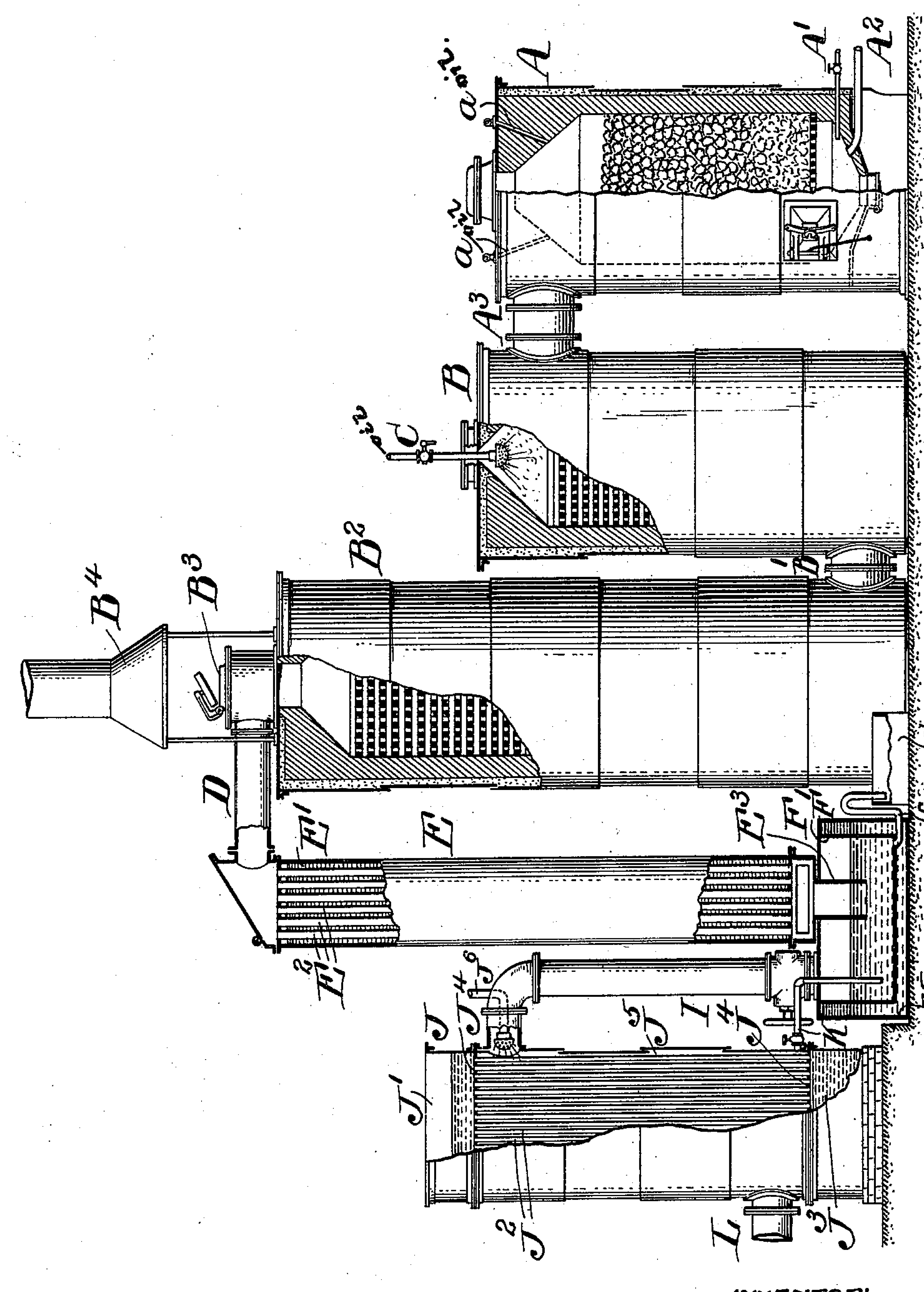
(No Model.)

A. G. GLASGOW.

METHOD OF AND APPARATUS FOR CARBURETING WATER GAS.

No. 598,921. Patented Feb. 15, 1898.



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METHOD OF AND APPARATUS FOR CARBURETING WATER-GAS.

SPECIFICATION forming part of Letters Patent No. 598,921, dated February 15, 1898.

Application filed May 11, 1894. Serial No. 510,896. (No model.) Patented in England December 10, 1894, No. 24,005.

To all whom it may concern:

Be it known that I, ARTHUR GRAHAM GLASGOW, a citizen of the United States, and a former resident of Philadelphia, Pennsylvania, now residing in London, England, have invented a new and useful Improvement in Methods of and Apparatus for Carbureting Water-Gas, (for which Letters Patent were granted me in England, dated December 10, 1894, No. 24,005,) of which the following is a true and exact description, reference being had to the accompanying drawing, which forms a part thereof.

My invention relates to the carbureting of water-gas, and has for its object to secure the better and more economical enrichment of the gas by means of hydrocarbon oils.

It is now recognized by those skilled in the art that to secure the best results from any oil used to enrich water-gas care must be taken that the carbureting and fixing chambers in which the oil-vapor is mixed with the water-gas and converted into a fixed gas are not heated to too great a temperature. Consequently it is approved practice to subject the oil-vapor to prolonged heating at moderate temperatures approximating that at which gases rich in carbon and yielding the best illuminating effect are produced; but practical questions as to space occupied, cost of construction and maintenance, and operating losses limit the size of the carbureting-chambers, and, particularly in using heavy oil, the gas-engineer is reduced to a choice between operating his carbureting-chamber at a temperature so high as to impair the illuminating value of the gas and convert a portion of it into lampblack and gases of low illuminating power or so low that a considerable percentage of the oil will pass off as an unfixed vapor.

The object of my invention is to operate the carbureters so as to obtain from the oil chiefly gases of the highest illuminating power and at the same time to practically obviate the loss of oil and preferably to utilize it entirely, as will be described.

My new method, generally speaking, consists in passing water-gas and oil-vapor through a chamber or chambers for carbureting and fixing the same that are maintained at a heat not substantially higher than that necessary to produce the best illuminating effect from the gasified portion of the oil, or, in other words, not sufficiently high to wholly reduce the oil to a permanent gas, and then carrying the resultant gases and vapors through one or more surface condensers or devaporizing-chambers, by which the unfixed oil-vapor is condensed in a condition suitable for further use. This treatment is especially adapted for such carbureting and fixing chambers as are internally heated—that is to say, such as are filled with checker-work and heated by the passage through them of the blast-gases produced alternately with the runs of water-gas in the ordinary operation of a water-gas generator when using complex crude oil or non-volatile distillates.

The oil saved in the condenser I preferably introduce into the top of the generator and above the top of the fuel-bed therein during the periods when water-gas is being made, so that the heat of the chamber and of the hot gases arising from the fuel will vaporize and carry into the carbureting and fixing chamber or chambers the volatile parts of the oil residue, while the unvaporized residue will form oil-coke, which will remain in the generator and form a valuable addition to its fuel charge. Simply cooling the gas in the condenser will not, however, readily and quickly remove from it all the unfixed oil-vapor. To effect this complete removal most expeditiously, I scrub the gas with oil, preferably as it passes through the final condenser, which in this case becomes a devaporizing-chamber of any suitable design, the oil having a great affinity for these unfixed vapors and serving to absorb them out of the gas. This combined cooling and scrubbing with oil accomplishes what neither the cooling nor scrubbing can so readily effect separately, since the temperature of the gas must be reduced to make the oil efficient as a scrubbing agent to an extent dependent upon the character of the oil employed; but by scrubbing and cooling the gas in the same apparatus the temperature may be easily regulated to suit all conditions.

The scrubbing may be done by circulating the condensed oil and tar collected in the seal-chamber prior to its being returned to the generator, as preferred, or by means of the enriching-oil fresh from the storage-tanks prior to its introduction to the carbureter, in which case it is not of course allowed to flow into the seal-chamber, but is kept separate from the condensed hydrocarbons collected in the said chamber, or by circulating oil from the storage-tanks through the devaporizing-chamber aforesaid.

In the claims the simple term "oil" will be understood to cover both the oil from the storage-tanks and the condensed oil collected in the seal-chamber.

The details of my method and the construction of the apparatus I have invented and believe to be best adapted for the practical utilization of my method will be best understood as explained in connection with the drawing, which shows my apparatus in elevation and the various parts thereof broken away to show their construction.

A is a water-gas generator of usual construction. A′ indicates the steam-pipe leading to its base, and A^2 the air-blast pipe, while A^3 represents the outlet-conduit, leading from the generator to the carbureter.

a a indicate oil-inlets, the use of which will be explained.

B and B^2 indicate chambers in which the gas is carbureted and fixed, said chambers being connected by conduit B′ and filled with checker-work. The blast-gases from the generator are, as usual, passed through these chambers, preferably ignited therein, and then allowed to escape through a valve B^3 into a stack, as B^4, while the water-gas is conducted off into conduit D.

C indicates an oil-distributer through which oil is thrown into chamber B when water-gas is passing through it.

E is a surface condenser forming part of the conduit D, the gases passing through a series of pipes E^2, which are situated in the water-chamber E.

F is a liquid seal formed by a "liquid-seal chamber," as I will call the tank F′, and a conduit-section E^3, which receives the gases after they have passed from the condenser and which extends down into tank F′. The liquid seal forms a part of the gas-conduit, which is continued, as shown at I, preferably leading into another surface condenser, as J′, or a devaporizing-chamber of any suitable form. A series of pipes J^2 connect water-chambers J′ and J^3, passing through heads J^4 J^4, between which lies the chamber J^5, through which the gases pass to conduit continuation L, which may lead to further appliances or to a gas-holder.

K is a pipe connecting chamber J^5 with the tank F′, so that the oil condensed in chamber J^5 may, if desired, run into the said liquid-seal chamber; but if scrubbing-oil fresh from the storage-tanks be used in the condenser or devaporizing-chamber J the drainage from said chamber is preferably withdrawn separately.

H indicates a device for cooling the oil in the chamber or tank F′, here shown as a water-jacket. *f* is an outlet-pipe for said tank, leading, preferably, from the bottom thereof, and G indicates a receptacle for oil.

J^6 is a pipe through which oil may be introduced into the top of the condenser or devaporizing-chamber J. This oil flows down around the pipes J^2, absorbing the uncondensed vapors yet present in the gas.

In operating my apparatus, after the fuel in the generator is properly ignited and the chamber or chambers in which the carbureting and fixing is done are heated to a temperature not greatly exceeding that at which the best illuminating-gases are produced from the oil, or, as before stated, not sufficiently high to wholly reduce the oil to a permanent gas, the generator is operated to produce water-gas and oil in proper quantity introduced into the carbureter, as by a distributer C. At the temperature employed a considerable percentage of the oil is not converted into fixed gas, but passes in vaporous form with the gas into the surface condenser E, where it is condensed and from which it is collected, as in tank F′. This oil so saved may be reused for carbureting gas; but as it is heavier than the oil originally employed I prefer to introduce it into the generator, as by inlets *a a*. As it enters the heated chamber it is met by the hot ascending water-gas and its volatile portions driven off and carried to the carbureting and fixing chamber or chambers, while its residue remains in the generator as oil-coke, a valuable fuel. I may point out in this connection that if the generator were so operated as to permit undecomposed steam to escape from the fuel-bed together with the water-gas and if this excess of steam be not decomposed in its further passage through the carbureting and fixing chambers or if the apparatus be not of the constant-carbureting type, as described in Letters Patent granted to C. R. Collins, dated April 12, 1892, No. 472,785, its equivalent in water will be collected, as in tank F′ or G, wherein it will separate from the oil and from which it must be withdrawn when necessary. Preferably I use the condensed heavy oil from the condenser E to form a liquid seal, as shown at F, the seal being to prevent a return flow of gas during the times when the manufacture of gas is intermitted, and in this case I take care to prevent the revolatilization of the oil by the gas passing through it, preferably by providing some device for cooling the oil in the liquid-seal chamber—as, for instance, the water-jacket H. In order to prevent the accumulation of unduly heavy oil in the tank F′, I preferably draw the oil from its bottom, as by pipe *f*, which leads to any convenient receptacle, as G. After the gas has passed the liquid seal I prefer to pass it through a second surface condenser or devaporizing-chamber, as J, the oil collected in which may or may not, as has been described, flow into the seal-chamber F′ through pipe K. The scrubbing-oil which enters through the pipe J^5, if this be used, is disposed of as previously described and carries with it the condensed oil-vapor which it has separated from the gas.

It will readily be seen that by my method the oil is entirely utilized for the production of a gas having the highest attainable illuminating power that can profitably be derived from the use of the oil employed. Of course the oil used to enrich the gas can be introduced in any way or at any convenient point in the apparatus preceding the carbureting or fixing chambers. It is usual to introduce oil to the top of the generator or in the conduit between it and the carbureter, and when I refer in the claims to the introduction of oil to the carbureter I do not mean to exclude constructions in which the oil is first thrown in at a point in advance of said chamber; nor do I intend to be understood when referring to the carbureting and fixing of the gas as speaking in the sense of distinct operations performed in separate chambers, since obviously the gas can both be carbureted and fixed in the same chamber.

The proper temperature of the chamber or chambers in which the carbureting and fixing is done will vary with the kind of oil used; but the temperature at which the best-fixed illuminating-gas is produced from the coal can in all cases be readily ascertained and regulated accordingly. In the case of naphtha of ordinary commercial character it has heretofore been customary to employ a temperature of about 2,000° Fahrenheit, more or less, according to the candle-power of the gas desired and the area of the fixing-surface; but I have found it advisable to decrease the temperature of the chamber or chambers at least 400° Fahrenheit, while a decrease of 1,000° Fahrenheit has even been found advantageous in many instances. The rule should be to regulate the temperature, essentially, by the quality of the gas produced and to disregard the degree to which the oil is merely vaporized and not fixed, the economy of my treatment being the result of reusing the condensed oil at a temperature appropriate to its character, such reuse resulting in the complete utilization of the oil to produce gas of the highest value.

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

1. The method of economically carbureting water-gas, which consists in passing the water-gas formed in the generator through a regenerative carbureting and fixing chamber or chambers heated only to temperatures not sufficiently high to wholly reduce the oil to a permanent gas, forcing oil into said chamber or chambers to gasify it and enrich the water-gas and then passing the enriched gas through a surface condenser or condensers to separate and save for reuse the large proportion of oil not converted into a fixed gas.

2. The method of economically forming and carbureting water-gas which consists in internally heating a regenerative carbureting and fixing chamber or chambers by means of the blast-gases given off in blowing up the generator, then passing the water-gas formed in the generator through said carbureting and fixing chamber or chambers heated only to temperatures not sufficiently high to wholly reduce the oil to a permanent gas, forcing oil into said chamber or chambers to gasify it and enrich the water-gas and then passing the enriched gas through a surface condenser or condensers to separate and save for reuse the large proportion of oil not converted into a fixed gas.

3. The method of economically carbureting water-gas which consists in passing the water-gas formed in the generator through a carbureting and fixing chamber or chambers heated only to temperatures not sufficiently high to wholly reduce the oil to a permanent gas, forcing oil into said chamber or chambers to gasify it and enrich the water-gas, then passing the enriched gas through a surface condenser or condensers to separate and save the large proportion of oil not converted into a fixed gas at the low temperature employed and then reusing the heavy condensed oil to carburet at a higher temperature but still not substantially exceeding that at which the oil-gas will have the maximum illuminating effect, a fresh supply of gas from the generator.

4. The method of economically carbureting water-gas which consists in passing the water-gas formed in the generator through a carbureting and fixing chamber or chambers heated only to temperatures not sufficiently high to wholly reduce the oil to a permanent gas, forcing oil into said chamber or chambers to gasify it and enrich the water-gas, then passing the enriched gas through a surface condenser or condensers to separate and save the large proportion of oil not converted into a fixed gas at the low temperature employed and then injecting the heavy condensed oil directly into the generator to drive off volatile constituents with the water-gas and coke the residue.

5. The method of economically forming and carbureting water-gas which consists in internally heating a carbureting and fixing chamber or chambers by means of the blast-gases given off in blowing up the generator, then passing the water-gas formed in the generator through said carbureting and fixing chamber or chambers heated only to temperatures not sufficiently high to wholly reduce the oil to a permanent gas, forcing oil into said chamber or chambers to gasify it and enrich the water-gas and then passing the enriched gas through a surface condenser or condensers or devaporizing-chamber into which oil is introduced to assist in separating out and saving the large proportion of oil not converted into a fixed gas.

6. The method of economically forming and carbureting water-gas which consists in internally heating a carbureting and fixing

chamber or chambers by means of the blast-gases given off in blowing up the generator, then passing the water-gas formed in the generator through said carbureting and fixing chamber or chambers heated only to temperatures not sufficiently high to wholly reduce the oil to a permanent gas, forcing oil into said chamber or chambers to gasify it and enrich the water-gas, passing the enriched gas through a surface condenser or condensers or devaporizing-chamber into which oil is introduced to assist in separating out and saving the large proportion of oil not converted into a fixed gas and then reusing the recovered oil to carburet the water-gas.

7. The combination with a water-gas generator of a carbureting and fixing chamber or chambers, an oil-inlet leading into said chamber, a gas-conduit leading from said chamber, a surface condenser forming part of said conduit and having tubes E^2 through which the gas passes, a tank F' arranged beneath the condenser, a conduit-section E^3 projecting into said tank F' below the level of the fluid therein the whole constituting a liquid seal, a second condenser or devaporizing-chamber, as J, situated in the gas-conduit on the delivery side of said seal, an oil-inlet J^6 arranged in the upper part of said chamber, all substantially as specified and so that the gas will be entirely freed from unfixed and objectionable hydrocarbons.

8. The combination of a water-gas generator with a carbureting and fixing chamber, or chambers, an oil-inlet to said chamber, a gas-conduit leading from said chamber, a surface condenser forming part of said conduit, a liquid seal arranged to receive the hydrocarbons condensed in the condenser, said seal being situated in the gas-conduit, a second surface condenser situated in the gas-conduit on the delivery side of the liquid seal and a conduit for the condensed hydrocarbons leading from said condenser to the liquid-seal chamber.

9. The combination in a water-gas apparatus of a suitable generator and a carbureting and fixing chamber or chambers with a gas-conduit leading from said chamber, a surface condenser or devaporizing-chamber forming part of said conduit and an inlet leading into said condenser and serving to introduce oil thereinto whereby the gas may be simultaneously subjected to the scrubbing action of the oil and the refrigerating action of the cooling medium in the condenser.

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Witnesses:
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