(No Model.)

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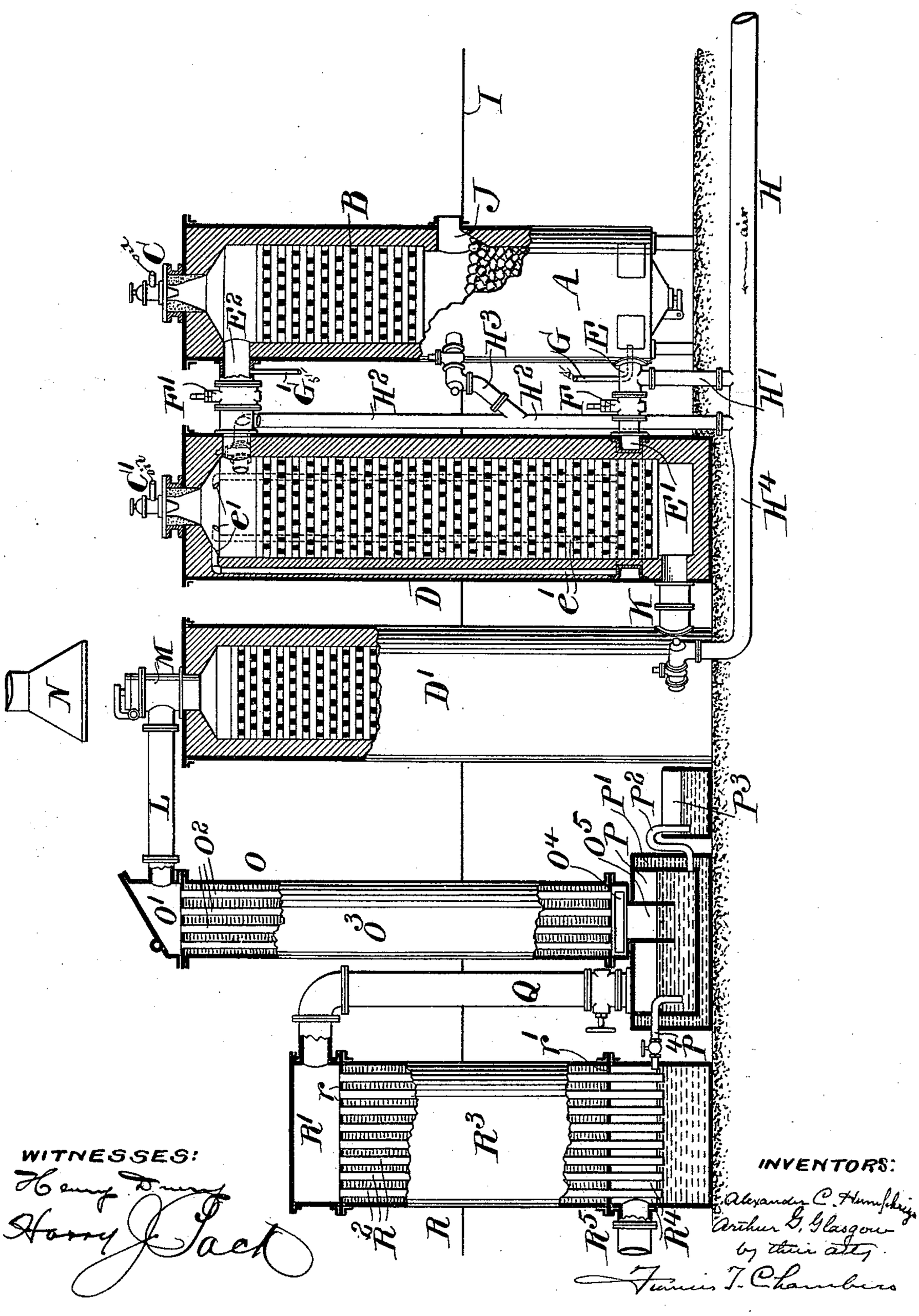
METHOD OF AND APPARATUS FOR MANUFACTURING CARBURETED WATER GAS.

No. 586,970. Patented July 27, 1897.



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METHOD OF AND APPARATUS FOR MANUFACTURING CARBURETED WATER-GAS.

SPECIFICATION forming part of Letters Patent No. 586,970, dated July 27, 1897.

Application filed February 18, 1895. Serial No. 538,791. (No model.) Patented in England February 12, 1895, No. 3,089.

To all whom it may concern:

Be it known that we, ALEXANDER CROMBIE HUMPHREYS, of the city and county of Philadelphia, State of Pennsylvania, and ARTHUR GRAHAM GLASGOW, of the city, county, and State of New York, citizens of the United States, have invented a certain new and Improved Method of and Apparatus for Manufacturing Carbureted Water-Gas, (for which we have obtained Letters Patent in England, dated February 12, 1895, No. 3,089,) of which the following is a true and exact description, reference being had to the accompanying drawing, which forms a part thereof.

Our invention relates to the manufacture of carbureted water-gas, and has for its object the more economical use of oils, and especially of difficult oils for carbureting the gas in the process of its manufacture.

We employ an apparatus including a water-gas generator, a preliminary carbureting-chamber filled with checker-work or equivalent refractory filling and situated above and in communication with the generator, so that liquids thrown into it will tend to flow down into the top of the generator, a device for supplying liquid hydrocarbon to the top of the preliminary carbureting-chamber, and a gas-outlet conduit leading from the top of the said chamber to a carbureting and fixing chamber, which also forms part of the plant. Preferably we also employ a conduit leading from the base of the generator to the carbureting and fixing chamber, providing, of course, valves for regulating the course of the gases from the generator, and in this case we employ also a steam-supply pipe leading into the top of the fixing-chamber. In addition, we prefer to employ a surface condenser or condensers, through which the gases pass on leaving the fixing-chamber.

In its most complete sense our method consists in passing water-gas through the preliminary carbureting-chamber, the carbureting and fixing chambers, and the surface condenser, the preliminary carbureting and carbureting and fixing chambers being preheated, and preferably to temperatures which do not substantially exceed those at which a gas having the maximum illuminating effect is produced from the oil employed. We inject into the top of the carbureting-chamber a liquid hydrocarbon, which is carried with the gas through the chamber, and into the top of the preliminary carbureting-chamber we inject the heavy tarry oil condensed in the surface condenser, said oil percolating through the filling of the chamber in the opposite direction to the ascending gas and the portion which is not vaporized falling onto the fuel-bed in the generator, where it forms a valuable addition to the fuel-supply.

Very valuable advantages are gained by our method of introducing liquid hydrocarbons both at the top of the preliminary carbureting-chamber and the top of the carbureting-chamber, causing part to pass in the opposite direction to the gas and part in the same direction, and this is true where both oil-supplies are of the same character, as it enables us to secure a highly-carbureted gas, and without overloading any part of the apparatus, thereby increasing the efficiency of the apparatus in its treatment of difficult oils, and especially in the production of high-candle-power gas.

Where only heavy or difficult fluid hydrocarbons containing a large proportion of pitch or carbon are used for carbureting, we introduce them in the top of the preliminary carbureting-chamber, the hot water-gas sweeping the vaporized portions into the fixing-chamber, while the decreasing residue percolates through the heated refractory filling of the chamber, undergoing a process of fractional distillation on its way, and its unvolatilized residue finally falling onto the fuel, to which it forms a valuable addition. In this case we do not inject oil into the carbureting-chamber except when the current of gas is reversed in the generator and the oil cut off from the distilling-chamber, as will be described.

Our improvement, both in method and apparatus, (and we have made several mechanical improvements not above mentioned,) will best be understood as described in connection with the drawing, which represents our apparatus in elevation and partly broken away.

A is the generator; B, the preliminary carbureting-chamber filled with refractory material; C, the oil-supplying device at top of chamber B. D and D′ are fixing-chambers, or, rather, as shown, carbureting and fixing

chambers, of usual construction, connected by conduit K, receiving gas by conduit E^2 from the top of the preliminary carbureting-chamber and delivering it through conduit L.

M is the opening through which the blast-gases issue to the stack N.

At the head of chamber D we provide the oil-supplying device C′, and when it is in use the chamber is what is generally called a "carbureter." A conduit E leads from the base of the generator to an annular chamber E′, surrounding the base of chamber D, and thence pipe-flues *e′* lead through the walls of D to its top. This construction is advantageous in saving room, keeping the gases hot, and introducing them in such a way that oil will not tend to run down in the conduit leading from the base of the generator. Means, as valves F and F′, are provided for closing either conduit leading from the generator.

G is a steam-pipe leading to the base of the generator in the usual way, and G′ is a steam-pipe leading into the top of chamber B.

H is the air-blast main, a connection H′ leading to the base of the generator, a connection H^2 H^3 leading to the base of the chamber B, a connection H^2 leading to the head of chamber D, and a connection H^4 leading to the base of chamber D′. The air is admitted through these various conduits for blowing up the fire in the generator and for heating the various chambers B, D, and D′.

I is the level of the operating-floor, and J the feed-door of the generator.

The conduit L leads into the head O′ of a surface condenser O, the body O^3 of which is kept full of cold water, while through it lead the pipes O^2, connecting the head O′ with the head O^4, an extension O^5 of which passes down into the liquid-seal box P and below the level of the fluid therein, which consists of heavy tarry hydrocarbons condensed from the gas, and which serves to prevent a backward flow of gas as well as to scrub the gas and free it from the tarry condensed oils. Having attained the desired level in box P the oils are permitted to escape through bent pipe P^2 into receptacle P^3.

P′ is a water-jacket surrounding box P and serving to keep the oils in it cool.

From box P the gas passes through conduit Q into the head R′ of the surface condenser R, the body R^3 of which, like that of O, is cooled by water, through which pass multiple pipes R^2, extending down into the head R^4 and below the level at which the condensed heavy oils stand therein, (said level being determined by the escape-pipe P^4,) so that the gas issuing in numerous fine streams is exposed to a peculiarly thorough scrubbing before it passes off through conduit R^5.

Of course a single condenser can be used, or both could be constructed like R, as should the single one be if no other is employed, because the extension subdivision of the body of gas in scrubbing it in the heavy oils is important.

In operation we bring the fuel charged into the generator through the door J to a proper degree of heat by means of the blast, and we pass the fuel-gas generated in this operation through the chambers B D D′, admitting air in properly-regulated quantities to each chamber in order to insure a proper combustion and the desired temperature in each. We then cut off the air-blast and admit steam through the pipe G, the valve F being closed and the valve F′ open. At the same time we force liquid hydrocarbons (preferably, as described, the oil-tar which remains after the more volatile parts have been driven off from lighter oils or any oily matter containing a large percentage of pitch or, as we may term it, "surplus carbon") through C into the top of the preliminary carbureting-chamber B and upon the refractory filling thereof, through which it gradually works down, giving off its volatile parts and undergoing a process of what we may call "fractional distillation" under the influence of the heated filling and of the hot water-gas from the generator, which sweeps upward through the chamber B and carries the vaporized oil with it into the chamber D, while the non-volatilized residue, after passing through the chamber B, falls upon the fuel in the generator and becomes a valuable addition to it. We prefer also to inject a lighter oil through C′ into the head of the chamber D, this oil percolating downward in the same direction taken by the water-gas and being gradually volatilized under the influence of the gas and of the heated filling of the chamber. The highly-carbureted gas is fixed in its passage through the chambers D and D′; but, as we have already stated, we prefer that both these chambers and also the chamber B should be maintained at a temperature not materially exceeding that at which an oil-gas of the maximum illuminating power is produced from the oils used. This temperature is materially less than that employed in what is now recognized as good practice, and as a result a smaller proportion of the oil or oils is converted into a fixed gas than would be the case were higher temperatures employed. Consequently the gases issuing from the fixing-chamber D′, through pipe L, are loaded with a considerable quantity of condensable heavy oil, and in order to save this oil in good condition for reuse we pass the gases through the surface condenser or condensers, a surface condenser being used to avoid the admixture of water with the condensed oil, which, as is well known, interferes with its profitable reuse as a carbureting fluid.

It is the oil collected in the seal-box P, coming partly from R^4, which we preferably inject into the preliminary carbureting-chamber B, using an ordinary oil of commerce in the head of the carbureting-chamber D.

The method and in some part the apparatus above described by which the carbureting and fixing chambers are maintained at a temperature not substantially exceeding that at

which oil-gases of the maximum illuminating power are obtained and in which a surface condenser is used for recovering the unfixed portion of the oil for reuse form the subject-matter of the application for Letters Patent filed by A. G. Glasgow, May 11, 1894, Serial No. 510,896, and are therefore not claimed in this application.

While, as we have stated, we prefer to inject the heavy oil into the preliminary carbureting-chamber and a lighter oil into the carbureting-chamber, it must be understood that we claim as our invention the injection of the same oil into both chambers, a pronounced advantage being gained in this case by the division of the oil-supply, causing a portion of it to travel against the gas-current and a portion with the current, and thus obtaining more gasified oil for a given amount of uncarbureted gas and for the temperature employed than would be otherwise practicable.

In case, owing to the tarry nature of any hydrocarbons introduced to the preliminary carbureting-chambers, a portion of the surplus carbon tends to cake upon the refractory filling of the preliminary carbureting-chamber B it can be removed without loss by stopping the supply of oil to the preliminary carbureting-chamber, closing the valve F′, opening the valve F, and turning on steam through pipe G′. The steam passing downward through the preliminary carbureting-chamber will, under the great heat of the chamber-filling, combine to a considerable extent with the carbon, producing gases which, continuing down through the fuel charge of the generator, will be further and completely decomposed, and the water-gas resulting will pass upward through the conduits E E′ *e′* to the head of the carbureting-chamber D, where oil may be injected to carburet the gas. This treatment is advantageous also in regulating the incandescence of the fuel in the generator.

It will be understood that carbureting and fixing chambers are not essentially distinct, the same chamber generally serving both functions where oil is injected into it.

Having now described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. The method of carbureting water-gas which consists in passing the water-gas formed in the generator upward through a preliminary carbureting-chamber, and thence through main carbureting and fixing chambers thence through a surface condenser or condensers, injecting into the main carbureting-chamber liquid hydrocarbons so that they will pass through it in the same direction as the gas and introducing into the preliminary carbureting-chamber the heavy hydrocarbons condensed in the surface condenser and so that said heavy oil will pass therethrough in the opposite direction to the gas.

2. The method of carbureting water-gas which consists in passing the water-gas formed in the generator upward through a preliminary carbureting-chamber, thence through main carbureting and fixing chambers, all said chambers being maintained at temperatures not substantially exceeding those adapted to produce from the oils entering them gases having the maximum illuminating effect, and thence through a surface condenser or condensers, injecting into the main carbureting-chamber liquid hydrocarbons and introducing into the preliminary carbureting-chamber the heavy hydrocarbons condensed in the surface condenser.

3. The method of utilizing liquid hydrocarbons in the manufacture of carbureted water-gas, which consists in preheating a preliminary carbureting-chamber connected with the gas-generator then forcing steam into the base of the generator and passing water-gas from the generator upward through the preliminary carbureting-chamber and at the same time passing liquid hydrocarbons downward through said chamber and draining the heavy residue which is not vaporized and carried off by the water-gas into the generator, fixing the vapors by passing the mixed gases and vapors through a heated fixing-chamber, then cutting off the steam supplied to the base of the generator and the supply of liquid hydrocarbons to the preliminary carbureting-chamber and forcing steam into the top of the preliminary carbureting-chamber and down through it and the generator from the base of which the resulting gases are carried to the fixing-chamber.

4. The combination with a single water-gas generator of a vertical preliminary carbureting-chamber filled with refractory checker-work and situated immediately above said generator, a separate substantially vertical main carbureting-chamber also filled with checker-work and the top of which communicates with the top of the preliminary carbureting-chamber and which is arranged to receive gases from the generator only at its top, and supply devices for liquid hydrocarbons whereby they can be introduced into the top of the main and preliminary carbureting-chambers, so that they may pass through the preliminary chamber in opposition to the current of gases and through the main chamber in the same direction with the current in said chamber.

5. The combination with a single water-gas generator of a vertical preliminary carbureting-chamber filled with checker-work and situated immediately above said generator, a separate substantially vertical main carbureting-chamber also filled with checker-work and the top of which communicates with the top of the preliminary carbureting-chamber, a fixing-chamber communicating with the main chamber at the bottom, supply devices for liquid hydrocarbons whereby they can be introduced into the tops of the main and pre-

liminary carbureting-chambers, and a surface condenser in communication with the fixing-chamber at the top.

6. The combination with a water-gas generator of a preliminary carbureting-chamber situated immediately above said generator, a substantially vertical fixing-chamber, conduits between the top of said fixing-chamber the top of the preliminary carbureting-chamber and the bottom of the generator, means whereby said conduits can be closed at will, means for injecting oil into the top of the preliminary carbureting-chamber and steam-pipes entering the base of the generator and the top of the preliminary carbureting-chamber.

7. The combination with a water-gas generator of a carbureting or fixing chamber, a conduit leading from the top of the generator to the top of the carbureting-chamber, an annular chamber situated near the base of the carbureter, a series of pipes leading from said chamber through the walls of the carbureter and opening into the top thereof, a conduit leading from the base of the generator to the annular chamber, valves whereby either conduit leading from the generator can be closed at will, steam-pipes leading into the generator above and below its fuel-bed, and means for supplying oil to the top of the carbureting-chamber.

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