

(No Model.)

2 Sheets—Sheet 1.

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MANUFACTURE OF WATER GAS.

No. 370,973.

Patented Oct. 4, 1887.

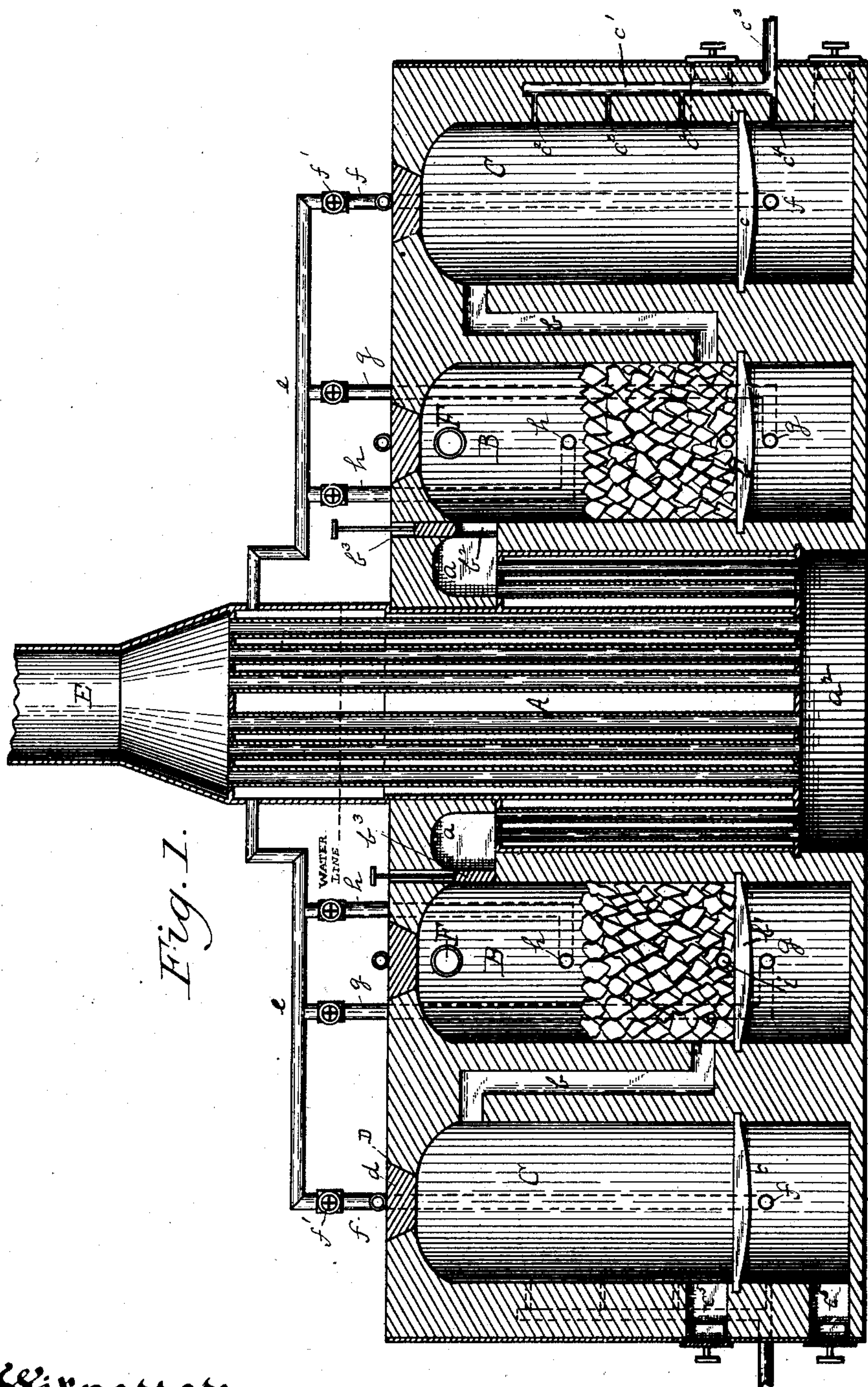


Fig. 1.

Witnesses:

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J. C. Barnes

Inventor.  
James M. Rose  
By James S. Ray  
Attorney



(No Model.)

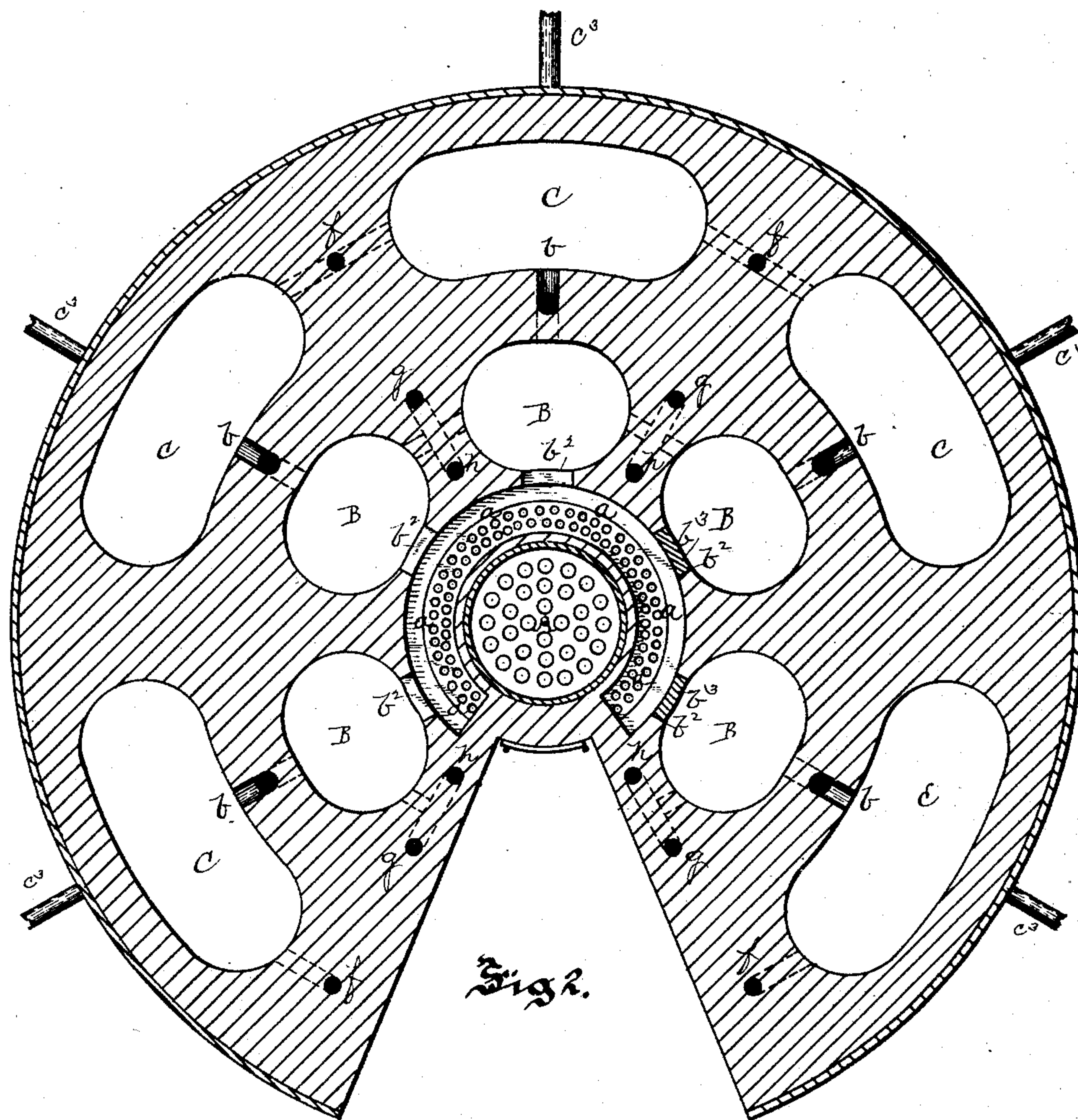
2 Sheets—Sheet 2.

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Witnesses:

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# UNITED STATES PATENT OFFICE

JAMES M. ROSE, OF ALLEGHENY CITY, PENNSYLVANIA.

## MANUFACTURE OF WATER-GAS.

SPECIFICATION forming part of Letters Patent No. 370,973, dated October 4, 1887.

Application filed February 7, 1887. Serial No. 226,762. (No model.)

*To all whom it may concern:*

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

My invention relates to the manufacture of water or fuel gas, and more especially to a form of apparatus shown and described by me in an application filed December 27, 1886, Serial No. 222,566; and it has for its object to provide an apparatus in which the gas may be economically and expeditiously made.

To this end my invention consists, generally, in a gas-generator chamber, a steam-supply pipe entering said chamber, a lime-chamber, flues for connecting said chambers, and steam-supply pipes entering said lime-chamber at the base or below the mass of lime therein and above the same.

The invention also consists in a central steam-boiler, a series of lime-chambers around the same, passages connecting said lime-chambers with the boiler, suitable valves for controlling said passages, a gas-outlet from the lime-chamber controlled by a suitable valve, and a series of gas-generator chambers communicating with the lime-chambers, as will be more fully hereinafter described; and the invention also consists in certain other improvements, all of which will be more fully hereinafter described 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 vertical central section of my improved apparatus, and Fig. 2 a horizontal section of the same.

Like letters of reference indicate like parts.

In constructing my improved apparatus I prefer to employ large generating apparatus formed of a series of different gas-generating and lime chambers arranged around a central boiler or steam-generator, as by the employment of this form of apparatus I am enabled to operate this method continuously, and I obtain heat from the waste products of combustion to maintain a sufficient pressure of steam,

one or the other of the gas generators being always discharging its heated products into and through the steam-boiler. The steam boiler or generator A is placed in the center or centrally of the apparatus, and either on each side or around the same are lime-chambers B, while beyond the purifying-chambers are the gas-generating chambers C. The gas-generating chambers are provided with grate-bars  $c$ , and the side wall of the chamber with a vertical air passage or flue,  $c'$ , having lateral offshoots  $c''$ , leading into the chamber. This flue or passage  $c'$  is connected by a lateral passage,  $c^3$ , with a blower, which supplies the air under pressure. The passage  $c^3$  also has a small outlet,  $c^4$ , into the generator-chamber below the grate-bar for supplying air at that point.

The generator-chamber C is also provided with a stoking-hole,  $c^5$ , a door,  $c^6$ , into the ash-pit, and charging-hole D, closed by a suitable cover,  $d$ , in the roof thereof. In the division-wall of the furnace, between the generator-chamber C and the lime-chamber B, is a flue or passage,  $b$ , leading from the top of the chamber C to the lower part of the chamber B, just above its grate-bars  $b'$ , or, if desired, opening into said chamber below the grate-bars.

The lime-chamber B is about half filled with lime, which rests on the grate-bars  $b'$ ; and leading from the upper part of this chamber is a passage,  $b^2$ , controlled by a damper,  $b^3$ , through which the products of combustion, after heating the lime, pass into the annular chamber  $a$  around the boiler A, and thence through the boiler-flues  $a'$  into the chamber  $a^2$  at the bottom of the boiler, from whence they pass up through the central flue of the boiler A, and finally out through the stack E. An outlet, F, is provided in the upper part of the lime-chamber into pipes controlled by valves leading to suitable storage-reservoirs.

Leading from the boiler A is a steam-pipe,  $e$ , which has a branch pipe,  $f$ , entering the gas-generator chamber C at or near the base of the mass of fuel and supplying steam to said chamber, the pipe being provided with a valve,  $f'$ , for cutting off and regulating the supply. There are also two branch pipes,  $g$  and  $h$ , having suitable valves for conveying the



steam to the lime-chamber B, the pipe *g* entering the chamber at the base of mass of lime and the pipe *h* about or slightly above the center of the chamber, for the purpose which will more fully hereinafter appear.

In operating this apparatus for producing water-gas the generator-chamber C is filled with coke or coal, and by means of an air-blast passing in at the opening *c*<sup>2</sup> and *c*<sup>4</sup> the same is raised to a high degree of incandescence, the products of combustion therefrom passing through the flue *b* into and upwardly through the lime in the lime-chamber B, heating the lime and passing from thence into the flues of the boiler A, heating the water in the same, and generating the necessary supply of steam, the mass of lime or other material employed for purifying the gas generated being then heated directly by the products of combustion in their course from the generator to the stack, any soot or free carbon carried over settling within the mass of lime and on the upper surface thereof. The heat generated by the burning of the fuel in the generator-chamber also acts to heat the lime in the lime-chamber by radiation through the division-wall, as set forth in the application filed by me dated December 27, 1886, Serial No. 222,566. As soon as the coal or coke in the generating-chamber C has been raised to the proper degree of incandescence, the damper *b*<sup>3</sup> is lowered, so as to close the passage *b*<sup>2</sup>. Steam is then allowed to pass into the chamber C from the pipe *f* at or near the base of the fuel, which steam, coming in contact with and passing up through the incandescent carbon, is decomposed, the oxygen uniting with carbon to form carbonic oxide, the hydrogen passing off as a free gas, and any sulphur in the coal uniting with the carbon to form carbon disulphide and sulphureted hydrogen. These gases then pass through the flue *b* into and up through the heated lime in the lime-chamber B, the carbon disulphide being broken up by the hot lime and hydrogen sulphide formed, which can subsequently be removed by passing the gas through a purifying-box.

To increase the proportion of hydrogen in the gas, steam is admitted from the pipe *g* into the lower part of the lime-chamber while the gas from the generator is passing through the lime. This second supply of steam, passing through the heated lime, is decomposed, and the oxygen, uniting with part of the carbonic oxide passing through the lime, forms carbonic acid, which is reduced to carbonic oxide in the upper part of the lime-chamber, as hereinafter described. During the time that the products of combustion from the burning of the coal pass through the lime there is more or less soot or carbon deposited within and on the top of the lime and the upper walls of the lime-chamber, and also a small amount is deposited by the gases passing over from the generator during the generating process. To take up this carbon and

still further enrich the gas in hydrogen and reduce the carbonic acid formed in the lower part of the lime-chamber, a third supply of steam is admitted at the exit of the pipe *h* into the lime-chamber just above the top of the lime, which steam is decomposed by the hot lime, the oxygen uniting with the carbon and the latter with the carbonic acid present to form carbonic oxide, and the resultant gases—composed largely of hydrogen, carbonic oxide, and some carbonic acid—pass out the outlet F to the purifying-boxes or storage-tanks. This process is continued until the coal or coke in the chamber C loses the heat necessary to decompose the steam, when the steam-supply is shut off, the damper *b*<sup>2</sup> opened, and the air-blast turned on, by which means the coal or coke is raised to the proper state of incandescence, when the process is repeated. As a series of these generating and lime chambers are arranged around the boiler, and as they do not act simultaneously, some one part of the apparatus is always discharging a supply of gas into the storage-tanks, while another is throwing off the products of combustion necessary to maintain the pressure of steam in the boiler. Thus a steady supply of gas is obtained which is rich in hydrogen at a very small cost.

Where it is desired to make illuminating-gas, the apparatus and process are the same, with the exception that a pipe, *i*, to supply oil or other suitable hydrocarbon, enters the lime-chambers above the grate-bars *b*<sup>1</sup>. The oil or other hydrocarbon, on entering the chamber, is vaporized by the heat of the lime and converted into a fixed gas, which passes over with the other gases obtained from the generator-chamber into the storage or supply reservoir.

This apparatus has the advantage that it is compact, simple, and inexpensive to construct, and gives a large amount of gas with a small amount of fuel.

I do not claim, broadly, in this application the combination of a central steam-boiler with a series of lime-chambers and generator-chambers arranged around the same, and flues for connecting said chambers to the boiler, as that forms the subject-matter of an application filed by me December 27, 1886, Serial No. 222,566.

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

1. In a gas apparatus, the combination of a central steam-boiler, an annular flue, *a*, around the same and communicating with the flues of said boiler, a series of lime-chambers arranged around the boiler and communicating with the flue *a*, and a series of generator-chambers which communicate with the lime-chambers, substantially as and for the purpose set forth.

2. In a gas apparatus, the combination of a central steam-boiler, an annular flue around the same and communicating therewith, a series of lime-chambers around said boiler, each having suitable communications controlled by a valve with the flue *a*, and a gas-outlet controlled by



a suitable valve, with a series of generator-chambers communicating with the lime-chambers, substantially as and for the purpose set forth.

5 3. In a gas apparatus, the combination of a gas-generator, a steam-pipe entering said chamber at the base of the fuel, a lime-chamber, flue or flues leading from the generator to the lime-chamber, a steam-pipe entering said lime-chamber at the base of the lime, and a steam-pipe entering said chamber above the lime, substantially as described.

15 4. In a gas apparatus, the combination of a gas-generator, a pipe for supplying said generator with steam, a lime-chamber, flue or flues leading from said generator to the purifying-chamber, pipes entering said lime-chamber for supplying it with steam, and a pipe,

*e*, entering said lime-chamber, for supplying oil or other hydrocarbon, whereby an illuminating-gas is obtained, substantially as and for the purpose set forth. 20

5. The combination of a generating-chamber, *c*, the boiler *A*, a lime-chamber, *B*, between said boiler and generator, and flues *b* 25 and *b*<sup>2</sup>, connecting said chamber and boiler with steam-pipe *f*, entering the chamber *c*, and steam-pipes *g*, entering the chamber *B*, substantially as and for the purpose set forth.

In testimony whereof I, the said JAMES M. ROSE, have hereunto set my hand. 30

JAMES M. ROSE.

Witnesses:

JAMES I. KAY,  
J. N. COOKE.