

(No Model.)

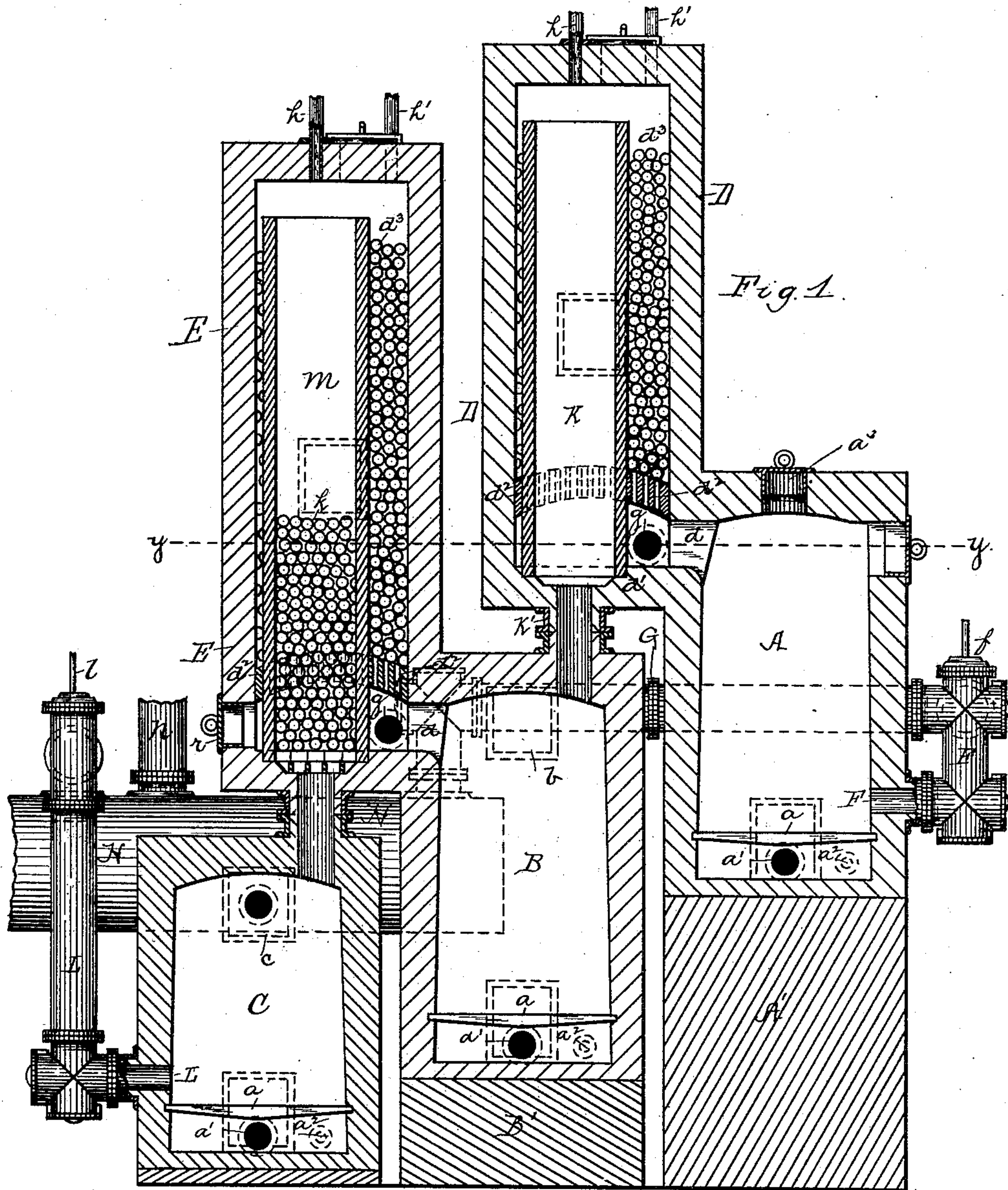
3 Sheets—Sheet 1.

J. M. ROSE.

APPARATUS FOR THE MANUFACTURE OF GAS.

No. 428,955.

Patented May 27, 1890.



Witnesses:
J. H. Coates
A. Lott

Inventor:
James M. Rose
By James D. Ray
Attorney

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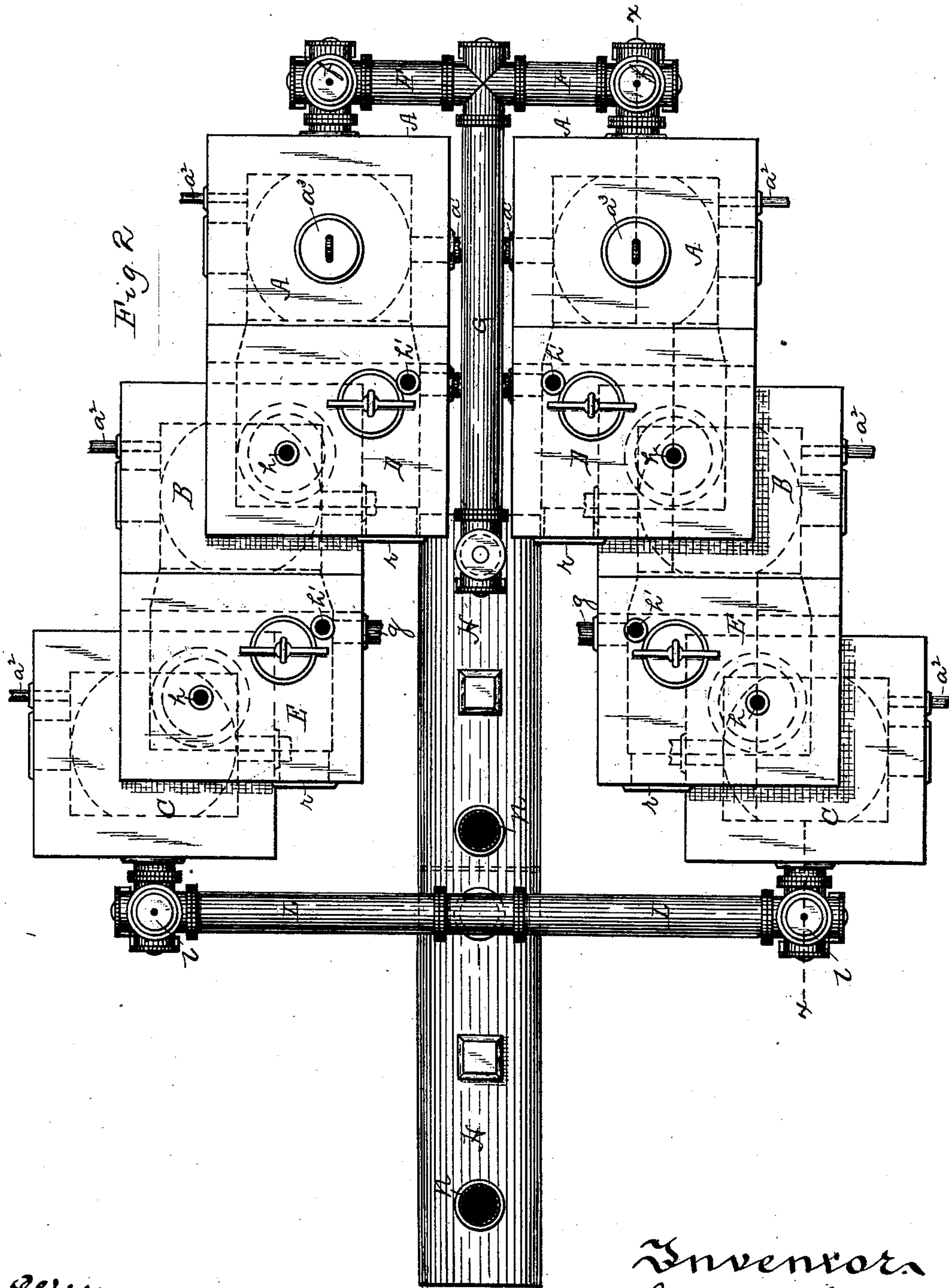
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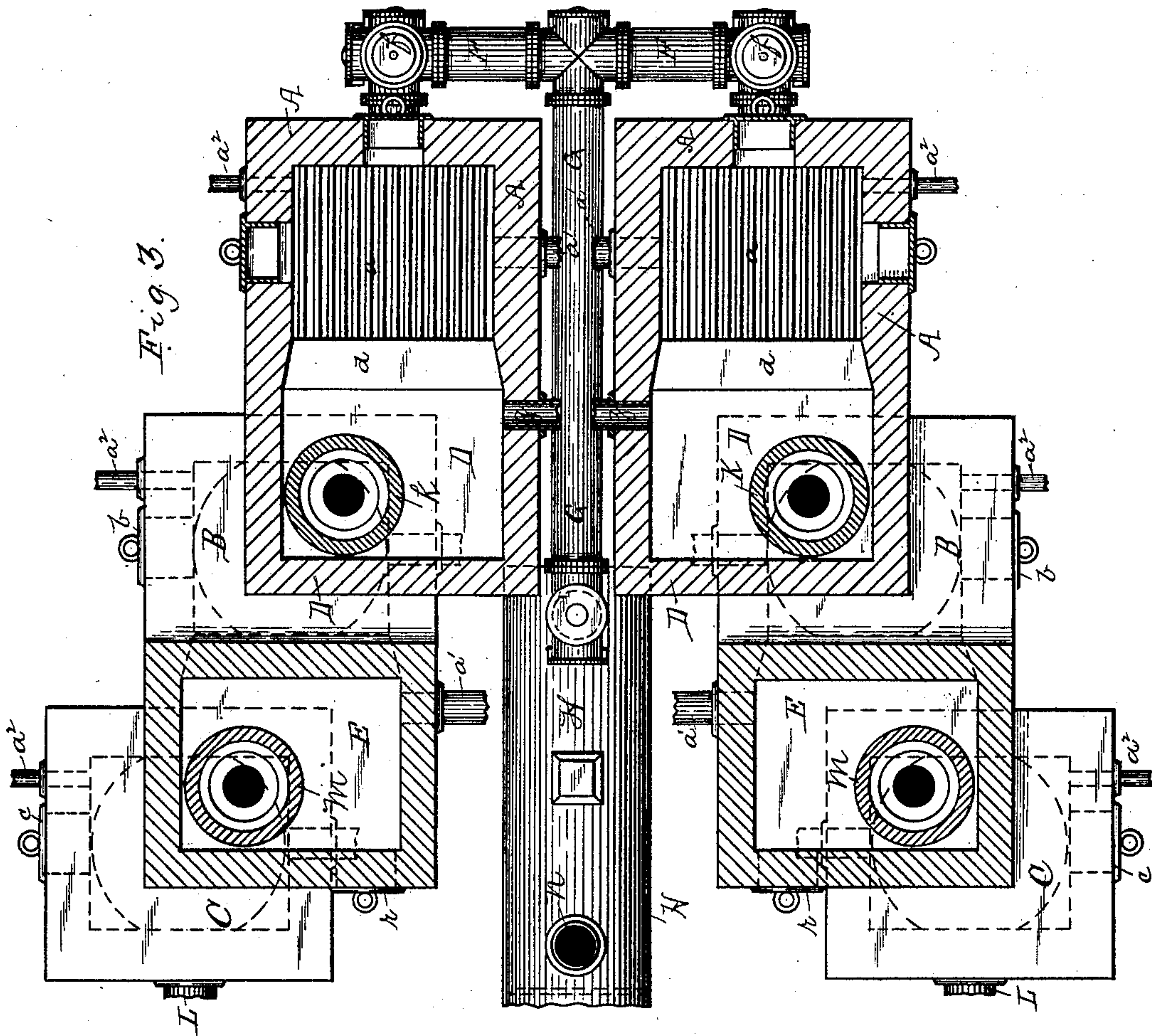
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Witnesses:

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UNITED STATES PATENT OFFICE.

JAMES M. ROSE, OF ALLEGHENY, PENNSYLVANIA.

APPARATUS FOR THE MANUFACTURE OF GAS.

SPECIFICATION forming part of Letters Patent No. 428,955, dated May 27, 1890.

Application filed March 14, 1889. Serial No. 303,312. (No model.)

To all whom it may concern:

Be it known that I, JAMES M. ROSE, a resident of Allegheny, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Apparatus for the Manufacture of Gas; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to certain improvements in apparatus for generating gas, its special object being to provide a compact apparatus in which practically all the pipes or passages, except those for carrying away the gas, are so inclosed as to be maintained at a high heat during the gas-making operation, and at the same time the gases generated may be subjected to different treatments; and, further, gases generated in different connecting-chambers, and a large volume of gas for fuel or other purposes formed therein, as well as to provide apparatus in which, if desired, a continuous coking operation may be carried on, and the cupola-generator in which the gases are formed may be supplied with the coke as it is formed.

To these ends my invention consists, generally stated, in a gas-making apparatus having a cupola-generator and a vertical chamber above and communicating therewith, and provided with a pipe or cylinder supported at the base of the vertical cylinder, and extending up within and opening at the upper end of the chamber, this chamber being filled with checker-work or loose refractory material around the pipe, whereby in such construction the said chamber and cylinder may be highly heated, and gases generated or treated therein, and the gases generated may pass into the cupola-generator or other exit.

It also consists in combining with two cupola-generators a chamber extending above and communicating at the base with one such cupola-generator, and communicating with a second cupola-generator under the chamber through a vertical pipe.

It also consists in placing this chamber at the side of and extending above the cupola-generator and providing a second cupola-generator under the chamber and a vertical pipe or cylinder leading directly from the upper part of the second cupola-generator through and opening into the upper end of the cham-

ber, whereby, when making gases, the gases formed in the one cupola-generator may pass first into said upper chamber and to the upper end thereof, and thence downwardly through said pipe or cylinder into the second generator, and upon the reversal of the current the gases formed in the second generator may pass therefrom upwardly through said vertical pipe or passage and downwardly through the upper chamber and thence into the first generator, and oil or other hydrocarbons may be admitted at the top of the cylinder and pass downwardly through the same, any of the heavier portions not decomposed in the cylinder being broken up by the heated carbon in the lower generator, onto which they will descend, a compact apparatus suitable for forming fuel or other gases being obtained and the passages from one chamber to the other being protected from the atmosphere, so that the rapid cooling of the gas passing through the same is prevented, while at the same time the said vertical pipe or passage may be maintained at a high heat, which is required in certain processes of generating gases, as will be hereinafter described. It also consists in other improvements, as will be hereinafter fully set forth and claimed.

To enable others skilled in the art to make and use my invention, I will describe the same more fully, referring to the accompanying drawings, in which—

Figure 1 is a longitudinal section of my improved gas-making apparatus on the line $x x$, Fig. 2. Fig. 2 is a top or plan view of the same. Fig. 3 is a cross-section on the line $y y$, Fig. 1.

Like letters of reference indicate like parts in each.

In the apparatus shown in Figs. 1, 2, and 3 I generally prefer to employ the cupola-generators A B C and two upper treating-chambers D E, though, if desired, a greater or less number of the same may be employed, my invention being practically shown where there are two generators and the one upper treating-chamber, as will be apparent on examination of the drawings.

The cupola-generators are supported at different heights or benches shown, the generator A being supported on the foundation A', the generator B on the foundation B', while

the generator C is generally level with the base of the apparatus, the foundations B' A' raising the other generators to the proper heights. The generator A is provided with the grate-bars *a*, the air-entrance *a'*, steam-entrance *a''*, below the grate-bars, and the feeding-port or opening *a'''*. It has also the eduction-pipe F leading therefrom and controlled by the valve *f* and opening into the pipe G leading to the hydraulic main H.

Adjoining the generator A at one side thereof and above the generator B is the vertical chamber D, this chamber being supported in suitable manner by the generator B and by suitable pillars, if necessary, and extending out from the floor or base of the chamber D and communicating with the upper end of the generator A is the horizontal passage *d*, this passage preferably extending for the width of the two chambers, so as to give a free passage between the same for the gases flowing either from the generator into the chambers or in the opposite direction.

Extending from the upper end of the cupola-generator B, through the top wall thereof and the bottom wall of the chamber D, is the vertical pipe or cylinder K, this pipe or cylinder being formed of an ordinary fitting K' suitably lined between the generator B and chamber D, and within said chamber D being preferably formed of lengths or sections of terra-cotta or like pipe, which will withstand the high heat to which it may be subjected, though metal pipe may in some cases be employed. This terra-cotta pipe is supported on the floor *d'* of the chamber D and extends up to the upper end of said chamber, preferably terminating a short distance below the same, so as to give a free passage of the gases from said chamber to the pipe or in the opposite direction, but in some cases—such as in the apparatus described in an application filed by me of even date herewith, Serial No. 303,314—extending entirely through the chamber.

Within the chamber D, in the part not occupied by the pipe K, I generally arrange an arch, as at *d''*, for supporting a mass of loose broken fire-brick, fire-clay balls, or like refractory materials, which fill the remaining part of said chamber up to about level with the top of the pipe K or up to about the line *d'''*. This refractory material may also be supported in any other suitable way, and, if desired, may be built up in the form of checker-work, and it provides a mass of material having intercommunicating interstices, through which the gases may pass.

For the purposes of the processes of gas-making preferably carried out in the apparatus I generally employ an air-entrance *g* at the base of the chamber D, and the hydrocarbon or steam and hydrocarbon entrance or injector *h* at the other end thereof, this injector or pipe being in the top wall above the cylinder K in such position as to introduce the hydrocarbons into the upper end of the cylinder,

and I also provide a like hydrocarbon-injector *h'* above the refractory material surrounding the cylinder to introduce hydrocarbons into the mass of refractory material surrounding it, or both, as may be desired. I generally employ within the cylinder K another body of refractory material extending part way or entirely to the top thereof, such material being composed of fire-clay balls or broken fire-brick or like material, as at *k*.

To provide access to the space within the chamber D below the arch *d*, I form the door or port *r* in the side wall of the chamber.

The connections with the cupola-generator B are the same as those described as to the cupola-generator A, except that when three cupola-generators are employed, as shown, it has no eduction-pipe communicating therewith, and, further, that the feeding-port *b* thereof is formed at one side of the top wall, where it is not covered by the chamber D, and the connections of the cupola-generator C are the same as those of the cupola-generator A, except as to the position of the feeding-port *c*, the eduction-pipe L communicating with said generator C above the grate-bars and leading to the hydraulic main, said eduction-pipe being controlled by the valve *l*. The construction and connections of the upper chamber E are the same as the upper chamber D, and said chamber E communicates with the cupola-generator B by the like passage *d*, and a pipe or cylinder M, similar to the cylinder K, leads from the upper end of the cupola-generator C and extends up within said chamber E, as above described.

The eduction-pipes above referred to communicate with the hydraulic main H, from which a pipe or pipes, as at N, leads either to a suitable storage-tank or to the supply-main, as may be found necessary. If desired, two or more sets of these gas-making apparatus may be arranged around the same hydraulic main, as shown in Fig. 2, a compact gas-making plant suitable for the generation of a large volume of fuel or other gas being thus provided.

In making gas in the apparatus above described according to the processes preferred by me the cupola-generators are filled with coal, coke, or other suitable carbon, and the relief-valves of the several upper chambers are opened, the fuel ignited, and the air-blast turned on to the several generators, the coke being raised by said blast to a high heat, while the products of combustion pass upwardly, passing through the upper chambers D E and through the cylinders K M in the said chambers, air being fed to the products of combustion as they enter the chambers D E through pipes *p*, so as to cause the burning of said products within said chambers, so that the refractory material therein is raised to a high heat, and the cylinders K M extending up through them are also heated by radiation and by the passage of the products through the same, as above stated.

When the apparatus is properly heated, all the relief-valves are closed and the eduction-pipe L from the generator C is opened. The air-blast is then continued through the generators A B, and in passing through the mass of carbon in the generator A a producer-gas is formed which passes upwardly through the horizontal passage *d* into the upper chamber D, and thence upwardly through the refractory material therein, and at the same time a suitable liquid hydrocarbon—such as tar or Lima oil—is fed into the upper end of said chamber into the refractory material, and as it descends through the same it is vaporized by the heat of the refractory material, the heavier portions of the liquid hydrocarbon descending against the current of the gases and into the more highly-heated refractory material, so that a greater portion thereof is vaporized thereby and the gases formed more thoroughly intermingled therewith. When the gases reach the upper end of said chamber, they come in contact with the steam admitted into said chamber and then pass downwardly through the cylinder K and enter the upper end of the cupola-generator B, in which a like body of producer or generator gas is being formed and the gases are intermingled in the upper part of the chamber and pass over through the passage *d* into the chamber E. At the base of said chamber a limited quantity of air is generally admitted through the pipe *p*, as described in an application for patent filed by me October 17, 1888, Serial No. 282,286, the oxygen of the air uniting with the hydrogen of the hydrocarbons passing over and setting free a corresponding body of carbon to enrich the gas, as fully described in said application. The gases then pass upwardly through the interstices within the body of refractory material in the chamber E, steam and hydrocarbon being admitted to said chamber in the same way as described in the chamber D, and the gases then pass downwardly through the pipe or cylinder M into the cupola-generator C, and thence downwardly through the body of incandescent carbon therein to the eduction-pipe, and thence to the hydraulic main. In passing through the highly-heated refractory material within the chambers D E, either around or within the cylinders K M, the gases generated are properly fixed and brought to a high heat, and in passing finally through the body of incandescent carbon a fixed and permanent gas is obtained, and any carbonic acid formed is reconverted into carbonic oxide, while at the same time any tarry matters are removed from the gases, being retained within the incandescent carbon. This is continued until the body of carbon in the generator C is so lowered in heat that it will not act to fix the gases and reconvert the carbonic acid, when the apparatus is reversed, the eduction-pipe L being closed, the eduction-pipe F being opened, the air-blast is cut off from the cupola-generators A B, and turned onto the cupola-

generator C. At the same time Lima oil and steam are admitted at the upper ends of the cylinders K M through the injectors *n* and pass downwardly through the same, and as the gas formed in the generator C passes upwardly through said pipe-cylinder M, leading therefrom, the oil descends against the currents of gases, the lighter hydrocarbons being quickly freed therefrom and carried off by the gases, while the heavier portions gradually descend therein, either around the refractory material within the pipe, or, when such material is not employed, they descend through the pipe against the upward current of gases into a more highly-heated part of the cylinder, and finally any heavy hydrocarbons which are not vaporized come in contact with the highly-heated carbon in said generator, and are there broken up by the disassociation of the hydrogen and carbon, these gases being carried off by the gases formed from the coal. At the same time a limited quantity of air is admitted in the upper end of the generator C through the pipe *c'*, which unites with the hydrogen, freeing the carbon, as above referred to, and as fully described in said application, Serial No. 282,286. All the gases so formed pass downwardly through the chamber E through the intercommunicating interstices of the heated refractory material contained therein, said gases taking up further portions of the hydrocarbons from the refractory material where it is coated therewith, and enter the upper part of the generator B, and at the same time steam is admitted at the lower end of said chamber and passing up through the same forms water-gas, which unites with the gases formed as above described, and these combined gases pass upwardly through the pipe K in the chamber D, into which the oil is sprayed, as before described, and descends against the upper current of the gases in the heavier portions which are not vaporized, coming in contact with the heated carbon in the generator B, and being broken up by the disassociation of the hydrogen and carbon. The gases then pass downwardly through the heated refractory material in the chamber D into the chamber A, and downwardly through the mass of incandescent carbon therein to the eduction-pipe F, and thence to the storage-tank. The gases are generated and passing through the apparatus, as above described, until the masses of carbon in the generators A B are so lowered in temperature as to cease to perform their desired functions, and the mass of carbon in the generator C is raised to a high heat, when the apparatus is again reversed and operated as described.

When an apparatus composed of only the two generators and one chamber—such as the generators A B and chamber D—is employed, the operation is substantially the same, except that no water-gas is formed such as described in the chamber B in the process above set forth, the course of the gases being from the generator A to the chamber D, thence

through the pipe K to the generator B, and through the incandescent carbon therein to the eduction-pipe L, which then communicates with said chamber; and on the reversal of the apparatus the current of gases being from the generator B, through the pipe K, through the chamber D, and thence through the generator A to the eduction-pipe. In some cases also the cylinder within the upper chamber may be closed at the base or have no flue or passage leading from its base, and may be used as a means for generating gas, such as by the injection of oil into the same through the injector *h*, while the cylinder is maintained in a highly-heated condition by the surrounding refractory material.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. A gas-making apparatus having a cupola-generator and a vertical chamber above and communicating therewith, said chamber being provided with a pipe or cylinder supported at the base thereof and extending up within and opening at the upper end of the chamber, and said chamber being filled with checker-work or loose refractory material

around said pipe, substantially as and for the purposes set forth.

2. A gas-making apparatus having a cupola-generator and a vertical chamber extending above the generator, a passage leading from the upper end of the cupola-generator into the lower end of said chamber, another cupola-generator under said chamber, and a vertical pipe or passage leading up from the second generator to the upper end of the chamber, substantially as and for the purposes set forth.

3. The gas-making apparatus herein described, having the three cupola-generators A B C, the upper chamber D, communicating with the generator A and provided with a pipe K, communicating with the generator B, the upper chamber E, communicating with the generator B and having a pipe M, communicating with the chamber C, substantially as and for the purposes set forth.

In testimony whereof I, the said JAMES M. ROSE, have hereunto set my hand.

JAMES M. ROSE.

Witnesses:

WM. P. MERCER,

E. P. NEWLIN.