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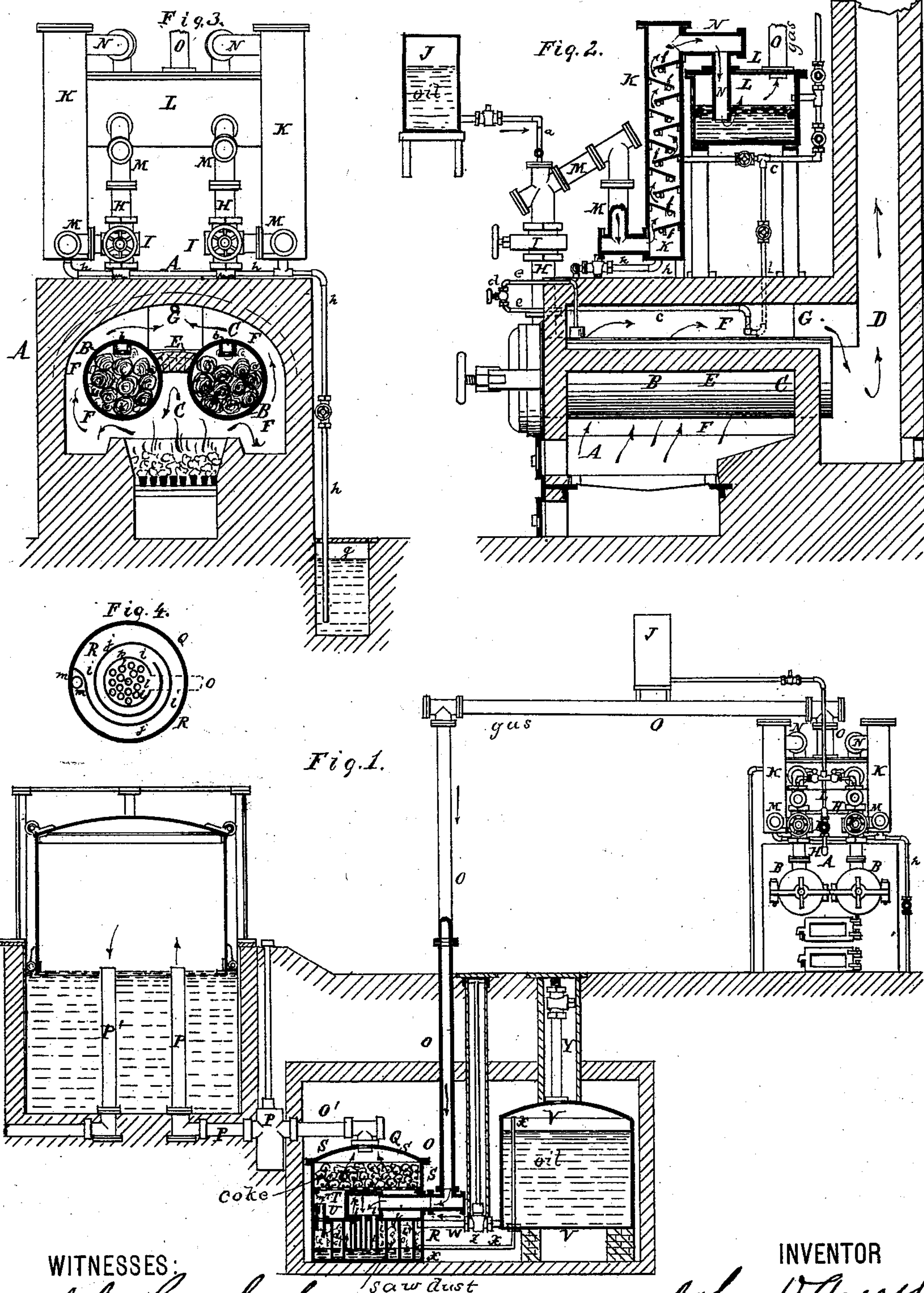
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J. D. AVERELL.

PROCESS OF AND APPARATUS FOR GENERATING ILLUMINATING GAS.

No. 360,944.


Patented Apr. 12, 1887.



WITNESSES:

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John Enadadu
J. W. Blake

INVENTOR

 *John D. Apple*

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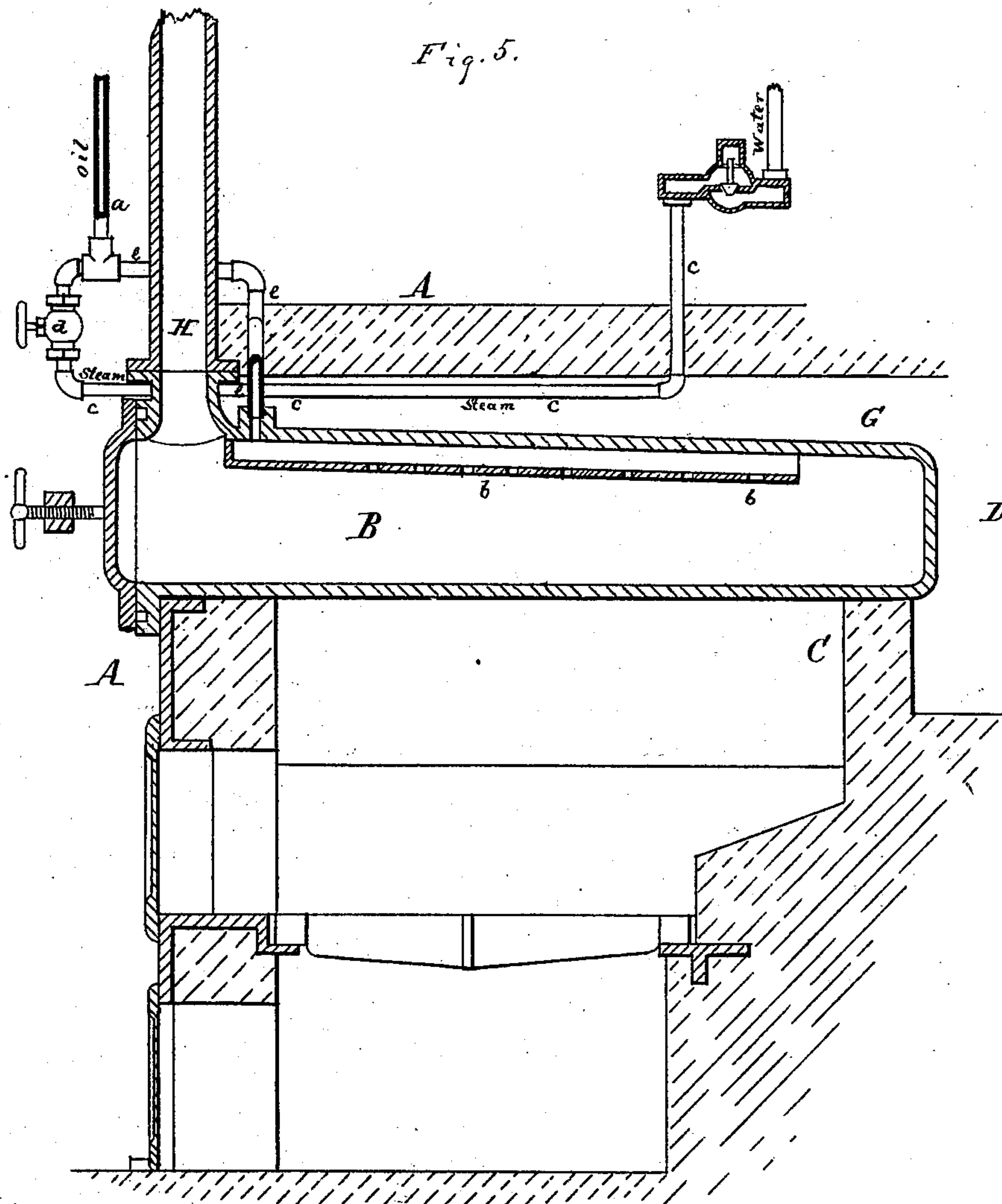
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John Cradock
J. W. Blake

INVENTOR

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UNITED STATES PATENT OFFICE.

JOHN D. AVERELL, OF BROOKLYN, N. Y., ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, OF PART TO GEORGE F. SWIFT, OF SAME PLACE, WILLIAM H. PLATT, OF ALBANY, AND ARTHUR FITCH, OF NEW YORK, N. Y.

PROCESS OF AND APPARATUS FOR GENERATING ILLUMINATING-GAS.

SPECIFICATION forming part of Letters Patent No. 360,944. dated April 12, 1887.

Application filed April 24, 1886. Serial No. 200,035. No model.)

To all whom it may concern:

Be it known that I, JOHN D. AVERELL, a citizen of the United States, and a resident of the city of Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in the Process of and Apparatus for Generating Illuminating-Gas, of which the following is a specification.

This invention relates to a process of generating from wood and analogous substances illuminating or heating gas by distilling wood with a supply of oil and steam in the same retort and passing the combined gaseous products through a scrubber and drawing from them, by friction and condensation, acid and carbonaceous liquids, and thereafter passing said products through hydrate of calcium or lime-water for purification.

Said invention relates, also, to a process in the generation of said gas from wood by first distilling the wood in a retort, then passing the products through a scrubber, then passing the same through lime-water, then passing them through hydrocarbon, and, finally, through a bed of coke or charcoal and delivering the same into a holder for storage and consumption.

Said invention relates, also, to combinations of parts in the construction of the apparatus for generating said gas under said process, hereinafter fully described, and set forth in the claims.

In the drawings hereto annexed, Figure 1 represents a sectional elevation of the apparatus for generating, enriching, and purifying illuminating-gas from wood according to my invention. Fig. 2 is a detached longitudinal vertical section of the generating-furnace with the scrubbing and purifying apparatus connected therewith, on a larger scale. Fig. 3 is a vertical section across the said furnace and its retorts. Fig. 4 is a detached horizontal section of the bottom chamber of the carburetor used in my apparatus. Fig. 5 is a detached vertical longitudinal section of the furnace and through a retort of the apparatus on a larger scale than the former figures.

A represents the furnace of the apparatus. In said furnace are employed two or more re-

torts, B B, a central longitudinal fire-box, grate, and ash-pit below them, with a suitable fire-door and ash-pit door. Said retorts rest with their mouth ends in the front plate and wall, and with their rear ends in a rear bridge-wall, C, back of which is arranged the furnace-chimney D. Between said retorts, near their topside, is made an arch-tile, E, from the front to the rear wall, C, preventing the passage of products of combustion up between said retorts.

A flue, F, is constructed along each side of the fire-box, up between the side walls of the furnace and the sides of the retorts, and over their top side all along between the front and rear wall, C, which has in its upper portion the opening G, through which the products of combustion pass from the fire-box and the flue F into the chimney D, as shown in Fig. 2. By the reflection of the tile E, the bridge-wall C, and flues F a powerful uniform heat is distributed over the retort-bodies. The mouths of the retorts are furnished with suitable lids, to open and close readily, and on the top of their mouth ends are formed flanged necks, Fig. 5, upon which the standing pipes H are attached, through which the generated gases pass from the retorts. The standing pipes H are each furnished with a gate or valve, I, Figs. 2 and 3, to close their passage during the time of charging the retorts. Each retort has a perforated longitudinal pipe or passage, b, along its inner top side, which is closed at its forward end and open at its rear end.

The retorts are charged with a suitable kind of wood—such as hard wood yielding a large volume of light carbureted hydrogen, or resinous pine wood rich in hydrocarbons—and the passage b is supplied with steam and oil in suitable proportions, according to the kind of wood used and according to the quality of gas, illuminating or heating, which it is desired to generate. If hard wood is used, yielding a poor gas, then a larger proportion of oil is admitted, and if resinous wood rich in hydrocarbons is used then a larger proportion of steam is admitted in order to generate a given quality or candle-power of gas. The quality of gas being generated is readily determined by the

test-light in the usual manner. The oil is obtained from an oil-tank, J, suitably located above the retorts, and connected by the oil-pipe *a* with pipe *e*, leading to passage *b* in the retort, and the steam may be supplied from a steam-boiler, or it may be obtained from the water-supply by the pipe *c*, which passes along in the top of the furnace to its front side, where it is furnished with a valve, *d*, for regulating the supply, and may connect with the oil-pipe *a*, and both the steam and oil may pass together by means of the pipe *e* into the passage *b* into the retort. If water is admitted from the supply-tank, it is passed slowly in regulated quantity into pipe *c*, which may be in the form of a coil arranged in the top of the furnace, and is there quickly converted into steam, which is passed in regulated quantity through valve *d* into pipe *e*, where it meets the oil from pipe *a*, and the two flow into the perforated distributor *p*, from which they are discharged in fine streams into the charge of distilling wood, where they are decomposed and converted into gas; or said oil and steam may pass into the retorts, each separately or either one only.

K represents a scrubbing-chamber, and L a purifying-box charged with lime-water. A separate scrubbing-chamber, K, may be employed for each retort, or one employed for both, and either both standing pipes H connected to the single scrubbing-chamber or each to a separate chamber, as shown, by means of the pipe M, which passes the gaseous products into the bottom portion of said chamber. The top portion of the chamber has attached the dip-pipe N, which passes down into the liquid of the purifying-box and conducts the products into the lime-water, from which they escape into a gas-space in the said box above the level of said lime-water. Said scrubbing-chamber K has arranged in its space between its top and bottom portion a series of alternate and counter-inclined shelves, *f*, and alternate gas-passages between the inclined ends of said shelves and the sides of said chamber, in which a moderate flow of water is allowed, which may be admitted at the top of the scrubber in the usual manner by a pipe. (Not shown.) The gaseous products in passing up drop readily the acidulous and carbonaceous vapors and liquids by means of friction and condensation in said chamber, which liquids are collected in the bottom of said chamber, from which they are passed into receptacles or cisterns *g*, Fig. 3, in the floor by means of small pipes *h*, connected with said chambers.

The top of the purifying-box L has attached the gas-main pipe O, which, for delivering heating-gas, connects directly with the gas-holder inlet-pipe P. For delivering illuminating-gas said pipe O connects with the carbureting apparatus Q, located, preferably, underground, as shown in Fig. 1. Said carbureting apparatus consists of a bottom chamber, R, charged with sawdust, excelsior, or other analogous absorbent agent and with naphtha, a top scrubbing-

chamber, S, charged with coke upon a perforated bottom, T, and a central distributing-chamber, U; and connected with said carbureting apparatus is a supply-tank, V, arranged in the same vault, which tank is connected by a suitable feed-pipe, W, and a vent-pipe, X, with said bottom chamber, R, to supply said chamber automatically with the same amount of naphtha, and in accordance with its consumption or evaporation. Said bottom chamber, R, has a spiral passage, *i*, formed by a vertical spiral partition, *j*, from its top to its bottom. The gas-main pipe passes through the side of the central chamber, U, into a central small circular box, *k*, which has a number of small vertical outlet-pipes, *l*, extending downward to the level of the oil of said chamber R. By means of said small pipes *l* the gas is passed in small streams in contact with the oil, and passes through the sawdust or excelsior impregnated with oil in the spiral passage *i*, from its smaller circles to the larger, until it reaches the outer part of space *i*, which has an opening, *m*, into the central chamber, U. The gas in said chamber U passes through the perforated bottom T into the coke above contained in the chamber S for scrubbing the gas, which thereafter flows into the gas-main O', connecting the top of the scrubbing-chamber S with the drip-pot and holder inlet-pipe P, and through it into the holder, where it is stored in the holder. From the holder the gas passes out for consumption through the gas-outlet pipe P'.

The supply-tank V contains a suitable large quantity of oil, to avoid frequent charging. It has a filling-pipe, Y, from its top to the surface of the floor or ground, and to the top end of said pipe is furnished a stop cock or plug, which is connected by a suitable hose or pipe attached to the oil-barrel from which the oil is delivered. The feed-pipe W is furnished with a suitable stop-cock, Z, which has a wrench on its plug extending to the surface of the ground for operating the plug and closing its passage of oil during the charging of the tank V. The delivery or bottom end of the vent-pipe X is placed very little above the bottom ends of the pipes *l*, to become sealed by the oil, and thereby stop the supply through the feed-pipe W at such a level constantly. The top end of said vent-pipe X is always above the top of the oil in the tank V. The oil being fed and held at the normal level at the outlets *l* in contact with the gas, nearly all oil is consumed equally and uniform illuminant power is imparted to the gas.

The furnace having been fired and the retorts properly heated in the usual way, they are charged with wood. After distillation commences, steam and oil in suitable proportions are admitted into the perforated distributor *b* and discharged therefrom in fine streams into the body of distilling wood, where the steam assists in driving off the gases from the wood, and, besides, mingles with the tarry matter expelled from the wood, and is thereby de-

composed in contact with the hot retort, resulting in the formation of hydrogen, light carbureted hydrogen, and carbonic oxide. These light poor gases unite with the rich hydrocarbon gases from the oil and wood, and are combined so as to form a fixed gas. The tarry matters are thus largely utilized and the volume of gas largely increased; and, moreover, tar is thus prevented from baking upon the sides of the retort in the form of hard carbon and interfering with the economical and successful manufacture of gas. The combined fixed gas passes from the retorts through the scrubber and purifier, where any condensable matter present and the ammonia and carbonic acid are removed. The purified gas may be passed direct to the holder for heating purposes; but if a richer gas is desired for illuminating purposes, the gas, after leaving the purifier L, is passed through the carburetor Q, where it takes up a sufficient quantity of light oil vapor to make it of a high illuminating candle-power, which may be passed directly to the burners or stored in the holder for use, as desired. It is important to remove the acid and tarry matter, and also the ammonia and carbonic acid, from the gas before it is passed to the holder, and especially before passing into the carburetor, since such matters greatly detract from the illuminating quality of the gas, and would soon clog up and interfere with the action of the carburetor, and in fact make it inoperative. The distribution of the steam and oil in fine streams, as described, is important, since they are thus brought into intimate contact with the whole body of wood, and are acted upon uniformly throughout the length of the retort, causing their better decomposition and conversion into fixed gas.

I am aware that it has heretofore been proposed to use steam in connection with the manufacture of wood-gas; but the steam was passed through the residual charcoal after distillation of wood and generation of wood-gas. I am also aware that wood-gas has been mixed with oil-gas in a separate heated retort; and I do not claim such operations, since my invention includes the distillation of the wood in connection with the decomposition of steam and oil directly in the same retort and at one operation. I am also aware that wood-gas has been purified and carbureted; but I do not claim such process, broadly; nor do I claim, broadly, the apparatus for such purpose. My invention includes a peculiar construction and arrangement of apparatus not heretofore known, whereby improved results are secured, as particularly defined in the claims.

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

1. The process of generating illuminating and heating gas from wood and analogous ma-

terial, which consists in distilling the wood in a heated retort and at the same time admitting a suitable supply of oil and steam into the wood retort and causing their decomposition, and combining their resulting gases with the gas from the wood and forming a fixed gas, whereby the tarry matter of the wood is utilized and the volume of gas largely increased, then passing such gas through a scrubber for removing condensable matter, and then through hydrate of calcium for removing impurities, as described.

2. The process of manufacturing illuminating and heating gas from wood and analogous substances, which consists in distilling the wood and at the same time decomposing in the same retort a suitable supply of steam and oil, and combining and fixing the gases resulting from the wood, steam, and oil, then passing such gas through a scrubber and through hydrate of calcium or lime-water, for removing condensable matters and impurities, and then passing such purified gas through a carbureting apparatus, and enriching it with light hydrocarbon vapors to increase its illuminating-power, as herein described.

3. In an apparatus for generating illuminating and heating gas, the wood distilling retort B, set in furnace A, and having the perforated distributing-passage *b*, arranged at its upper internal portion, in combination with supply-pipe *e*, the connecting steam-pipe *c*, and oil-pipe *a*, having regulating-valves, oil-tank J, and means for scrubbing and purifying the gas, connecting and operating as described.

4. In an apparatus for generating illuminating and heating gas, the retorts B, set in the reverberating furnace A, and having their rear ends resting in bridge-wall C, in combination with tile E, placed between the retorts and connecting with said bridge-wall C, the flues F, and passage-way G, leading to the chimney D, at the rear ends of the retorts, substantially as and for the purpose described.

5. In an apparatus for generating illuminating and heating gas, the combination, with retorts B, set in furnace A, and having suitable supply-pipes, *c* and *a*, for steam and oil, the scrubber K and purifier-box L, and connecting-pipes, of the carbureting apparatus Q, having naphtha-chamber R, coke-chamber S, and vertical distributing-pipes *l*, the oil tank V, and pipes W-X, connecting it with the carburetor, substantially as and for the purpose described.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 12th day of April, 1886.

JOHN D. AVERELL.

Witnesses:

J. W. BLAKE,
ADOLPH PEARL.