

(No Model.)

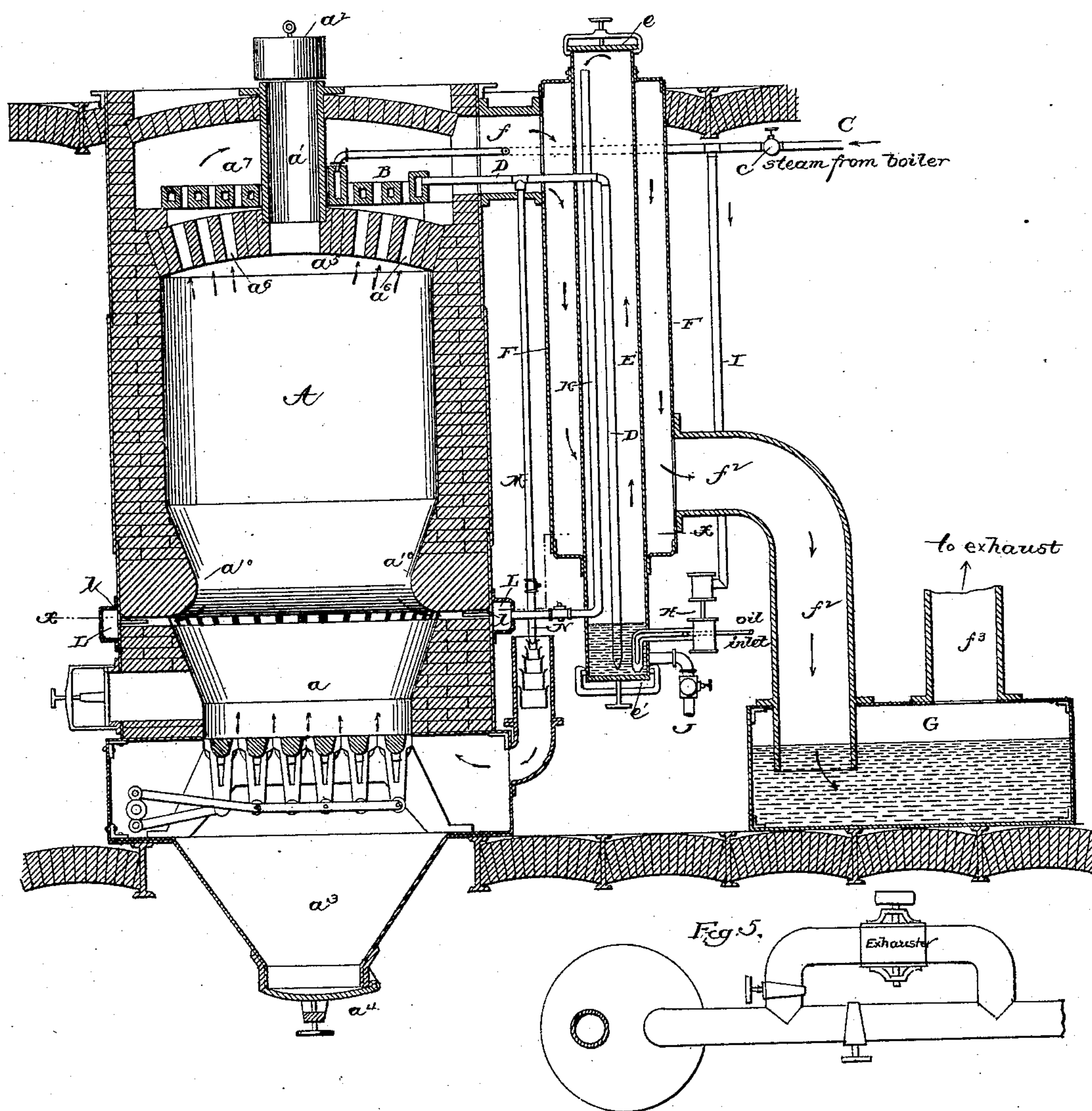
2 Sheets—Sheet 1.

L. STEVENS.
APPARATUS FOR THE MANUFACTURE OF GAS.

No. 444,091.

Patented Jan. 6, 1891.

Fig. 1.



Witnesses
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Inventor
L. Stevens
By his Attorney Phil. T. Dodge

(No Model.)

2 Sheets—Sheet 2.

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Fig. 2.

ON LINE X — X

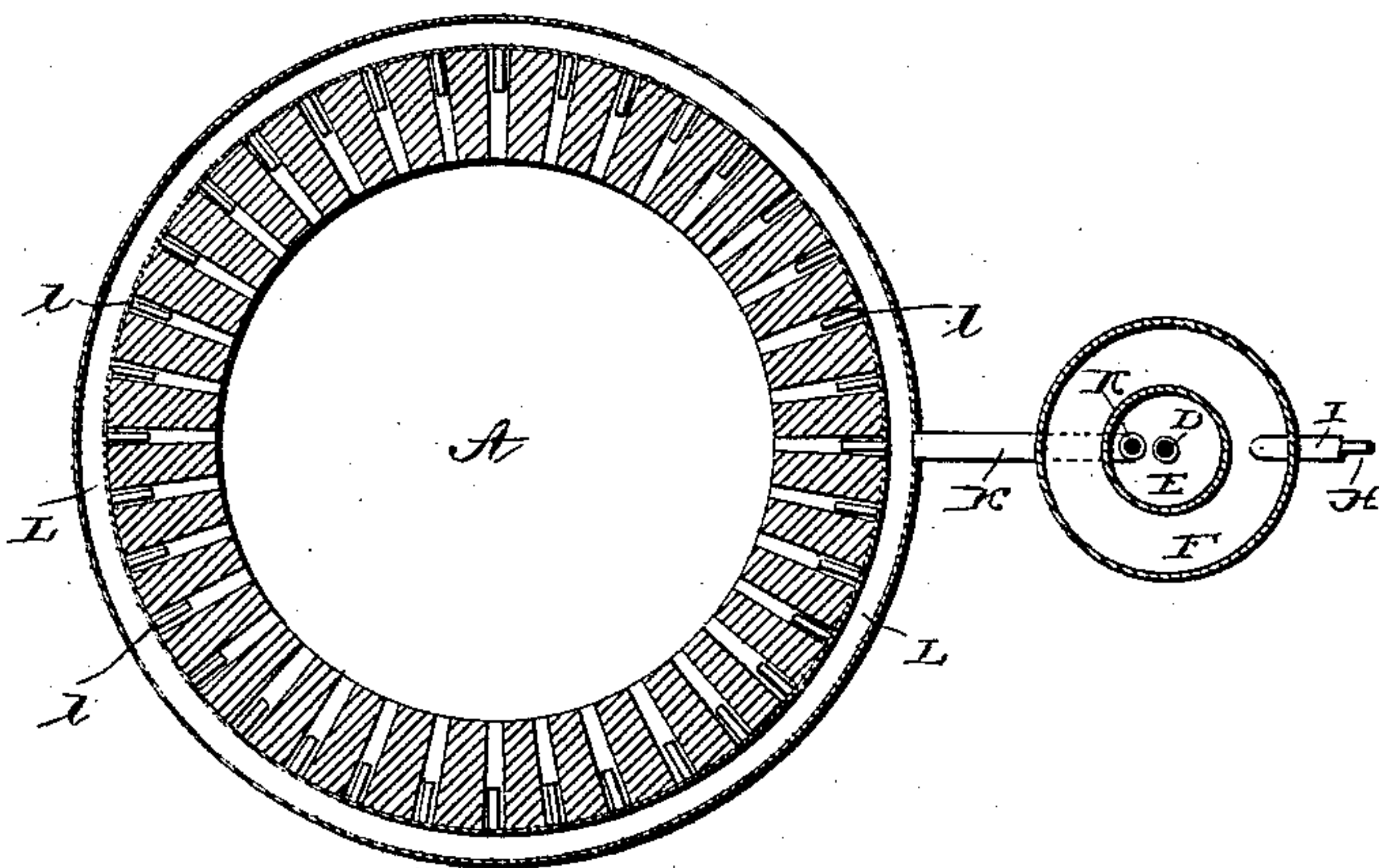


Fig. 3.

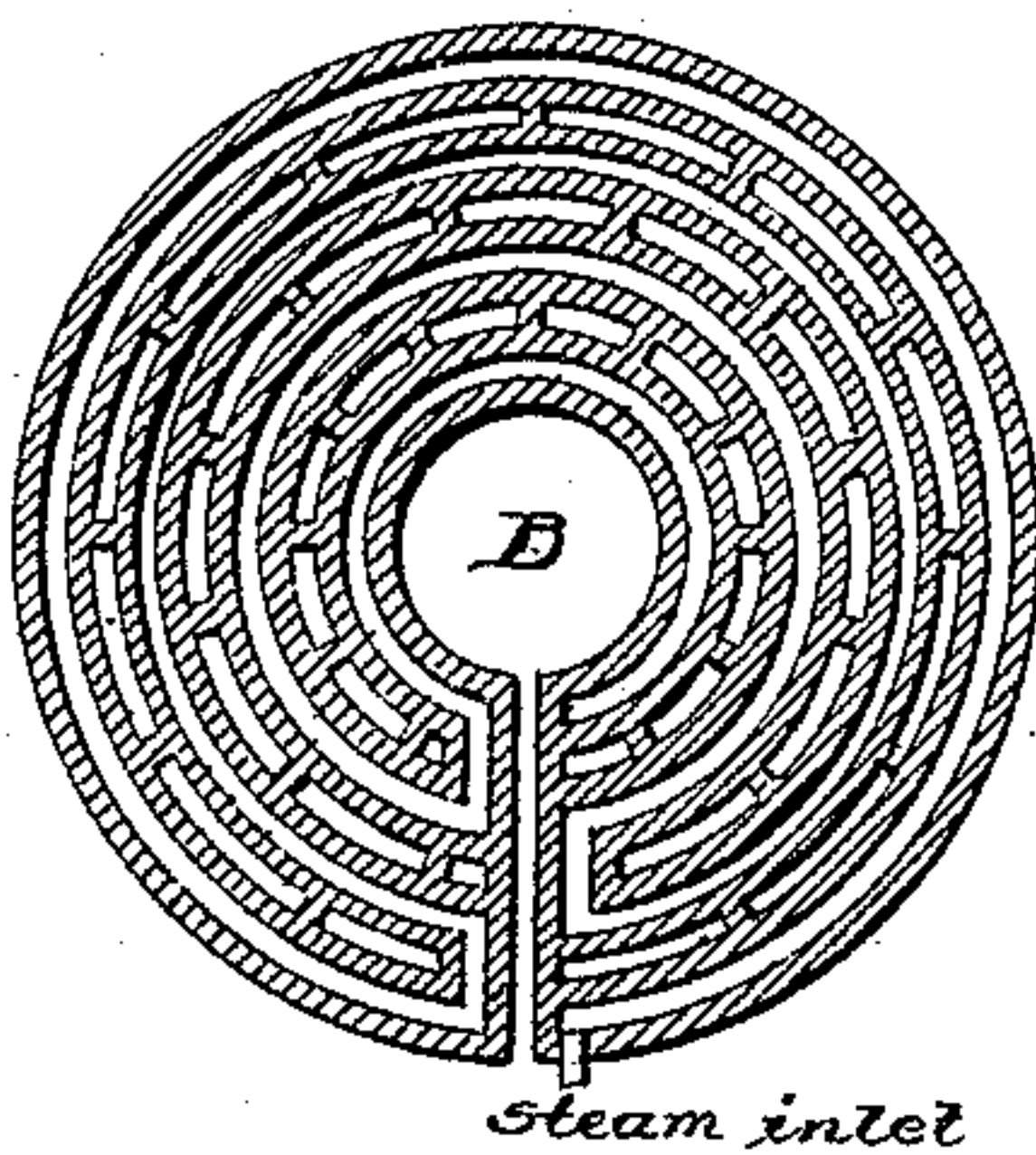
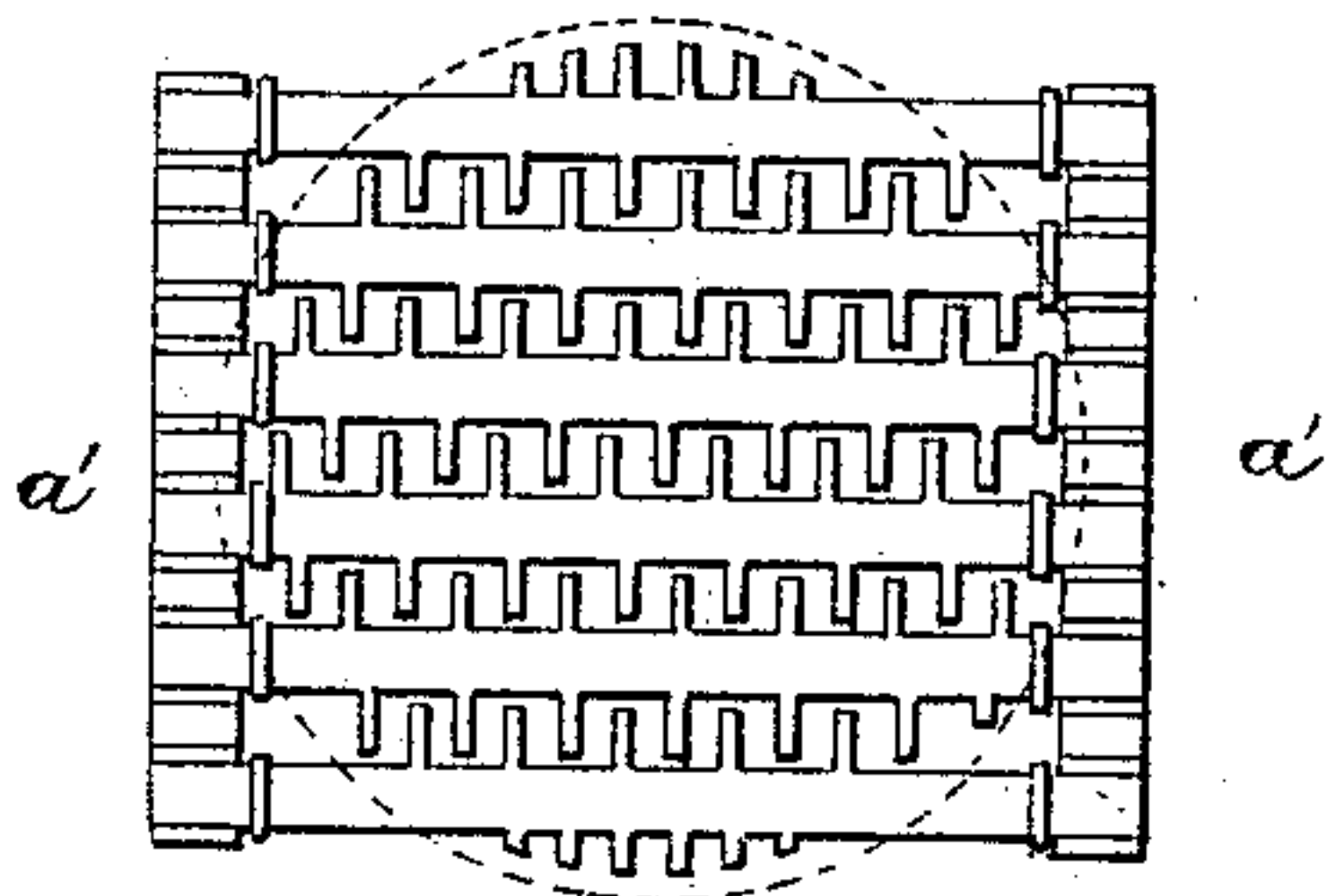


Fig. 4.



Witnesses

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UNITED STATES PATENT OFFICE.

LEVI STEVENS, OF TRENTON, NEW JERSEY.

APPARATUS FOR THE MANUFACTURE OF GAS.

SPECIFICATION forming part of Letters Patent No. 444,091, dated January 6, 1891.

Application filed April 8, 1889. Serial No. 306,420. (No model.)

To all whom it may concern:

Be it known that I, LEVI STEVENS, of Trenton, in the county of Mercer and State of New Jersey, have invented certain Improvements in Apparatus for the Manufacture of Gas, of which the following is a specification.

This invention relates to an improved apparatus for the manufacture of combustible gas by passing steam and hydrocarbon vapors at high temperatures through the mass of burning coal or similar carbonaceous material, and relates to various features of construction having in view the rapid, economical, and uniform production of gas.

In the accompanying drawings, Figure 1 is a vertical central cross-section through my apparatus. Fig. 2 is a horizontal section of the same on the line xx of Fig. 1. Fig. 3 is a horizontal section of the superheater. Fig. 4 is a plan view of the fire-grate. Fig. 5 is a view showing the exhaustor.

Referring to the drawings, A represents an upright combustion-chamber or generator, preferably of cylindrical form, constructed of masonry or other suitable material, with a fire-grate a at the base. The retort is contracted or reduced in diameter internally, as shown, immediately above the fire-grate and also at a higher point a^{10} . Below the grate the retort is closed by an ash-pan a^3 , having a door or lid a^4 at the bottom. The top of the combustion-chamber is formed by an arch or wall a^5 , through which there are openings a^6 for the passage of the products of combustion into an upper chamber a^7 , which contains a steam-superheater B. A central neck a' , closed by a removable cap a^2 , permits the introduction of fuel into the top of the combustion-chamber or generator.

The superheater is preferably made of cast metal in the form shown in Figs. 1 and 3; but it may be made of any other appropriate form which will provide a sinuous passage for the flow of the steam and expose a large surface to the action of the hot gases and flame.

C is a steam-pipe leading from a boiler or other generator through the center of the superheater.

D is a second pipe conducting the superheated steam from the outside of the superheater into the lower part of a vertical cylin-

drical mixing-chamber E, which is closed at its upper and lower ends by removable caps e and e' , which may be fastened in place by the yoke-bars and screws, as shown, or in any other appropriate manner. The upper portion of the mixing-chamber is surrounded by a heating-jacket F, which receives at its upper end, through the neck f , the highly-heated products escaping from the top of the retort.

These products after descending around the outside of the mixing-chamber, escape from its lower end through pipe f^2 , which extends downward into a washing-chamber or condenser G below the level of the fluid therein, after which they escape through the ascending pipe f^3 .

H is a device—such as a steam-pump—for delivering oil or other hydrocarbon into the lower end of the mixing-chamber. The steam for operating this pump is delivered through a pipe I from the pipe C at a point in advance of the superheater.

A cock J is applied to the lower end of the mixing-chamber for the purpose of withdrawing the fluids precipitated therein. In the operation of the apparatus these fluids are commonly maintained at such a level as to cover the steam and oil inlets, as indicated in the drawings.

K is a pipe leading from the upper part of the mixing-chamber to a hollow ring L, which surrounds the generator, and which is provided with a series of delivery-nozzles or tuyeres l , discharging through the walls of the generator into the combustion-chamber from all sides immediately below the annular shoulder formed by the contraction a^{10} . This pipe is provided, as shown, with a cock or valve of ordinary construction, by which the delivery of the mingled steam and vapor is limited, so as to maintain in the mixing-chamber a pressure of from twenty to forty pounds (more or less) to the square inch.

It will be observed that the oil and steam are separately introduced into the base of the mixing-chamber or retort E, where the vapor of the oil becomes thoroughly and uniformly mingled with the steam. This mingled steam and vapor rising in the mixing-chamber is subjected to a gradually-increasing temperature until they reach the top of the chamber acted upon by the products from the

generator at their highest temperature. From the upper highly-heated end of the mixing-chamber the vapor and steam are delivered through the pipe K to the generator.

5 M is a superheated-steam pipe connected to the pipe D and leading to the air blower or injector N. This injector or blower, which discharges into the base of the generator or combustion-chamber below the fire-grate, is
10 of familiar form, consisting of a series of concentric nozzles of successively greater diameter. The jet of steam directed through these nozzles induces the inflow of a large volume of air, which is driven forward with
15 the steam into the base of the generator upward through the grate and the burning carbon thereon.

The steam-supply pipe C is provided with a cock *c*, which serves to regulate the flow of
20 the steam into the mixing-chamber, the flow of steam to the oil-pump, and thereby the rate of oil delivery and the flow of steam to the air-forcing device. The employment of a single cock to supply steam for all three pur-
25 poses named is of great importance, since the interdependence of said actions and their effect in controlling the temperature of the combustion and the temperature of the superheated steam is such that a uniformity in
30 the action of the apparatus and in the character of the gas delivered is automatically secured.

The grate may be of any approved character; but I prefer, as shown in the drawings, a
35 series of rocking toothed bars connected as shown. This grate is not claimed as of my invention.

While I prefer to retain the annular ring L and its series of nozzles for introducing the
40 mingled steam and hydrocarbon vapor into the lower part of the generator, it is to be understood that any equivalent conductors may be used for this purpose.

The operation of the apparatus is as follows:
45 The combustion-chamber is filled to a suitable height with anthracite coal or similar material and combustion of the same started at the base. The ash-pit door is left open, and the exhauster, which draws the gases from
50 the generator, is put in motion, drawing air through the mass of coal until it has become thoroughly ignited at the base, when the ash-pit door is closed and steam is introduced through pipe C. This steam flows in part to
55 the oil-pump, which forces oil into the base of the mixing-chamber, where it is immediately vaporized. Another portion of the steam, continuing its course through the pipe C and the superheater, is delivered from the latter
60 at a temperature of from 1,000° to 1,300° through the pipe D into the base of the mixing-chamber, where it meets and combines with the hydrocarbon vapor. During this action the heated products of combustion
65 ascend from the top of the generator into the chamber *a*⁷, acting upon the superheater and continuing thence downward through the

heating-jacket F around the outside of the mixing-chamber, whereby the mingled steam and hydrocarbon vapor is raised to and maintained
70 at a temperature of about 1,000° Fahrenheit. The steam-supply, the oil-feeder, and other parts are so proportioned that a pressure of from twenty to forty pounds to the square
75 inch is maintained within the mixing-chamber. The mingled steam and vapor pass from the top of the mixing-chamber downward through the pipe K, and finally through the ring L and its nozzles *l* into the lower part of the combustion-chamber in the generator,
80 where they are distributed throughout the mass of burning material, through which they ascend at a relatively low temperature. During this action another portion of the superheated steam, descending through the pipe M,
85 passes, accompanied by a large volume of air, upward through the grate and through the burning fuel.

It will be observed that in my apparatus the gases and products from the top of the
90 combustion-chamber are applied to heat and break up the hydrocarbon and heat the carbon of the oil, in connection with the steam, forcing the oxygen of the steam into combination therewith. These commingled gases
95 or vapors are delivered at high temperature into the mass of highly-heated carbon. As the oxygen of the steam has already received its equivalent of carbon in the mixing-chamber, it does not act to effect the consumption
100 of the hot carbon in the retort. The hydrogen receives from the hot carbon in the retort its equivalent of heat not furnished in the mixing-chamber, and the mingled gases or hydrogen, or carbureted hydrogen and carbonic
105 oxide, pass from the top of the generator a permanent gas. The combustion and the necessary heat depending thereon are mingled in the generator principally by the atmospheric oxygen delivered into the bottom of the gen-
110 erator. The gas from the burning of the carbon in the generator to sustain the heat therein will be carbonic oxide and nitrogen, (what is commonly called "producer gas.") Its
115 percentage will be very small. A temperature of about 1,600° Fahrenheit should be maintained in the generator to permanently fix the gases discharged therefrom.

The pressure in the generator or combustion-chamber should be about equal to that
120 of the atmosphere. This result may be attained by connecting an exhauster of any suitable character with the discharge-pipe *f* or otherwise applying them so that it will communicate with the chamber.
125

Having thus described my invention, what I claim is—

1. In a gas apparatus, the combination of the combustion-chamber or generator, the steam-superheater in its top, the upright elongated mixing-chamber E, its inclosing-jacket
130 arranged to receive the products of combustion at its top directly from the generator, the steam-pipe leading from the superheater into

the base of the mixing-chamber, the oil-forcing device also delivering into the base of the mixing-chamber, the pipe K, leading from the top of the mixing-chamber into the base of the generator and provided with a valve to maintain the pressure in the mixing-chamber, and the blower M, also delivering into the base of the generator.

2. In combination with the combustion-chamber or generator, the steam-superheater in its top, the independent mixing-chamber E and its surrounding jacket, through which the products of combustion are delivered from the generator, an oil-forcing device delivering into the mixing-chamber, a jet-blower N,

delivering into the base of the combustion-chamber, a pipe D, leading from the superheater, provided with two branches leading one into the mixing-chamber and the other to the jet-blower, and a pipe K, leading from the mixing-chamber to the base of the generator.

In testimony whereof I hereunto set my hand, this 16th day of March, 1889, in the presence of two attesting witnesses.

LEVI STEVENS.

Witnesses:

GEO. N. ROBESON,
SAML. D. OLIPHANT, Jr.