

(No Model.)

2 Sheets—Sheet 1.

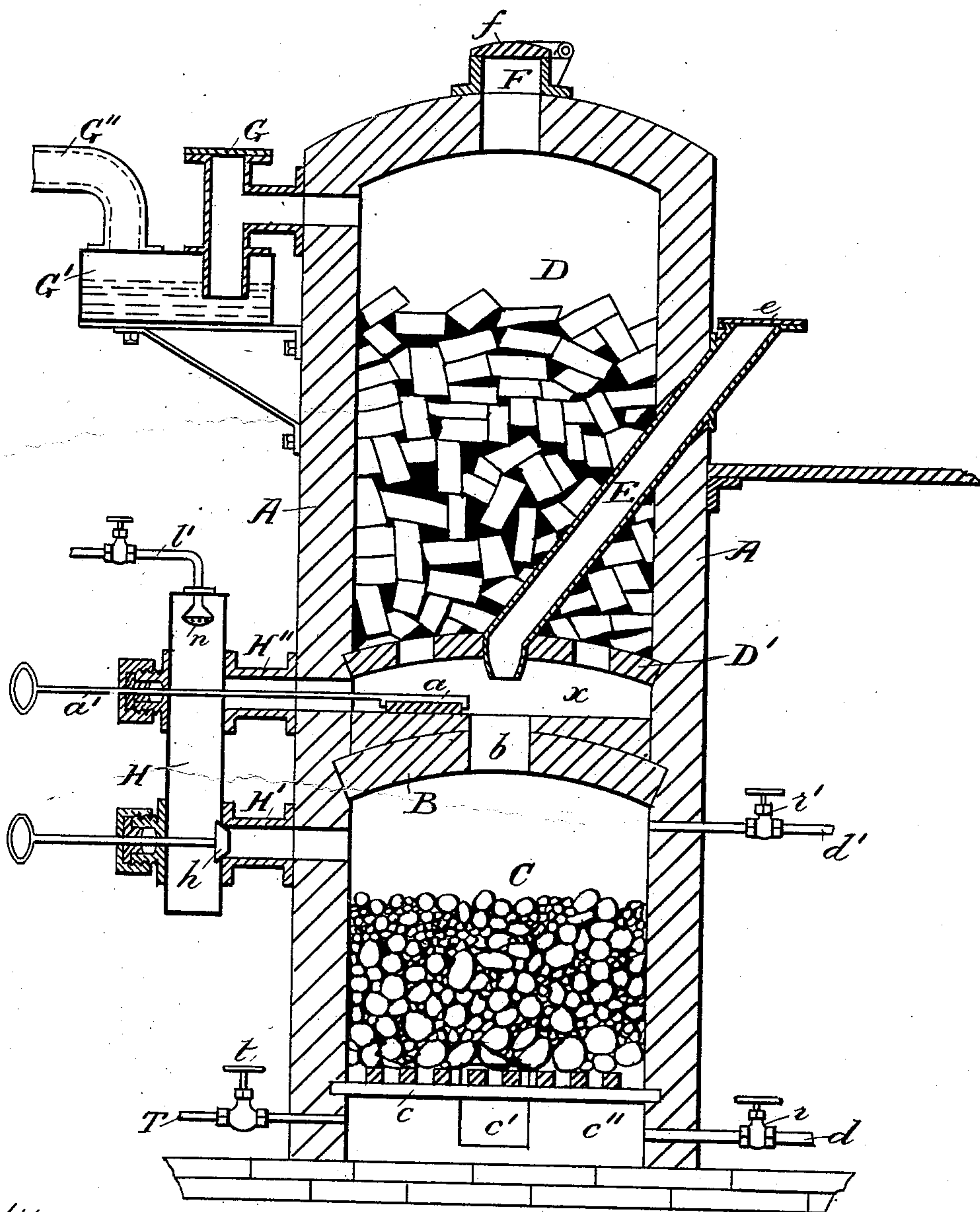
T. G. SPRINGER.

# PROCESS OF AND APPARATUS FOR MANUFACTURING GAS.

No. 362,233.

Patented May 3, 1887.

*Fig. 1.*



Witnesses:

H. W. T. Jenner.  
John T. Arms

Inventor.  
Theodore G. Springer.

(No Model.)

2 Sheets—Sheet 2.

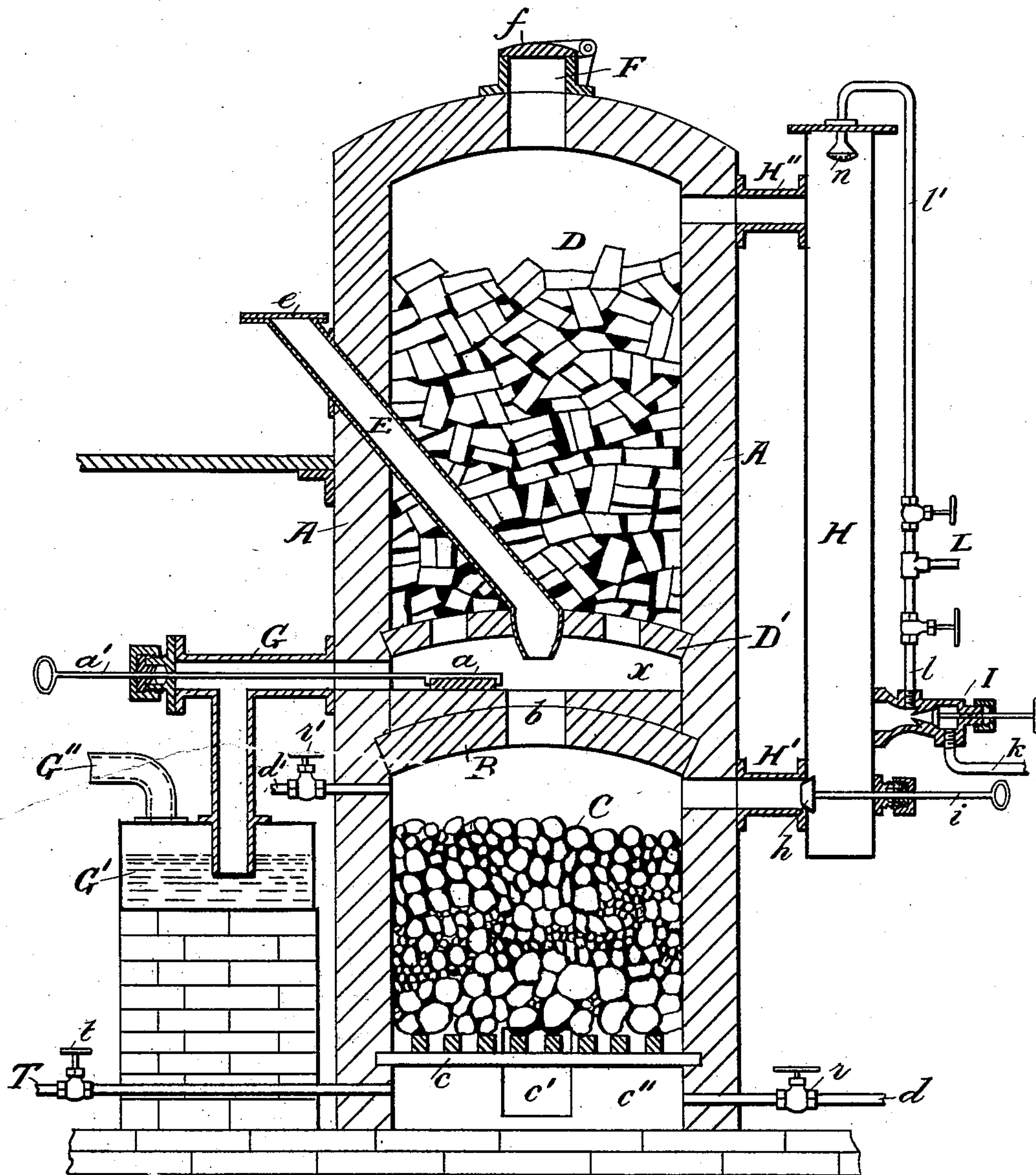
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# PROCESS OF AND APPARATUS FOR MANUFACTURING GAS.

No. 362,233.

Patented May 3, 1887.

*Fig. 2.*



Witnesses:

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John T. Armes

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# UNITED STATES PATENT OFFICE.

THEODORE G. SPRINGER, OF NEW YORK, N. Y., ASSIGNOR TO THE NATIONAL  
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## PROCESS OF AND APPARATUS FOR MANUFACTURING GAS.

SPECIFICATION forming part of Letters Patent No. 362,233, dated May 3, 1887.

Application filed March 7, 1885. Serial No. 158,006. (No model.)

*To all whom it may concern:*

Be it known that I, THEODORE G. SPRINGER, a citizen of the United States, residing at New York city, in the county of New York and State of New York, have invented certain new and useful Improvements in the Process of and Apparatus for Manufacturing Gas, of which the following is a specification, reference being had to the accompanying drawings.

This invention relates to the manufacture of illuminating-gas, and more particularly to the method of subjecting the carbureted water-gas to a progressively-increasing temperature in the fixing-chamber by passing it into the cooler portion of such chamber and passing it out at the hottest portion thereof, thereby preventing carbonization of the oily matter or formation of lamp-black and consequent waste of hydrocarbon oil or vapor. The hot-water gas and hydrocarbon oil or vapor may be combined in any known manner, and the mixture then passed through the fixing-chamber in the reverse direction to that in which the fixing-chamber was heated.

The improvements will be disclosed in the description of the construction and operation of the apparatus, and will be particularly pointed out in the claims.

In the accompanying drawings, Figure 1 represents a longitudinal vertical section of my improved gas-generating apparatus. Fig. 2 represents a longitudinal vertical section of the gas-generating apparatus, having modifications in constructions.

The cupola generator A is built of brick with an iron jacket in the usual manner, and about one-third the distance from the bottom is divided by an arch or diaphragm, B, forming a fuel-chamber, C, at the base, and a fixing or superheating chamber, D, at the top. The arched partition B is provided with one opening, *b*, centrally located, as shown, and serves to establish direct communication at will between the fuel-chamber and the fixing-chamber.

A damper or slide valve, *a*, composed of fire-tile or soapstone, and having handle *a'*, controls opening *b*, so that it may be closed or opened, as desired. The fuel-chamber is provided at the base with the usual grate, *c'*, and

door *c''*. Air-blast pipes *d* and *d'*, having valves *r r'*, connect, respectively, with the ash-pit and top of the fuel-chamber. A perforated arch, *D'*, is built a short distance above arch B, and serves to support the refractory material of the fixing or superheating chamber. A tubular fuel-supply chute, *E*, extends diagonally from the outside of the fixing-chamber to the central portion thereof, passing through arch *D'* and terminating in an open end just above opening *b*, and has a cap or lid closing its outer end. A steam-supply pipe, *T*, having valve *t*, connects with ash-pit *C''*. A short stack or chimney, *F*, having a tight-fitting lid, *f*, leads from the top of fixing-chamber *D*, for the escape of waste products of combustion.

In the cupola represented by Fig. 1 the gas-take-off pipe *G* leads from the top of the fixing-chamber into the hydraulic seal-box *G'*, from which extends pipe *G''*, which connects with the usual condensing and purifying apparatus. With this arrangement the carbureted water-gas is passed up through the heated refractory material of the fixing-chamber and is conducted away from the top of such chamber.

In the cupola represented by Fig. 2 the gas-take-off pipe *G* leads from the base of the fixing-chamber, or, more correctly, from small chamber *x*, between arches B and *D'*. By means of this arrangement and an auxiliary carbureting pipe or flue, hereinafter described, the carbureted water-gas is passed into the top or cooler portion of the refractory material, thence down through it and out at the hottest portion of such material at the base of the fixing-chamber, whereby it is subjected to progressively-increasing temperatures, and destructive decomposition of the hydrocarbons and formation of lamp-black is prevented.

In both forms of the generator the top or upper portion of the fuel-chamber is connected by an auxiliary carbureting and mixing pipe, having a controlling-valve with the fixing-chamber for conducting water-gas from the fuel and decomposing chamber into the fixing-chamber at some point above arch B.

In Fig. 1 the pipe *H* connects by pipe *H'* with the top of fuel-chamber *C*, and by pipe *H''* with the base of fixing-chamber *D*, through the small chamber *x*. Valve *h*, having rod *i*



passing through a stuffing-box, controls the inlet to pipe H, and such valve being conical it is seated in the end of connecting-pipe H'. Other forms of valve might be used—such as  
 5 a gate-valve or a plug-valve—suitably fitted in pipe H or H'.

In Fig. 2 pipe H connects by pipe H' with the top or fuel chamber, C, as in Fig. 1, but is made much longer than the one in such figure,  
 10 being extended to the top of the fixing-chamber, where it connects by pipe H'' with such chamber above the refractory material. A controlling-valve, *h*, with rod *i* is applied to the pipe, as in Fig. 1. An oil-spraying nozzle,  
 15 *n*, having a supply-pipe, *l'*, is placed at the top of pipe H, and in Fig. 2 an injector, I, having steam-pipe *k* and oil-supply pipe *l*, connects with the lower end of pipe H, and the branch oil-supply pipes *l* and *l'* connect with the main  
 20 oil-supply pipe L.

In manufacturing gas the fire is blown with an air-blast till the fuel is heated to incandescence, and at the same time the hot gaseous products are burned by an air-blast above the  
 25 fuel for heating up the fixing-chamber to the desired temperature, the valve or damper *a* and lid *f* being at that time open and valve *h* closed. The fuel and the refractory material being properly heated the air-blasts are shut  
 30 off, valve *a* and lid *f* are closed, and valve *h* opened, and steam is admitted to the base of the fuel by opening valve *t* in pipe T. It is decomposed by passing through the fuel, and the resulting hot water-gas passes into pipe H,  
 35 where it is carbureted to the desired candle-power by the spray of hydrocarbon oil or vapor admitted through nozzle *n* or injector I. If the apparatus shown in Fig. 1 be used, then the carbureted gas passes up through the re-  
 40 fractory material, where it is fixed, and is then conducted off from the top of the fixing-chamber by pipe G.

In the operation of heating up the apparatus the fixing-chamber becomes most highly  
 45 heated at the base, where the hot products of combustion first enter it, and is heated to gradually-decreasing temperatures toward the top, where it is at the lowest temperature. Now, it has been found advantageous to pass the carbureted water-gas first into the cooler portion  
 50 of the fixing-chamber and conduct it into the successively hotter portions till it finally passes out at the hottest portion of such chamber. I therefore construct the apparatus as shown in  
 55 Fig. 2, with the gas-inlet pipe connecting with the top of the fixing-chamber, and conduct the carbureted gas in at the top and take it off at the base of the fixing-chamber by means of pipe G, extending to the hydraulic seal-box.

60 By passing the gas and oil vapor first into the cooler portion of the fixing-chamber the oil-vapor gradually expands and becomes uniformly diffused through and mixed with the water-gas, so that the oil-vapor is not burned  
 65 or changed to lamp-black and thus wasted, and by the time the gas passes from the hot-

test part of the fixing-chamber it is uniformly fixed, and is of superior quality.

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

70 1. The process of generating gas, which consists in heating a body of fuel to incandescence by an air-blast and by means of the resulting gaseous products heating up a fixing-chamber, then decomposing steam by bringing it in con-  
 75 tact with the highly-heated fuel, producing water-gas, then carbureting the hot water-gas with hydrocarbon vapor, and passing the resulting mixture through the fixing-chamber in the reverse direction from that in which  
 80 such chamber was heated, thus subjecting the mixture to an increasing temperature until a homogeneous fixed gas is produced in said fixing-chamber, whereby the formation of lamp-black is prevented and improved results se-  
 85 cured.

2. The process of generating gas, which consists in heating a body of fuel to incandescence by an air-blast, then burning the resulting hot gaseous products by a current of air, heating  
 90 up a fixing-chamber, then decomposing steam by bringing it in contact with the highly-heated fuel, producing water-gas, then carbureting the hot water-gas with hydrocarbon vapor, and passing the resulting mixture into the  
 95 cooler portion of the fixing-chamber, subjecting it to an increasing temperature, and passing it out at the hottest portion of such chamber, whereby the formation of lamp-black is prevented and improved results secured.

100 3. A cupola gas generator or apparatus having a combustion-chamber for burning solid hydrocarbons, and a fixing chamber or superheater containing refractory material for absorbing heat, the combustion-chamber having  
 105 two openings or flues from its top into the fixing or superheating chamber, both flues or openings being controlled by a valve or damper arranged so as to cause the products of combustion to enter the fixing or superheating  
 110 chamber and come into contact with the refractory material through one of the flues or openings and the water-gas to enter through the other flue or opening.

115 4. A cupola gas generator or apparatus having a combustion-chamber for burning solid hydrocarbons, and a fixing or superheating chamber containing refractory material for absorbing heat, the combustion-chamber having  
 120 two flues or openings from its top into the fixing or superheating chamber, both flues or openings being controlled by a valve or damper, one of said flues or openings entering the fixing or superheating chamber at or near the  
 125 bottom, and the other flue or opening entering the fixing or superheating chamber at or near the top, arranged so as to cause the products of combustion to enter the fixing or superheating chamber and come into contact with  
 130 the refractory material through one of the flues or openings, and the water-gas to enter through the other flue or opening.



5. The generating-chamber and the fixing or superheating chamber of a cupola gas-generator, connected by a valved flue or passage-way leading from the top of the generating-chamber to the bottom of the fixing-chamber, in combination with a valved flue or passage-way leading from the top of the generating-chamber to the top of the fixing-chamber, whereby the water-gas may be passed first into the cooler portion of the fixing-chamber and be conducted into successively hotter portions, and finally passed out at the hottest portion of such chamber.

6. The generating-chamber connected at its top by a valved flue or passage-way to the bottom of the fixing or superheating-chamber, in combination with a valved flue connecting the top of the generating-chamber with the top of the fixing-chamber for conducting water-gas, and a supply pipe or nozzle for supplying hydrocarbon oil or vapor to the water-gas, where-

by the carbureted water-gas may be passed into the coolest portion of the fixing-chamber and subjected to gradually-increasing temperature till it is passed out at the hottest portion of the chamber.

7. The generating-chamber connected at the top by a valved passage-way with the bottom of the fixing or superheating chamber, in combination with a valved flue leading from the top of the generating-chamber to the top of the fixing-chamber, an oil-supply pipe or nozzle connecting at the top of such flue, a smoke-stack leading from the top of the fixing-chamber, and a gas-take-off pipe leading from the bottom thereof, for the purposes described.

In testimony whereof I have affixed my signature in presence of two witnesses.

THEODORE G. SPRINGER.

Witnesses:

JOHN T. ARMS,  
W. C. ALVORD.