

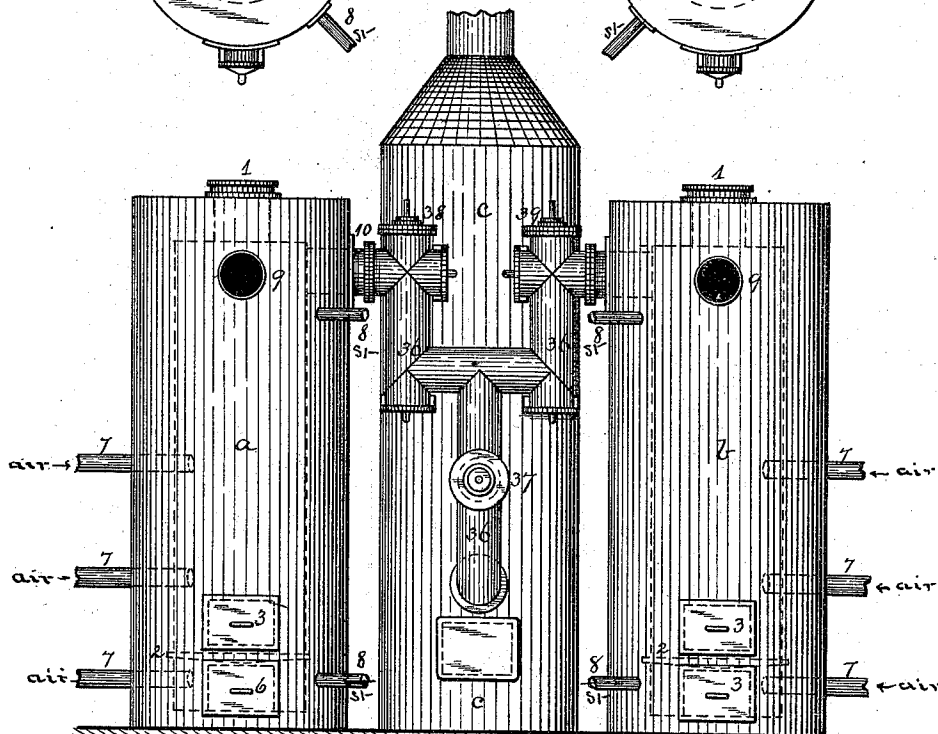
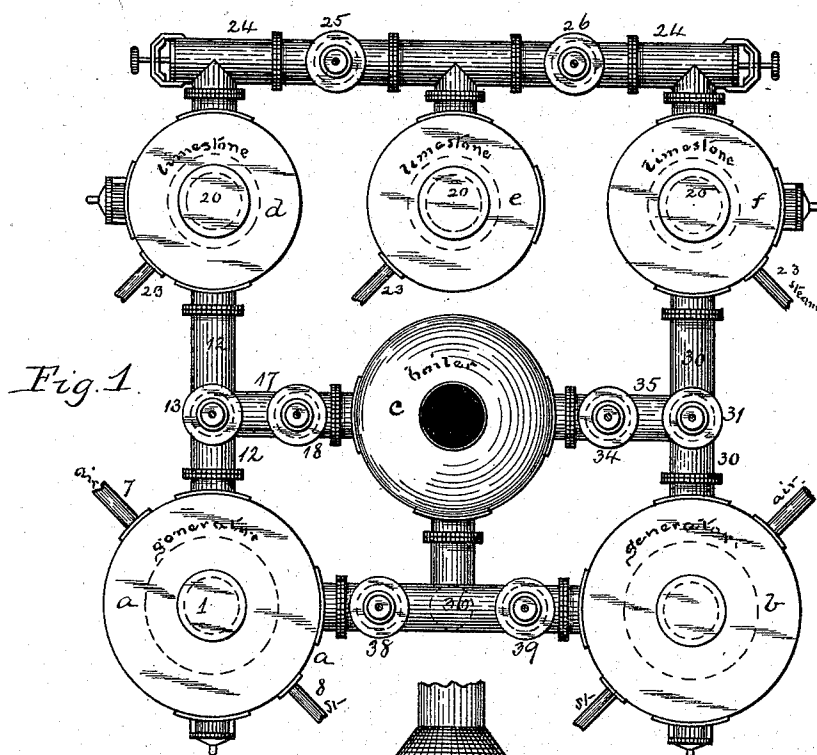
(No Model.)

2 Sheets—Sheet 1.

J. M. ROSE.
CUPOLA GAS MAKING APPARATUS.

No. 552,587.

Patented Jan. 7, 1896.



Witnesses:

J. M. Rose
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Fig. 2.

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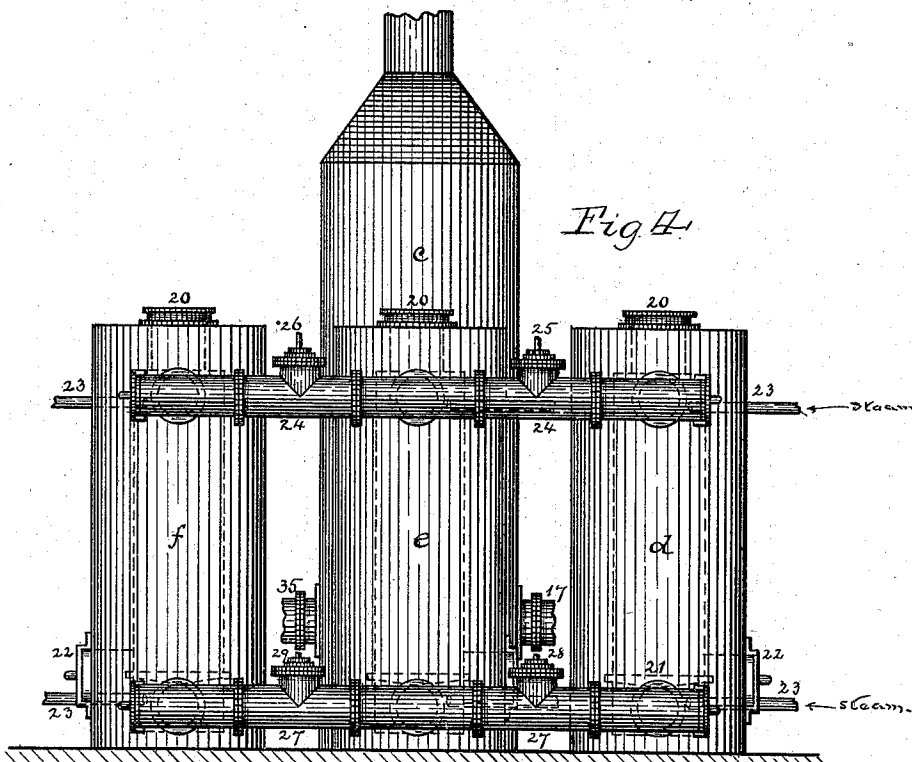
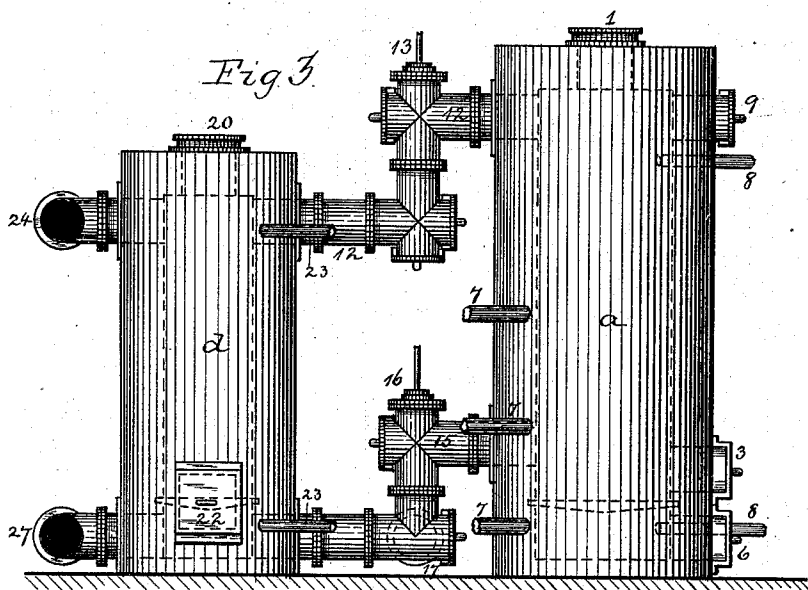
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2 Sheets—Sheet 2.

J. M. ROSE.
CUPOLA GAS MAKING APPARATUS.

No. 552,587.

Patented Jan. 7, 1896.



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J. H. Cooke.
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Inventor.

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UNITED STATES PATENT OFFICE.

JAMES M. ROSE, OF ALLEGHENY, PENNSYLVANIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE NATIONAL HEAT AND POWER COMPANY, OF NEW JERSEY.

CUPOLA GAS-MAKING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 552,587, dated January 7, 1896.

Application filed March 16, 1888. Serial No. 267,362. (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 the manufacture of gas, and more especially to an apparatus therefor.

In patents granted to me October 4, 1887, Nos. 370,971 and 370,973, I have shown and described an arrangement of gas apparatus which consists of a central steam-boiler and a series of generators and lime-chambers arranged around the same. My present invention is a modification of this arrangement and is adapted to carry on a process described by me in Letters Patent No. 391,386, dated October 16, 1888, which, however, consists, generally stated, in passing the waste products from the water-gas generator through a mass of limestone impregnated with a heavy hydrocarbon, and then passing through the incandescent fuel and heated limestone a current or currents of steam, though it may also be employed in practicing other gas-making processes, such as a gas-making process described in connection with such apparatus in an application of even date herewith.

My present invention has for its principal objects the providing of apparatus in which there is a large surface exposure of heavy hydrocarbons to the action of the water-gas, and therefore a greater generation of light hydrocarbon gases, and in which the gases previously formed are fixed and a further portion of gas generated within a chamber heated by means independent from that employed in heating the other parts of the apparatus, while for the more economical operation of the apparatus the direction of the flow of the gases may be reversed, and the steam employed in gas-making may be generated. To these ends it comprises, generally stated, a gas apparatus composed of a central boiler, two generators on one side of the same and a series of connected auxiliary gas generating or treating chambers on the opposite side of the boiler

and connected to the generators and the boiler. By my invention said several generators, chambers, and boiler are provided with a set of connecting-conduits and valves for controlling them, by which the direction of the flow of gas through the apparatus chambers may be reversed from time to time. The invention also consists in certain other improvements, all of which will be more fully hereinafter set forth.

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 plan view of my improved apparatus. Fig. 2 is a front view looking toward the generators. Fig. 3 is a side view showing the connections between the generators and the limestone-chambers. Fig. 4 is an end view looking toward the series of limestone-chambers.

Like letters and numerals refer to like parts in all the figures.

The apparatus which I shall describe in this application consists, generally, of a central boiler, two water-gas chambers on one side of the boiler connected thereto and with each other, and a series of auxiliary chambers on the other side of the boiler. These chambers contain material for the treatment of the gas from the water-gas generators or generation of gas in connection therewith, such as, in the first case, a mass of lime to purify the gas, or in the second case a mass of limestone or other refractory material coated with a heavy hydrocarbon, with which the hydrogen unites, the chambers being hereinafter designated as "limestone-chambers." The end limestone-chambers are connected to the water-gas generators and the boiler, so that the products of combustion from the water-gas generators can be made to pass through said chambers on their way to the boiler to be burned, and the gases made in one generator allowed to pass through the heated limestone-chambers, and finally through the incandescent fuel in the other water-gas generator, while water-gas is being made therein.

The water-gas generator *a* is of the usual construction—that is, it is provided with a

charging-port 1 in the roof thereof for charging the fuel therein, grate-bars 2 at the base of said generator for the support of said fuel, and with stoking-hole 3 in the side wall for the withdrawal of the clinkers or fuel therefrom, and ash-pit door 6 below the grate-bars for the withdrawal of the ashes. This generator is also provided with suitable air-inlets 7 for the supply of the necessary air to raise the fuel to incandescence, and steam-inlets 8 for the admission of the steam during the gas-making stage, and with an outlet 9 leading to the gas-receiving tanks and another outlet 10, controlled by a valve, which connects this generator with the second generator *b* and with the central boiler *c*, as hereinafter explained. The generator *a* is also provided on the side or at the top with a pipe or conduit 12, controlled by a suitable valve 13, which pipe serves to connect the top of the generator with one of the limestone-chambers *d* hereinafter described, and a similar pipe or conduit 15, controlled by a suitable valve 16, also leads from the lower part of the generator *a* to the chamber *d*, this latter pipe being also connected by a branch pipe 17, controlled by a valve 18, to the central boiler *c*, hereinafter described. The chamber *d* is preferably cylindrical, and is provided with a charging-port 20 in the roof thereof for the charging of the impregnated limestone or other material therein, grate-bars 21 at the base of said chamber for the support of said limestone, outlet 22 above and below said grate-bars for the discharge of the limestone when spent, and steam-inlets 23 at the top and bottom for the admission of steam therein, said inlets being provided with injectors so as to admit a supply of hydrocarbon or solvent, as hereinafter explained.

Placed at the side of the limestone-chamber *d* are two other similar chambers *e* and *f* which are also provided with the same appurtenances as to charging-ports, grate-bars, steam-inlets and discharging-outlets as the chamber *d* heretofore described, and they are also charged with the same material. The limestone-chambers *d*, *e* and *f* are connected together at their top by a conduit or main 24, a valve 25 being placed in said conduit between the chambers *d* and *e* and a similar valve 26 in the conduit between the chambers *e* and *f*, these valves serving to close the communication through the conduit from one chamber to another when desired. These chambers *d*, *e* and *f* are also connected together below their grate-bars by a similar conduit 27, which has therein a valve 28 between the chambers *d* and *e* for controlling the communication between them through this conduit, and also a valve 29 between the chambers *e* and *f*. The top of the chamber *f* is also connected to the top of the second generator *b* by a pipe 30 controlled by a valve 31, and the bottom of the chamber *f* with the lower part of the generator *b* by a pipe controlled by a valve. (Not shown in the draw-

ings, but the same as shown in Fig. 3 between the chambers *a* and *d*.) This pipe is also connected by a branch pipe 35 to the boiler *c*, a suitable valve 34 being provided in said pipe. The second generator *b* is provided with the same appurtenances, as to charging-ports, steam and air inlets, stoking-holes and outlets to the generator, that the generator *a* is provided with, as heretofore described. The generator *b* is also connected to the generator *a* and to the boiler *c*, to effect which connection a Y-shaped pipe 36 is preferably employed, the lower end of the Y having an inlet into the boiler *c* controlled by the valve 37, and one side of the upper arms of the Y having an inlet into the generator *a* which is controlled by a valve 38, while the other arm has inlet into the generator *b*, controlled by a valve 39, so that the gases or products of combustion from one generator can be made to pass to the boiler or from both, or from one generator to another, without going to the boiler. The central boiler *c* may be of any suitable type, the upright tubular boiler being well adapted for the purpose.

In making gas with this apparatus, according to the process preferred by me, the generators *a* and *b* are about filled with coal or coke, and the limestone-chambers *d e f* with blocks of limestone coated with heavy hydrocarbon, as described in my said Patent No. 391,386, and the chambers closed to prevent the access of air therein. The fuel in the generators *a* and *b* is now blown up by air-blasts to incandescence, the products of combustion from the generator *b* passing down through the pipe 36 (the valves 37 and 39 being open and the valve 38 closed) to the boiler *c* to generate steam, air being admitted if desired to ignite the said products; or when more heat is required in the limestone-chambers *d e f* the valve 37 is closed and the valve 38 opened, so that the products can pass to the top of the generator-chamber *a* to pass off with products generated therein to the limestone-chambers. In the ordinary operation of the apparatus, however, the heated products from the generator *b* pass to the boiler and only the heated products from the generator *a* pass to the limestone-chambers, these products passing out through the pipe 12, the valve 13 being open and the valves 16 and 18 closed. These heated products of combustion thus enter the top of the limestone-chamber *d* and pass down through the hydrocarbon-bearing material therein, imparting thereto much of their heat, and finally passing out into the conduit 27, the valve 28 being open and the valves 25 and 29 closed. From this conduit they enter the second limestone-chamber *e* at the base of the latter and rise up through the impregnated material therein, parting with still more of their heat and passing out the top of the chamber *e* to the conduit 26, passing therethrough to the top of the limestone-chamber *f*, through which they pass downward, parting with substan-

tially all of their heat, and escaping at the bottom of the chamber into the pipe leading from the base thereof to the generator *b*, the valve therein being closed, and passing thence, the valve 34 being opened, through the branch pipe 35 to the central boiler *c*, where the products are burned. The heat from these waste products is substantially exhausted in their passage through the limestone-chambers, but as the heated products from the generator *b* also enter the boiler they will act to raise these products to a heat at which they will readily ignite, so that they will materially assist in heating the boiler. Any hydrocarbon vapors carried over from the limestone-chambers with the waste products can also be burned in this manner. When the coke or coal has been raised by the air-blast to the proper degree of incandescence the air-blast is turned off, and the valve in the pipe leading from the generator *b* to the boiler is closed, and the gas-outlet 9 to the receiver of the generator *b* is now opened. Steam is then allowed to enter the generator *a*, which steam is decomposed, the hydrogen and carbonic oxide formed passing over through the pipe 12 to the top of the heated limestone-chamber *d*, when a further portion of steam is admitted at the top inlet, the steam being decomposed, and the resultant gases passing down with the gases coming from the generator, the nascent hydrogen uniting with the heavy hydrocarbons to form light hydrocarbons. The gases after passing through the chamber *d* pass thence through the pipe 27 to the chamber *e*. At the injector-pump at the bottom of this chamber, as the gases are passing up through the same, a solvent for the heavy hydrocarbon—such as alcohol or wood spirits—is sprayed into the chamber for the purpose of assisting the union of the hydrogen with the heavy hydrocarbons, the generation of light hydrocarbon gases, and obtaining a larger exposure to the action of the hydrogen, as described in my application, Serial No. 261,139. After passing up through the hydrocarbon-chamber *e* the gases escape into the conduit 24 and are conducted to the top of the chamber *f*, where a further supply of solvent is injected during the time the gases are passing through this chamber, for the purpose heretofore described. An additional quantity of light hydrocarbon is formed in this chamber, and finally the gases pass out at the bottom to the pipe leading to the bottom of the generator *b*, rising up through the incandescent fuel therein and mingling with the water-gas formed by the direct admission of steam into this generator during the passage of the gas therethrough. In passing through this generator the gases formed in the first generator and in the limestone-chamber are intermingled with those formed in this second generator *b*, and any carbonic-acid gas entering this generator is converted into carbonic oxide, while on account of the high heat of the fuel in this generator all the gases are

fixed and a permanent or stable gas, composed principally of hydrogen, light hydrocarbons, such as marsh-gas, and carbonic oxide, obtained, the gas passing through the outlet from the generator to the receiver. When the temperature of the fuel in the generator-chambers *a* and *b* has fallen too low for gas-making, the steam is turned off and the outlet to the receiver from the generator *b* closed and the valves 37 and 39 opened, when the air-blast can be again turned on and the fuel again raised to incandescence, the products from the generator *a* passing, as before described, through the chambers *d*, *e* and *f*, and the valve *c'* having been opened the products from the generator *b* passing to the boiler *c* to be burned, as heretofore described.

If it is desired to reverse the operation of the apparatus and make the products of combustion from and the gases formed in the generator *b* pass through the chambers *f*, *e* and *d* and thence to the boiler, or through the generator *a* to the gas-receiver, the valves 31, 27, 25 and 17 and the gas-outlet from the generator *a* to the receiver are opened, the valves 38 and 39 closed, also the valves 13, 28, 26, 34 and the valve in the pipe leading from the base of the chamber *f* to chamber *b*, which will give the current of gases a reverse course from that heretofore described, thus insuring a uniform exhaustion of the hydrocarbon in the limestone-chambers. If desired, where too much steam is generated and the limestone-chambers are not sufficiently heated, part of the products of combustion from the generator heating the boiler may be caused to pass, as above described, through the upper part of the other generator and thence with the products therefrom to the limestone-chambers, or part of the products may be caused to pass through the third limestone-chamber and thence to the boiler, this being accomplished by the operation of the valves before referred to.

If after the gas-making step it is desired to freshen the hydrocarbon material in the limestone-chambers, liquid hydrocarbon may be sprayed into the top of the chambers *d*, *e* and *f* or any one or more of them while the products of combustion are passing therethrough, and this hydrocarbon thus spread over the refractory material, as described in Letters Patent No. 403,382, granted to me May 14, 1889. I am thus enabled to obtain the generation of steam for gas-making purposes, the generation of a large volume of water-gas, the proper heating of the auxiliary gas making or treating chambers, and the fixing of the gases formed without the employment of a superheater, the products of combustion from the generators being employed for other purposes.

The apparatus is compact and on account of the arrangement of the several chambers and their connecting valve-controlled pipes all the heat can be properly utilized.

The limestone-chambers can of course be

employed for any suitable treating or gas-generating purposes according to the process carried out in the apparatus.

Having now described my invention, what I claim is—

1. A gas making apparatus, having a central boiler, two separate cupola gas generators on one side of said boiler and having valve controlled pipe connections therewith and a series of casings containing auxiliary gas generating or treating chambers on the other side of said boiler having valve controlled connecting pipes, and valve controlled connecting pipe between the end chambers of said series and the cupola generators, substantially as and for the purposes set forth.

2. A gas making apparatus having two cupola gas generators, valve controlled pipes connecting said generators, and a series of casings containing connected auxiliary gas generating or treating chambers, the end chambers of which series are connected to the generators by valve controlled pipes, substantially as and for the purposes set forth.

3. A gas making apparatus, having two cupola gas generators, valve controlled pipes connecting said generators, a series of casings containing auxiliary gas generating and treating chambers, a conduit connecting the upper parts of said chambers together and a similar conduit connecting the lower parts of said chambers, valves in said conduits between

said chambers, and connections between the end chambers of the series and the generators, substantially as and for the purposes set forth.

4. A gas making apparatus, having two cupola generators and connections between them, a series of casings containing auxiliary gas generating or treating chambers, a conduit connecting the upper parts of said chambers and a conduit connecting the lower parts of the chambers, valves in said conduits between each chamber, and connections between the top portion of the end chambers of the series and the top portions of the generators and connections between the lower parts of said chambers and the lower part of the generator, and valves for controlling said connections, substantially as and for the purposes set forth.

5. A gas making apparatus, having a central steam boiler, two generators on one side of the same, a series of casings containing connected auxiliary gas generating or treating chambers on the other side of the boiler, and valve controlled pipe connecting pipes between the end chambers of the series, and the boiler and generators, 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:

BUTLER KENNER HARDING,
HOWARD QUICK.