired. This process of heating the apparatus by the air-blast is continued until the operator considers a proper heat is obtained for decomposing steam in the generator a and for properly fixing the hydrocarbons admitted into the chamber a^3. When this point is reached, the following action is taken: The air-blast valves d^8 d^7 d^6 are closed. The valve a^{15} is closed; the valve a^{22} opened. The steam-valve d^{43} at the top of the generator or producer a is closed, while the steam-valve b^{44} at the bottom of the generator is opened, permitting the steam to pass into the generator up through the bed of coal, where it is decomposed and forms water-gas. The water-gas thus produced is employed to clear the apparatus from the deleterious gases and products remaining in the apparatus and which would be objectionable to have present in the carbureted gas. The water-gas passes from the generator through the pipe a^{20}, into the mixing-chamber a', thence down through the intermediate chamber a^2 and fixing-chamber a^3, through the pipe b into the boiler b^2, thence through the feed-water heater b^7 into the valve-fitting b^{10}, and through the port b^{23} into the stack or pipe b^{21}. The water-gas on its passage through the apparatus, as described, forces ahead of it all the deleterious gases and waste products which remain in the apparatus. The apparatus is now in condition to manufacture the carbureted water-gas, and as soon as the water-gas reaches the port b^{23} the valve b^{22} is closed, and uncarbureted water-gas, made as above described, passes through the pipe a^{20}, the valve a^{22} being open, to the top of the mixing-chamber a', where it is met by preferably heated hydrocarbons, admitted by opening the valve a^{50}.

The hydrocarbons admitted into the chamber a' may be heated or vaporized after the manner shown and described in Letters Patent No. 443,214, granted to me December 23, 1894. The hydrocarbons admitted into the chamber a' have their temperature raised within the said chamber by the high heat of the water-gas in the said chamber. The mixing structure in the chamber d facilitates and renders perfect the intermingling of the water-gas and hydrocarbons, which are now more or less vaporized, according to the nature of the oil used. The mixture of the water-gas and hydrocarbons thus produced descends by a downward draft assisted by gravity from the mixing-chamber a' into and through the intermediate chamber a^2 and into and through the fixing-chamber a^3, and the said mixture on its passage through the chamber a^2, which, for the best results, is moderately heated, as compared with the highly-heated fixing-chamber a^3, becomes gradually heated in its passage through the intermediate chamber and is highly heated in its passage through the fixing-chamber a^3, wherein the carbureted water-gas becomes finally fixed or rendered permanent at normal pressures and temperatures. The highly-heated carbureted water-gas may pass from the fixing-chamber a^3 through the pipe b, and into and through the boiler b^2, the feed-water heater b^8, the valve-casing b^{10}, and pipe b^{12} into the hydraulic main b^{13}, where it meets for the first time a body of water and from which it passes through the pipe b^{15}, the condenser b^{16}, and outlet-pipe b^{17} to the purifiers or scrubbers, such as is now commonly used in gas-producing apparatus. The highly-heated carbureted water-gas has its temperature reduced by its passage through the boiler b^2 and feed-water heater b^8, so that when it comes in contact with the water in the hydraulic main b^{13} its temperature is reduced to such extent as to avoid shock to the said gas, and as a result the objectionable features resulting from the contact of the highly-heated carbureted water-gas with the cooler body of water is avoided.

I propose in the manufacture of carbureted water-gas to utilize the boiler b^2 and feed-water heater b^8 after the manner above described; but to provide for emergencies and to enable the boiler b^2 to be cut off from the remaining portion of the apparatus without interrupting the manufacture of carbureted water-gas the pipe b is adapted to be hermetically closed, which may and preferably will be effected by the cap b^3, and when the pipe b is closed it will be seen that the boiler b^2 is entirely independent of the gas producing and fixing portion of the apparatus and may be utilized after the manner of the ordinary boiler.

When the pipe b is closed, an outlet for the fixed carbureted water-gas may and preferably will be provided through the valve-casing c^6, pipe c, branch pipe c^4, leading to the hydraulic main, the branch pipe c^4 being provided with the valve c^5, which at such time is opened. In this latter instance the highly-heated carbureted water-gas passes from the fixing-chamber a^3 through the valve-casing c^6, the valve c^8 at such time being opened, and from said casing the highly-heated carbureted water-gas passes through the pipe c and branch pipe c^4 to the hydraulic main b^{13}, from which it passes through the pipe b^{15}, the condenser b^{16}, and outlet-pipe b^{17}. In order that the producer-gas and uncarbureted water-gas may be generated when the boiler b^2 is cut-off from the remaining portion of the apparatus, the pipe c is carried upward and coöperates or discharges into the stack c', the pipe c being provided with the valve c^2, which in the generation of the producer-gas is opened, the said gas passing directly from the fixing-chamber a^3 through the pipe c to the stack c'.

The course of the steam through the generator may be reversed by closing the valves b^{44} a^{22} and opening the valves b^{43} a^{23}.

By means of the auxiliary hydraulic main connected to the fixing-chamber and also by means of the valve c^5 in the pipe c^4 the manufacture of carbureted water-gas may be continued without interruption, in case it is desired to cut off the hydraulic main b^{13} from the fixing-chamber for repairs or other purposes, and in this emergency the valve c^{72} in the pipe c^{71} is opened and the valve c^5 in the pipe c^4 closed. The auxiliary hydraulic main c^{70} may be connected with the condenser b^{16} by a suitable pipe. (Not herein shown.)

When the hydraulic main b^{13} and the boiler b^2 are cut off from the fixing-chamber the producer-gases and the uncarbureted water-gas may pass to the stack c', the valve c^2 being at such time open.

I have herein shown what I regard as a desirable and highly-useful arrangement and construction of carbureted water-gas-manufacturing apparatus, but I do not desire to limit that feature of this invention which permits me to connect or disconnect the boiler to or from the fixing-chamber of a carbureted water-gas plant to the particular construction and arrangement shown.

To facilitate the manufacture of gas with a minimum amount of labor, appliances are provided for the expeditious and economical handling of the fuel fed into the generator and of the ashes taken out therefrom. The appliances employed to facilitate the handling and feed of the fuel may and preferably will consist, as herein shown, of a bin or receptacle e, provided with an inclined bottom e' and with a spout or chute e^2, the latter being extended, so as to discharge the coal directly into the generator, when the fuel-inlet d^{15} is open, and when the valve or gate e^3 is also opened to permit the contents of the bin or receptacle to gravitate into and through the chute e^2, the said valve or gate in the present instance being adapted to be pulled downwardly by the handle or bar e^5, and being movable between suitable guides e^6 on the sides of the chute.

The coal bin or receptacle e may be supported by suitable brackets e^{10} e^{12}, secured to the inner and outer sides of the wall A, the said bin being represented as extended through a suitable opening in the said wall.

The coal or fuel may be supplied to the bin or receptacle e by means of small cars e^8, which, in practice may run upon a suitable track or way, (not shown,) but which may be laid on suitable supports within and without the building or gas-house, the coal bin or receptacle being represented as provided with a suitable opening e^9, through which the coal may be deposited into the said bin. The appliances for handling the ashes may and preferably will be substantially as shown in Figs. 1 and 2, and consist of a screen f, hinged or pivoted at one end, as at f', to the under side of the platform b^6, and having pivotally secured to its other end a rod or bar f^2, extended upward to the platform b^6, and by which the screen f may be shaken to sift the ashes, the said screen having coöperating with it side pieces or wings f^4, (shown in Fig. 2 as secured to the platform b^6 and inclined outwardly over the screen, so as to direct the ashes toward the center of the screen and prevent the same from falling off the sides of the screen.) The screen f may also have coöperating with it movable conveyers or cars f^5 f^6, one, as f^5, being designed to receive the cinders or sifted coal passing off from the screen, and the other, as f^6, being designed to receive the ashes passing through the screen, and for the best results the screen may have secured to its under side a chute f^{10}, which is suitably shaped to direct the ashes through the screen into the car f^6. These cars or movable receptacles are and preferably will be mounted to travel on suitable tracks or ways f^{12} and f^{13}, and I propose to extend the track or way f^{12} around near the boiler b^2, so that the cinders and coal deposited into the car f^5 from the screen may be easily and quickly carried to the boiler and be utilized therein as fuel.

The valve b^{80} in the pipe b, leading from the fixing-chamber into the boiler, is essential, in order that the cap or cover b^3 may be secured gas-tight to the outlet-mouth of the pipe b, for without the valve b^{80}, to choke the passage of gas into the boiler, the workman would be overcome by gas if he should attempt to place the cap or cover b^3 over the mouth of the pipe b while the gas-producing apparatus is in operation. On the other hand, the valve b^{80} alone could not be depended upon to close the gas-outlet pipe b, as it would be practically impossible to maintain the said valve gas-tight, so that if the valve b^{80} alone is depended upon there would be danger of explosion from the gas leaking into the ash-pit of the boiler and igniting therein in the presence of air, when the said boiler is under repairs or is used independent of the gas-manufacturing apparatus. Therefore the valve b^{80} and the cap b^3 practically coöperate in cutting off the boiler from the gas apparatus and rendering it safe to repair the boiler or to use it separately.

I claim—

1. In an apparatus for manufacturing carbureted water-gas, the combination of the following instrumentalities, viz: a gas-generator, a fixing-chamber communicating therewith for the passage therethrough of the gases created in said generator, a boiler or steam-generator, a gas-outlet pipe for the fixing-chamber extended into and terminating within the said boiler to leave a normally open end within the said boiler, a cover for the open end of the gas-outlet pipe normally removed therefrom but adapted to be secured thereto gas-tight to permanently close said

pipe, a valve in said gas-outlet pipe adapted to cut off the said boiler preparatory to securing the said cover in place, a separate gas-outlet for the fixing-chamber and a valve to control said separate gas-outlet, substantially as described.

2. In an apparatus for manufacturing carbureted water-gas, the combination of the following instrumentalities, viz: a gas-generator, a fixing-chamber communicating therewith for the passage of the gases created in said generator, a hydraulic main, a boiler or steam-generator intermediate of the said hydraulic main and the said fixing-chamber and connected to the said hydraulic main, a gas-outlet pipe for the fixing-chamber extended into and terminating within the boiler to leave a normally open end within the boiler, a cap or cover normally removed from the open end of the said gas-outlet pipe but adapted to be secured thereto gas-tight, a valve in the said gas-outlet pipe to cut off the boiler while the gas-tight cap is secured in position, a separate gas-outlet for the fixing-chamber connecting the latter with the said hydraulic main, and means to control the passage of the gases through the separate outlet for the said fixing-chamber, substantially as described.

3. In an apparatus for manufacturing carbureted water-gas, the combination of the following instrumentalities, viz: a gas-generator, a fixing-chamber communicating therewith for the passage of the gases created in said generator, a hydraulic main, a boiler or steam-generator intermediate of the said hydraulic main and the said fixing-chamber and connected thereto for the passage of the gases from the fixing-chamber through the boiler to the hydraulic main, a separate gas-outlet pipe *c* for the fixing-chamber adapted to communicate with the atmosphere, a pipe c^4 connecting the pipe *c* to the said hydraulic main, a valve controlling the communication of the separate outlet with the atmosphere, a valve in the pipe c^4 controlling the communication of the separate outlet with the hydraulic main, an auxiliary hydraulic main connected with the fixing-chamber, means to cut off the said auxiliary hydraulic main from the said fixing-chamber, and means to cut off the boiler from the fixing-chamber, substantially as described.

4. In an apparatus for manufacturing carbureted water-gas, the combination of the following instrumentalities, viz: a gas-generator, and a structure comprising a mixing-chamber located at one end, a fixing-chamber located at the opposite end, and an intermediate chamber, a valved pipe connection between the generator and the intermediate chamber for the passage through the intermediate and fixing chambers of the blast gases, and a valve pipe connection from the generator to the mixing-chamber for the passage of water-gas into the top of the single structure comprising the said chambers, a boiler, a gas-outlet pipe for the fixing-chamber extended into and terminating within the boiler to leave a normally open end, a cap or cover adapted to be secured to the open end of the said gas-outlet pipe gas-tight, a valve in said outlet-pipe to cut off said boiler from the fixing-chamber preparatory to closing the end of the said pipe by the said cover, and a gas-outlet from said fixing-chamber normally not in operation while the boiler is connected to the fixing-chamber but which is brought into operation when the boiler is detached from the fixing-chamber, substantially as described.

5. In an apparatus for manufacturing carbureted water-gas, the combination of the following instrumentalities, viz: a gas-generator, and a structure comprising a mixing-chamber, a fixing-chamber, and an intermediate chamber, a pipe connection between the said generator and mixing-chamber, and an expansible and contractible pipe connection between the said generator and intermediate chamber, substantially as and for the purpose specified.

6. In an apparatus for manufacturing carbureted water-gas, the combination of the following instrumentalities: a generator, a fixing-chamber communicating therewith, a boiler, a gas-outlet pipe for the said fixing-chamber connected to the said boiler, a hydraulic main, a gas-outlet pipe for the boiler communicating with the hydraulic main, a valve-casing in the gas-outlet pipe for the boiler and provided with a gas-outlet port, a pipe or stack communicating with the atmosphere and connected to said valve-fitting, and a valve to control the said port, whereby the gases after passing through the boiler may be caused to pass off to the atmosphere or to the hydraulic main, substantially as described.

7. In an apparatus for the manufacture of carbureted water-gas, the combination of the following instrumentalities, viz: a water-gas generator, a single structure comprising a hydrocarbon-mixing chamber, a fixing-chamber and an intermediate chamber, pipe connections between the said generator and the mixing-chamber, and between the generator and the intermediate chamber, a boiler communicating with the fixing-chamber and adapted to be disconnected therefrom, a feed-water heater communicating with the boiler, a gas-outlet pipe leading from said feed-water heater and provided with a port or gas-outlet, a pipe or stack connected to said gas-outlet pipe to communicate with said port and communicating with the atmosphere, a valve to control the passage of gas from the said outlet-pipe to the said stack, and a hydraulic main connected to the said valve-casing, substantially as described.

8. In an apparatus for manufacturing carbureted water-gas, the combination with a fixing-chamber and a hydraulic main, of a gas-outlet pipe for the fixing-chamber com-

municating with the hydraulic main and provided with a valve casing or fitting having a steam-inlet port, a pipe or stack connected to said valve-casing and communicating with the atmosphere, and a valve to control the passage of gas into the said pipe or stack, substantially as described.

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

WALTER R. ADDICKS.

Witnesses:

JAS. H. CHURCHILL,

J. MURPHY.