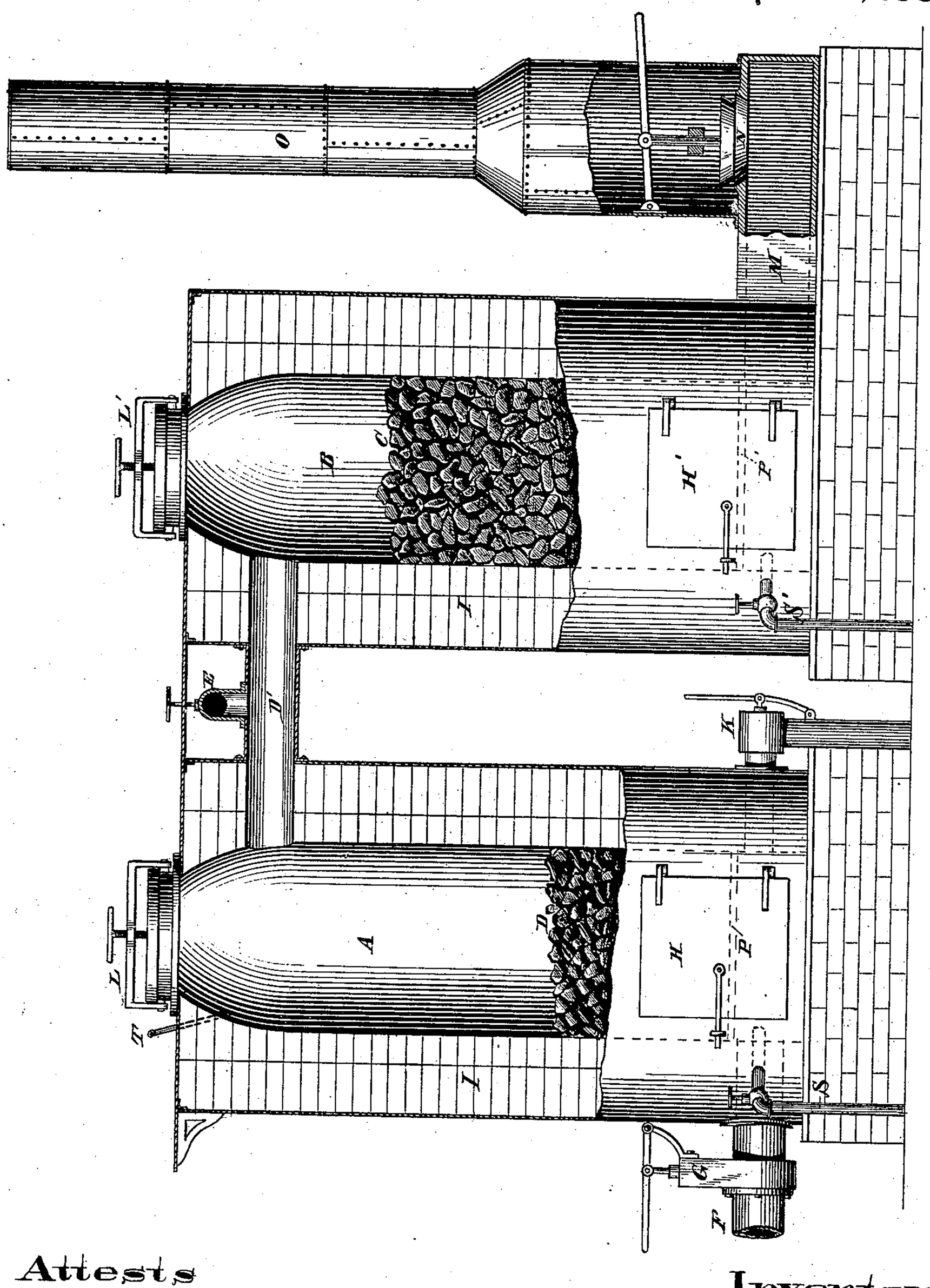
M. S. FROST.

Process and Apparatus for Manufacturing Gas.

No. 226,397. Patented April 13, 1880.



Attests

Howard S. Jones Jr.

H. M. Hoffman.

Inventor

Mahlon S. Frost

By his Attorney

Wm. A. Smith

N. PETERS, PHOTO-LITHOGRAPHER, WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

MAHLON S. FROST, OF PHILADELPHIA, PENNSYLVANIA.

PROCESS AND APPARATUS FOR MANUFACTURING GAS.

SPECIFICATION forming part of Letters Patent No. 226,397, dated April 13, 1880.

Application filed April 21, 1879.

To all whom it may concern:

Be it known that I, MAHLON S. FROST, of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented an Improvement in Process and Apparatus for Manufacturing Gas, of which the following is a specification.

My invention relates to those processes for the manufacture of water-gas in which carbonaceous material is used to decompose the water which is converted into steam; and it consists in the combination of two or more generators or chambers with open passages between them, and said passages being provided with a suitable air-pipe and valve, whereby a regulated supply of air can be admitted at will by the operator.

It further consists in the combination of the generators with steam and blast pipes, whereby substance for the production of gas and blast for combustion may be properly admitted, as will be hereinafter explained.

It further consists in furnishing the two end generators, respectively, with a gas-exit flue and a smoke-exit flue, both of which are supplied with gas-tight valves.

The beds of carbonaceous material in the generators are of different depth, the reason for which will presently be explained.

My invention further consists in the process in which a bed of carbonaceous material is brought to a state of incandescence, but not consumed, by carbonic acid passing through it, which carbonic acid is produced by combustion of carbonaceous materials in another generator and their entire burning by the air which is admitted prior to their descent through the before-mentioned bed of carbonaceous materials, and then the decomposition of steam by said incandescent carbonaceous materials, which hold the oxygen in combination and set the hydrogen free, and finally the mixing of this hydrogen with volatilized hydrocarbon.

The object of my invention is to produce water-gas, or, as it is sometimes designated, "fuel-gas," at a less expense than that at which it has heretofore been manufactured; also to free said gas from some of its impurities; and also to produce a fuel-gas having greater calorific intensity than the gas which has formerly been produced by the decomposition of water by carbonaceous agents.

My object is also to do away with the superheater which is commonly used, in which to fix the gas after the fluid hydrocarbons have been mixed with it in any of the usual methods.

As a process, the decomposition of steam by incandescent carbon is old, and so is the volatilization of fluid hydrocarbons in the same retort that the steam is decomposed in, as is shown in Lowe's patent; but the decomposition of steam in the manner and by the means hereinafter explained, in combination with the method of carbureting the resulting gas, is new.

In no other water-gas process where two generators are used is the fire in the carbureting-generator kept with a carbonic-acid flame, and that in which the steam is decomposed with an oxide flame. Neither am I aware that the products of combustion from the carbureting-generator are fully burned in their passage to the decomposing-generator when the steam is decomposed in any other process. Neither have I any knowledge of any other process in which steam is decomposed always by coal in one generator and the resulting gas carbureted and made a fixed gas by heat and over a bed of incandescent carbon in a second generator. These are points wherein my process differs from all others.

The accompanying drawing represents two generators, of which the upper portion is broken away to show the different depths of the beds of coal, and also a portion of the escape for smoke is broken open to show gas-tight valve.

A and B are generators or chambers, and are connected at the top by a flue, D′. Opening into the flue D′ is an air-blast pipe, E, provided with a valve for the admission of a regulated supply of atmospheric air into said pipe D′. The chambers A and B are supplied at their tops with gas-tight doors L L′, through which the chambers or generators are furnished with coal or other carbonaceous material, D and C. The generator A has grate-bars P near the bottom of the combustion-chamber within said generator, and upon which rests the carbonaceous fuel D. Opening into the

combustion-chamber under the grate-bars P are the blast-pipe K, steam-pipe S, and gas-exit flue F, all of which are supplied with valves. At the base of generator A is a gas-tight door, H, which opens into the combustion-chamber partly above and partly under the grate-bars P.

The generator B is supplied at the bottom with a steam-pipe, S′, furnished with a valve, a door, H′, of the same construction as H, grate-bars P′ at the same level as bars P, and a smoke-exit flue, M, which opens from the generator B under the grate-bars P′, and is provided at its outer end with a gas-tight valve, N. Over valve N is a chimney, O, by which the gases of combustion are led off.

The generators are lined with fire-brick I I. Pipe T admits petroleum.

The operation is as follows: The valve N and blast K being open and steam-pipes S S′ and valve G in flue F being closed, combustion is set up in the chamber or generator A, which has the shallow bed of coal D.

The products of combustion are carbonic oxide and carbonic acid mixed with some unburned carbon which is carried in suspension. When these products of combustion arrive in flue D′ the carbonic oxide and unburned carbon are burned to carbonic acid by the admission of air by blast-pipe E, said admission being just sufficient to burn the above to carbonic acid, for reasons which will be stated presently.

The products of combustion of generator A, being burned to their full extent, pass into generator B with their produced heat, which raises the carbonaceous material in this generator to incandescence, but does not consume it to a great extent, for the reason that by admitting just sufficient air at E for combustion of the gases from A there is no oxygen wherewith the carbon in generator B can combine with the exception of that in the carbonic acid. Hence the carbonaceous material C is not burned much, but raised to incandescence. The products of combustion, after having performed their duty, pass into flue M through valve N, and out into the atmosphere by stack O.

Now close valve N and blast from K and the valve in blast-pipe E and open the valve G in gas-exit flue F and steam-pipe S′. The steam passes into the generator B and ascends through the incandescent coal-bed C, and is decomposed into its elements—hydrogen and oxygen, the oxygen combining with the incandescent carbon to form carbonic oxide and carbonic acid, and the hydrogen passes up free. These gases then pass through flue D′ and enter the generator A and pass down through the shallow bed of coal D, when any carbonic acid is reduced to carbonic oxide by said acid taking up another equivalent of carbon. This conversion of carbonic acid into carbonic oxide is particularly advantageous when this gas-fuel is desired for heating purposes.

The object of a shallow bed of coal, D, in generator A is that the gas which I desire, and with which I heat the coals or other carbonaceous material, C, in generator B, is carbonic acid, and to get it such a bed of coal and sufficient blast are necessary. The deep bed C in generator B is so required because I wish to convert my decomposed water in form of steam into carbonic oxide and hydrogen as near as possible. After the gas has passed through the coal-bed D it passes under grate-bars P and out to the holder or mains by flue F.

Each of the generators may be supplied with steam and blast pipes, and the process may be carried on in one direction; but I prefer it as described.

In the place of the coal-bed C, I can use any other carbonaceous material, as cast-iron, charcoal, &c.

I do not confine myself to any number of generators.

When I wish to use the produced gas for illuminating purposes I introduce fluid hydrocarbons into the generators at T, or the top or sides, or, if desired, in the flue D′, and said hydrocarbons are immediately vaporized and mixed with the water-gas, and, owing to the high temperature, due to the generation of carbonic acid previously, this illuminating-gas is made a fixed gas without the aid of the usual superheater.

Another advantage is that the hydrocarbons are not burned to such an extent by fixing them in the generators as by means of a superheater; hence I save substance for luminosity.

In practice I prefer to inject the petroleum or other hydrocarbon into the generator A, because the bed of carbonaceous material in generator B is so deep that the steam is entirely decomposed in this generator and the compound gas passes into generator A without steam; and hence I do not have any of my fluid hydrocarbon decomposed by the superheated steam. When the hydrocarbon is decomposed the carbon combines with the oxygen of the steam and sets hydrogen free, which has no luminosity of itself, and by my admitting the hydrocarbons into generator A, instead of B, I save much material which gives luminosity, and also reduces the cost of the gas.

I do not confine myself to using a smaller bed of coal in generator A than in B; but I prefer to do so for reasons already given.

If the carbonic acid generated in B should be too hot and tend to melt the flue M or valve N, I can admit air by a door under valve N, which would dilute the carbonic acid, which, being already charged with oxygen to its full extent, could not burn further, and hence the incoming air would reduce the temperature of said gas, and thereby protect the flue M, valve N, and chimney O.

I claim—

1. The combination of two or more generators, each supplied with a bed of carbonaceous

material, and supplied further with steam-pipes, blast-pipes, and gas-flues, with passage or passages between said generators, provided with blast-pipe, substantially as and for the purpose specified.

2. The combination of two or more generators, A B, containing carbonaceous material, steam-pipe S′, passage D′, blast-pipes E and K, gas-flue F, and exit-flue M, substantially as and for the purpose specified.

3. The process of manufacturing illuminating gas by first causing partial combustion of carbonaceous materials and generating a heating-gas, then causing complete combustion of such gas and heating to incandescence a second bed of carbonaceous material by admitting air to the gas in its passage to the secondary generator, then decomposing steam by passing it through the incandescent carbonaceous material, and finally carbureting the resulting gases in the primary generator, substantially as described.

In testimony of which invention I hereunto set my hand.

MAHLON S. FROST.

Witnesses:
R. M. HUNTER,
CHAS. F. VAN HORN.