

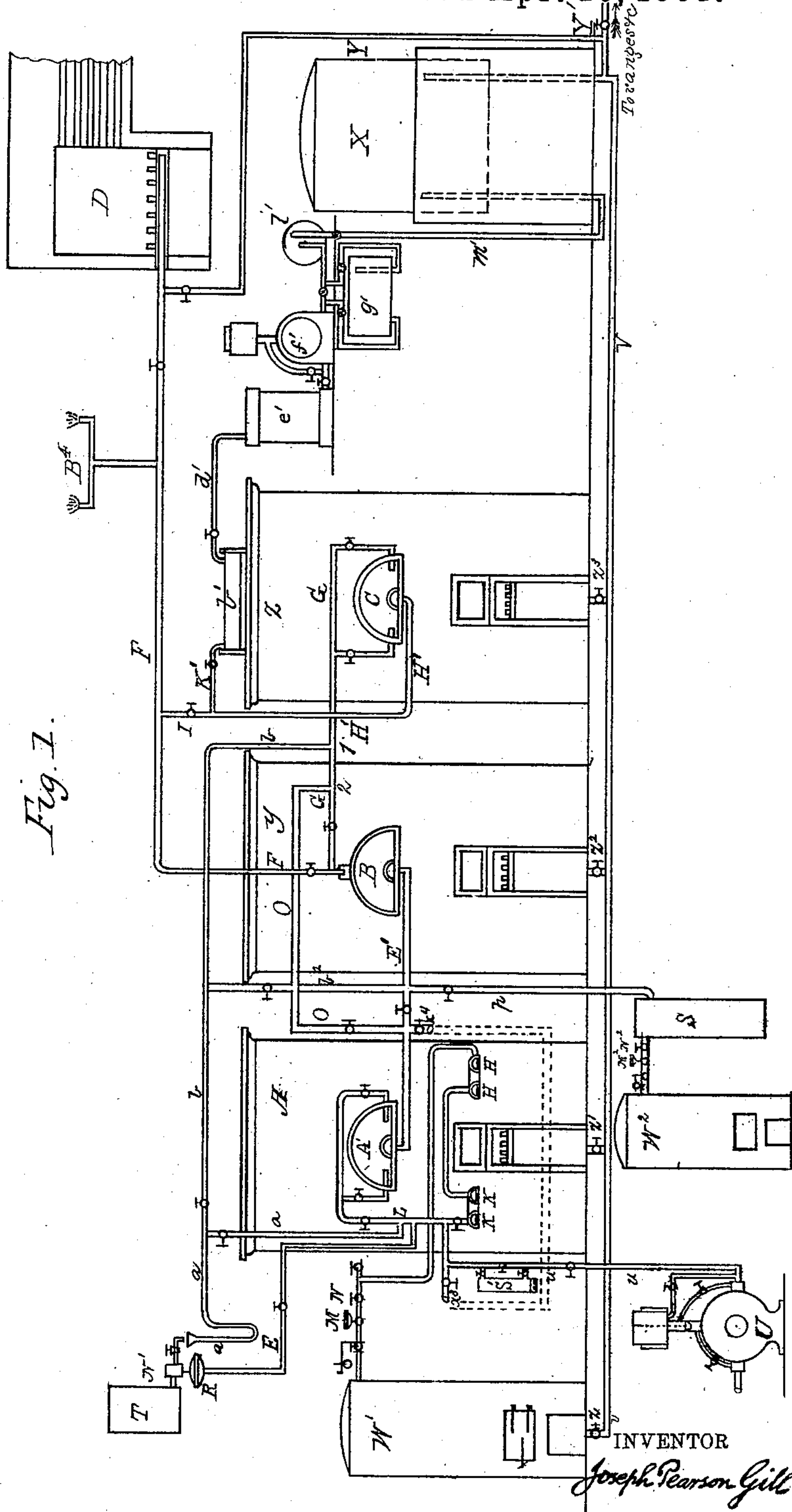
(No Model.)

2 Sheets—Sheet 1.

J. P. GILL.

PROCESS OF AND APPARATUS FOR MANUFACTURING GAS.
No. 275,761. Patented Apr. 10, 1883.

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WITNESSES

R. F. James,

Wm. H. Grevelle

INVENTOR

Joseph Pearson Gill

ATTORNEYS.

(No Model.)

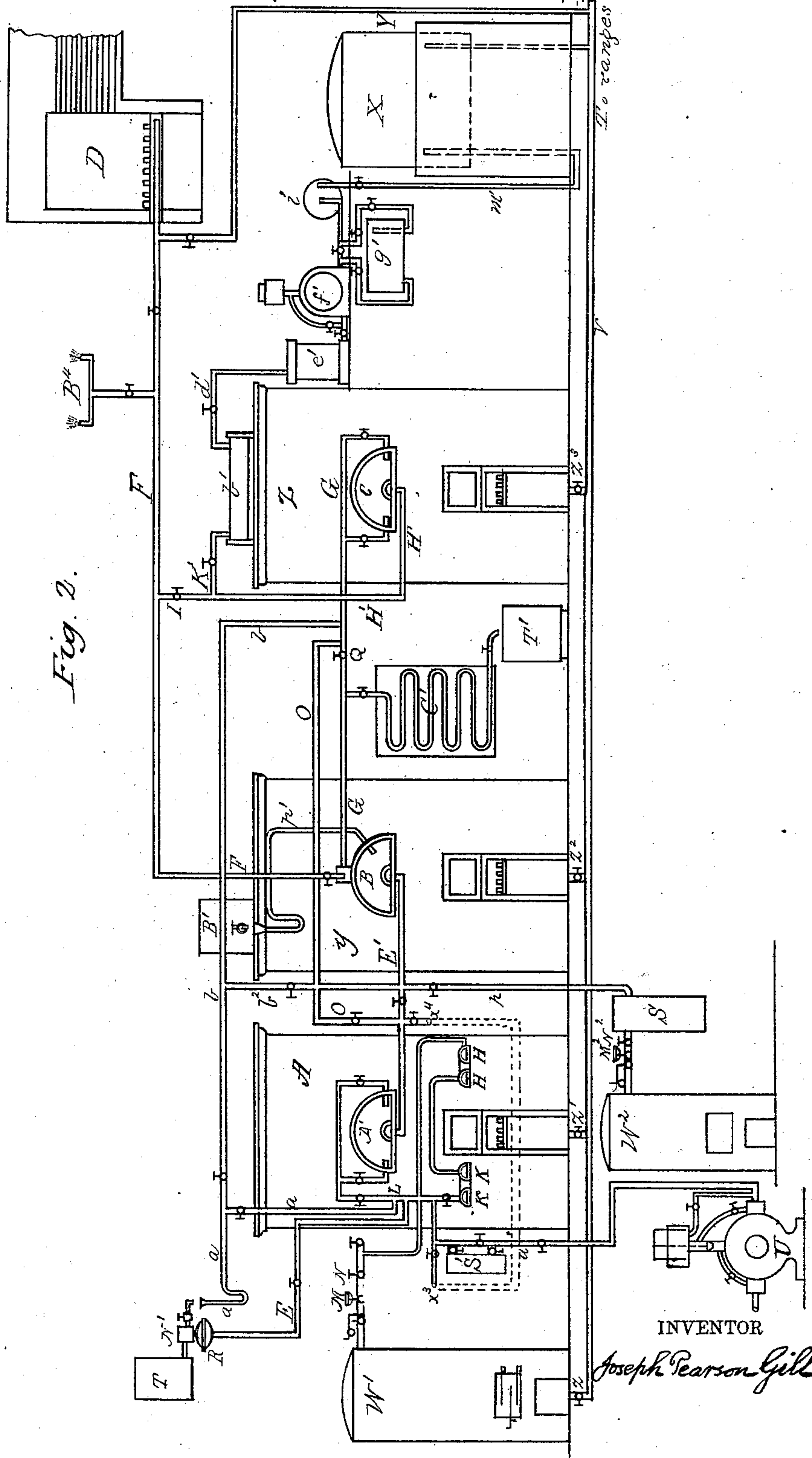
2 Sheets—Sheet 2.

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UNITED STATES PATENT OFFICE.

JOSEPH P. GILL, OF NEW YORK, N. Y.

PROCESS OF AND APPARATUS FOR MANUFACTURING GAS.

SPECIFICATION forming part of Letters Patent No. 275,761, dated April 10, 1883.

Application filed March 19, 1881. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH PEARSON GILL, of the city, county, and State of New York, have invented certain new and useful Improvements in Processes of and Apparatus for Manufacturing Gas; and I do hereby declare that the following is a full, clear, and exact description of the same.

My invention consists in improvements in apparatus and processes for manufacturing illuminating and non-illuminating gases; and it includes in one apparatus mechanism for combining heated air, superheated steam, non-illuminating gas, hydrocarbon liquids, and vapors arising from solid hydrocarbons, coal-tar or melted resinous or oleaginous substances in the process of vaporization, and in the conversion of the combined vapors into fixed gases.

The apparatus and processes are hereinafter fully described and particularly claimed.

In the accompanying drawings, Figure 1 represents the apparatus in a form adapted to use bituminous coal or any other similar solid hydrocarbon for producing hydrocarbon vapors by distillation and the saturation of steam-heated air or non-illuminating fixed gas, all as herein described. Fig. 2 represents an apparatus in all respect similar to that shown in Fig. 1 and adapted to be used for the same purposes, with the exception in respect to the apparatus that it is provided with devices for holding coal-tar or melted resinous or oleaginous substances to be supplied to the retort above specified in the place of the solid hydrocarbon used in the form first shown, all as hereinafter explained.

In the apparatus shown in Sheet 1 there are three benches, *x*, *y*, and *z*, in each of which there is a retort, (marked respectively A', B, and C,) although these retorts may, if preferred, all be placed in a single larger bench.

The apparatus, as shown, is capable of three distinct operations or processes: First, there is provided a boiler, W', with pipe-communications and an automatic regulator, M N. The pipe in which the regulator is placed is connected with superheaters H H and K K, and from K K a pipe leads through a vaporizer, L, to a retort, A'. From the retort A' a pipe, E', leads to the retort B, and from the retort B a pipe, F, leads to burners B' and furnace D.

From the pipe F a branch, I K', leads through condensing and purifying apparatus *e'*, *f'*, *g'*, and *l'* to a storage-tank. The retort B is also connected to the retort C by the pipe G, and the retort C is connected by pipe H' to the pipe K', leading to the tank, and to the pipe F, leading to the burners and furnace, so that both B and C are in connection with the same source of supply and with the same destination of consumption or storage. The oil-tank is indicated at T. Its faucet is over the opening of a siphon-pipe, *a*, which leads, first, to the vaporizer L; second, to a pipe, *b*, which leads around the benches *x* and *y* and connects with the pipe G at a point, 1, from which point, by said pipe G, it is in communication with the retort C, being shut off from the retort B by a stop-cock or valve. The tank T is provided with an automatic regulator, R N', R being a diaphragm working a needle-valve, N', the diaphragm being operated by steam taken from the vaporizer L through the pipe E, so that any increase of pressure in the vaporizer L will tend to open the valve and allow more of the hydrocarbon oil to escape from the tank.

The retort A' is supplied with air from a blower, U, which is provided with regulating devices, substantially such as shown in my Patent No. 241,208, of May 10, 1881. Air from this blower passes by the pipe *u* to a superheater, *s'*, to which it is admitted by short pipes provided with valves; or it may be conducted past the superheater through L to the retort A'. The branch pipe *x*³ is also provided with connections with a short pipe, *x*⁴, which connections are shown by dotted lines in the drawings, by which the air may be conducted from the superheater around the retort A', and by pipes O and G to the retort C, or by pipe E' to the retort B. I have provided also another steam-boiler, W², with automatic regulators M² and valve N², and a superheater, S, which is connected by a pipe, *p*, with the pipe E', and also with the pipe *b*. Instead of this second boiler, W², the superheater might be attached to the boiler W', communicating in the same manner with the pipe *p*. It will be understood that these pipes are provided with stop-cocks or valves, as indicated in the drawings, by which any part of the apparatus may be shut off, and the

steam or air, or steam and air mixed with the hydrocarbon vapors or non-illuminating gas, may be conducted through the various pipes, as herein explained, for carrying on the different processes and producing the different results.

I proceed now to describe the several operations, premising that the main distinction between the apparatus above described and the methods employed in its use and the apparatus shown in application No. 26,951 lies in the addition of the apparatus for supplying the heated air in the retort B and in the use of the vapors arising from the solid hydrocarbon in said retort in the process of distillation, all as hereinafter explained.

Before explaining the particular methods of operating the above-described apparatus, it may be stated generally that the retort B contains bituminous coal or any suitable solid hydrocarbon, which is to be subjected to a low heat only sufficient to vaporize the oil therefrom, and that from the proper source, heretofore explained, either steam or heated air, or steam and air saturated with liquid hydrocarbon vapors, or a non-illuminating gas from the retort A', also so saturated, may be passed through the retort B, and there take up the vapors arising from the distillation of the solid hydrocarbon therein, and thence be passed either to the furnace or to the retort C, where the commingled vapors are converted into a fixed gas. This saturation of the air, steam, or gas, as described, by liquid hydrocarbon vapors is an important feature in connection with the vaporized solid hydrocarbon, for the reason that the latter vaporizes in constantly diminishing quantity, and this variation may be compensated by the easily-controlled hydrocarbon-supply.

Describing the particular operations separately, I refer first to the use of steam. Steam from the boiler W', in automatically-regulated quantity, passes through the superheaters H and K, and thence to the retort A'. When steam alone is to be used the air from the blower is shut off, and if a solid hydrocarbon is used in the retort A' the liquid hydrocarbon is shut off. In that case the steam in the retort A' is decomposed by contact with the anthracite coal and forms a non-illuminating gas. This passes through the pipe E' to the retort B, where it mingles with the hydrocarbon vapors distilled from solid hydrocarbon therein. From this retort B the commingled gas and vapor pass by the pipe G to the retort C, in which they are converted into a fixed gas, and from which, by the pipes H' K', they are conducted through the purifying and condensing apparatus, &c., *e', f', g', and l'*, to the storage-chamber; or they may be taken by the pipe F directly to the points of consumption.

In case it be preferred to use the liquid hydrocarbon instead of the anthracite coal, heretofore described as used in the retort A', the hydrocarbon is admitted through the pipe *a*

to the vaporizer L, where it combines with the superheated steam from the boiler W' and passes to the retort B, in the manner heretofore explained, as a non-illuminating gas.

In case it be desired to use air instead of the non-illuminating gas, the steam-supply is shut off and air is admitted through the pipe *a*. In this case the retort A' serves simply to heat the air, from which retort it passes through the pipe E' to the retort B, where it mingles with the vapors arising from the vaporization of the solid hydrocarbon, and the commingled air and vapors pass through the pipe G to the retort C, where they are converted into a fixed gas, and thence are taken to the storage-tank through condensing, purifying, and measuring apparatus *e', f', g', and l'*, or to the point of consumption, D, in the manner heretofore explained. The gas thus produced is an illuminating-gas like that made by the process first described. As before stated in respect to the non-illuminating gas and hydrocarbon vapors in the retort B, the mixed heated air and hydrocarbon vapors may be taken from the retort B and carried directly to the points where they are to be consumed as a vapor by means of the pipe F. In case the retort A' is not employed in the process last described, I may use the superheater S', conducting the air by pipe (shown in dotted lines) from the point *x³* to the point *x⁴*, thence by pipe E' into the retort B, the process from that point being the same as that heretofore described.

In the described apparatus I may also use superheated steam carried directly to the retort B for mixing with the hydrocarbon vapors arising from the solid hydrocarbon contained therein. In this case the superheated steam is conducted by the pipe *p* and pipe E' to the retort B, and the commingled superheated steam and hydrocarbon vapors are thence conveyed to the retort C for conversion into a fixed gas or through the pipe F, as a vapor, in the manner heretofore explained. Although this may be done, this direct use of the steam to take up and convey the hydrocarbon vapors is greatly less advantageous, since the liability of the steam to condensation renders it variable in capacity as a conveyer and interferes with the exactness of the proportions, which is so desirable in my processes.

In case of inconvenience of obtaining a supply of solid hydrocarbon, the apparatus may be run by a supply of liquid hydrocarbon brought from the tank by the pipe *b* to the pipe G at the point 1. Either non-illuminating gas or heated air or superheated steam may be brought by means of the described connections through the pipe O to the point R² in the pipe G, whence it carries the oil from the pipe *b* through a suitable vaporizer to the retort C.

It will be understood that in all these operations the proper valves are opened or closed according to the direction required to be given to the gases or vapors.

In Sheet 2 precisely the same apparatus is shown as in Sheet 1, with the exception of devices which are added for the purpose of vaporizing tar or any heavy liquid hydrocarbon, instead of bituminous coal or other solid hydrocarbon, in the retort B. I use a small tank, B', placed on the top of the furnace or in some other warm position, for the purpose of keeping the tar, heavy oil, resins, or oleaginous substances in sufficient fluid condition to run freely. This tank is of a size to contain a quantity of liquid to be vaporized in the retort B in any given time—that is to say, during a charge or run of the material. The liquid flows through the pipe *p'* into retort B accurately and uniformly during the period in which the vaporization is to take place. I commence the vaporization at a low red heat, and gradually increase it to a cherry red to vaporize the tar to dryness. When the vapor passing from the retort B is not otherwise required, it may be allowed to pass through a condensing-coil, C', into a reservoir, T', thereby avoiding waste of material. It is necessary that the flow of the tar or other substance to the retort B should be uniform and graduated, so that it may be vaporized as fast as supplied, and as the residuum accumulates in the retort it is requisite that the charge in the tank should be such in quantity that it will be exhausted before the retort becomes clogged. The residuum is a very fine coke, which may be removed and used for fuel or other purposes. The vapor from the tar or other substance is used in the same manner as that heretofore described in connection with the vapors of solid hydrocarbon in the retort B.

The apparatus, as described and shown, is capable of supplying the air, steam, and non-illuminating gas in mixture to the fixing-retort. I contemplate supplying to the heated air a proportion of steam or non-illuminating gas whenever it may be desirable to make a gas of less density. It is especially desirable to thus mix the steam or gas with the air when liquid hydrocarbons are used in connection with the solid. The non-illuminating gas may be used alone.

Although I have described the manufacture of vapors by means of heated air, non-illuminating gas, and superheated steam, I do not herein claim the manufacture of such vapors, that being the subject of another application, of which the serial number is 28,853, filed March 21, 1881.

I do not herein claim the combination of an air-supply pipe and regulator and liquid-hydrocarbon and steam supplying devices provided with automatic regulators, a superheater and vaporizer, said combination being claimed in application Serial No. 28,425, filed March 16, 1881.

Having thus described my invention, what I claim is—

1. An apparatus for the manufacture of gas, consisting of a retort, A', in combination with an automatically-regulated air-forcing device

and a hydrocarbon-liquid-supply pipe having a regulating device connected with the air-forcing device, whereby the supply of hydrocarbon is proportioned to the supply of air, a heater, and a vaporizer, substantially as described.

2. In combination with the retort A', a steam-supply pipe and an air-forcing device, with a heater for each, and with suitable connections and stop-cocks, whereby either may be used at will, and a hydrocarbon-liquid-supply pipe with an automatic valve, whereby the amount of oil is proportioned to the amount of steam or air, substantially as described.

3. The combination of the retort A' and the automatically-regulated steam or air supplying devices, hydrocarbon-supply pipe regulated, substantially as described, by the steam or air admitted, a suitable superheater and vaporizer, the retort B, adapted to hold a dry hydrocarbon, a pipe and regulator between the vaporizer and oil supply pipe, and suitable intermediate connecting-pipes, all substantially as described and shown.

4. The combination of the retort A', with its liquid-hydrocarbon-supply reservoir and pipe and steam or air supplying device, superheaters, vaporizer, and automatic regulators, as described, whereby the proportions of hydrocarbon and steam or air are automatically maintained, a vaporizing-retort, B, adapted to contain dry hydrocarbon, and a fixing-retort, C, with suitable intermediate pipes and connections, all substantially as described.

5. In the described apparatus, the combination of the retort A' and air or steam supplying devices, adapted to produce a non-illuminating gas, substantially as described, the retort B and pipe E' for taking such gas to the said retort B, and a steam generator and superheater and steam-supply pipe *p*, connected to the said pipe E' at a point between the said retorts A' and B, and connections, substantially as described, whereby the resulting gas may be conducted from the retort B to a point of consumption or storage, or to a third retort, C, substantially as and for the purpose described.

6. The combination of an air-supply pipe, an automatic air-forcing device and air-heater, a steam-supply pipe, an automatic regulator, a hydrocarbon-supply pipe having an automatic valve, and a fixing-retort.

7. In the described apparatus, the combination, as herein described, for the manufacture of gas, of an air-supply pipe, an automatically-regulated forcing device, a heater therefor, a steam-supply pipe provided with an automatic regulating device, a superheater therefor, a retort, B, substantially for the purpose described, and a fixing-retort, substantially as set forth.

8. In the described apparatus, the combination, as herein described, for the manufacture of gas, of an air-supplying device, an automatically-regulated air-forcing device, and a steam-supply pipe provided with an automatic regulating device and a superheater, a hydro-

carbon-liquid-supply pipe provided with an automatic regulating device and a vaporizer, a retort in which solid and melted hydrocarbon, coal-tar, and similar heavy liquids are vaporized, and a fixing-retort, substantially as set forth.

9. In an apparatus for the manufacture of gas, the combination of the following parts: tank T, regulator N¹ R, vaporizer L, boiler W¹, regulator M, valve N, superheaters H K, non-illuminating-gas retort A', air-pump U, compensator G', superheater S', boiler W², regulator M², valve N², superheater S, vaporizing-retort B, and fixing-retort C, substantially as described.

10. The process of manufacturing gas herein described, consisting in vaporizing liquid hydrocarbon by use of highly-heated air in contact with the liquid in a vaporizer at a temperature below that of the destructive distillation of the liquid, in supplying the heated air by an air-forcing device, in regulating the supply of liquid hydrocarbon automatically by the heated-air supply, whereby the definite proportions of each are maintained, and in conveying the commingled vapors to a heated retort and converting them into a fixed gas.

11. The process of manufacturing gas, consisting in combining highly-heated air and

superheated steam or non-illuminating gas with vapors arising in a heated retort from bituminous coal or other solid or melted hydrocarbons, coal-tar, or similar heavy liquids in the process of vaporization at a temperature below that of destructive distillation, and conveying the commingled vapors to a heated retort, and then converting them into a fixed gas, substantially as set forth.

12. The process of manufacturing gas, consisting in combining highly-heated air and superheated steam or non-illuminating gas, in conjunction with the vapor of a liquid hydrocarbon, with the vapors arising in a heated retort from bituminous coal or other solid or melted hydrocarbons, coal-tar, or similar heavy liquids in the process of vaporization at a temperature below that of destructive distillation, and conveying the commingled vapors to a heated retort, and therein converting them into a fixed gas, substantially as set forth.

In testimony that I claim the foregoing as my own I affix my signature in presence of two witnesses.

JOSEPH PEARSON GILL.

Witnesses:

B. F. JAMES,

WM. H. GRENELLE.