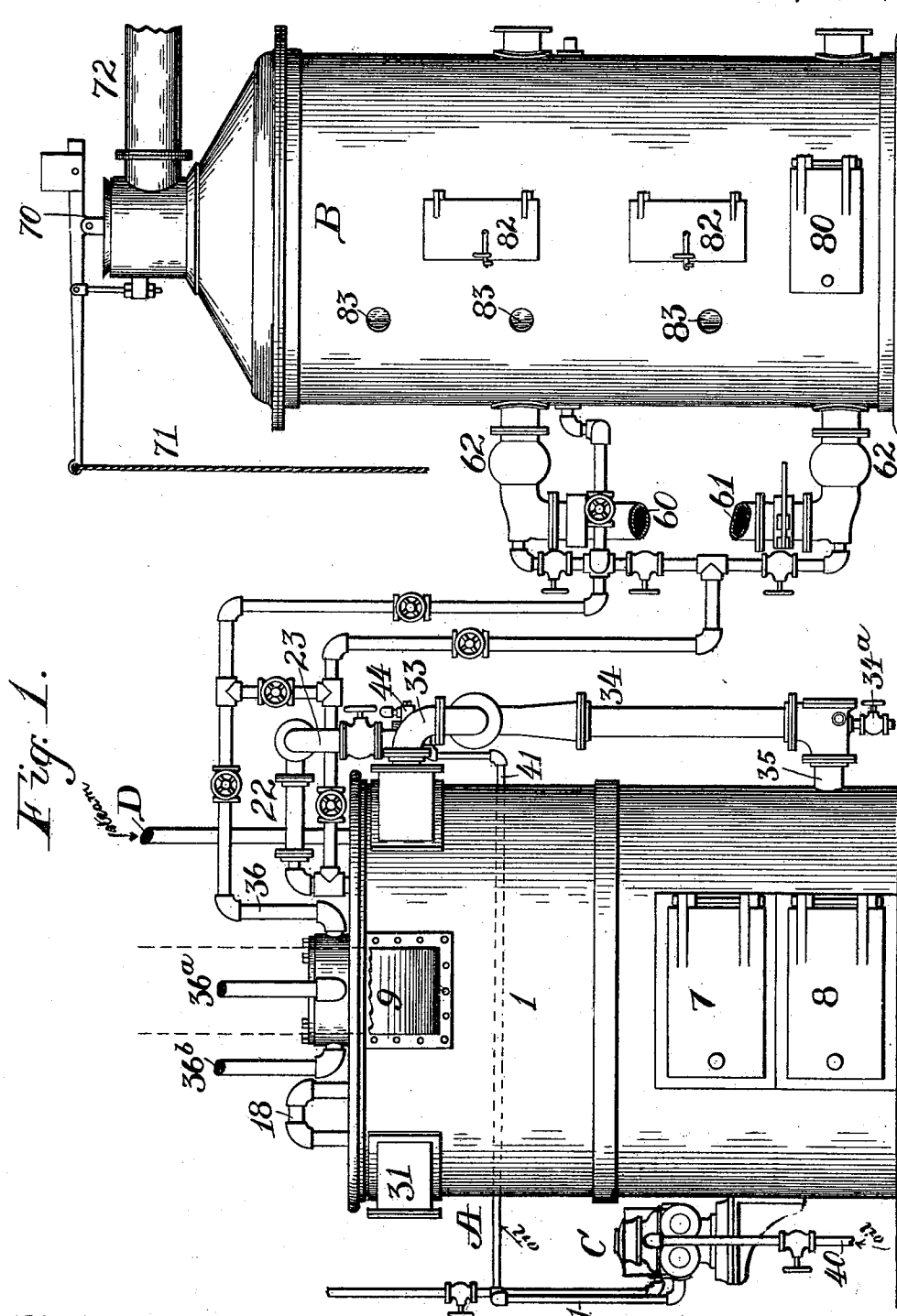


J. B. ARCHER.
APPARATUS FOR THE MANUFACTURE OF GAS.

No. 505,998.

Patented Oct. 3, 1893.



Witnesses;
Rey C. Bowen.
John E. Wilson.

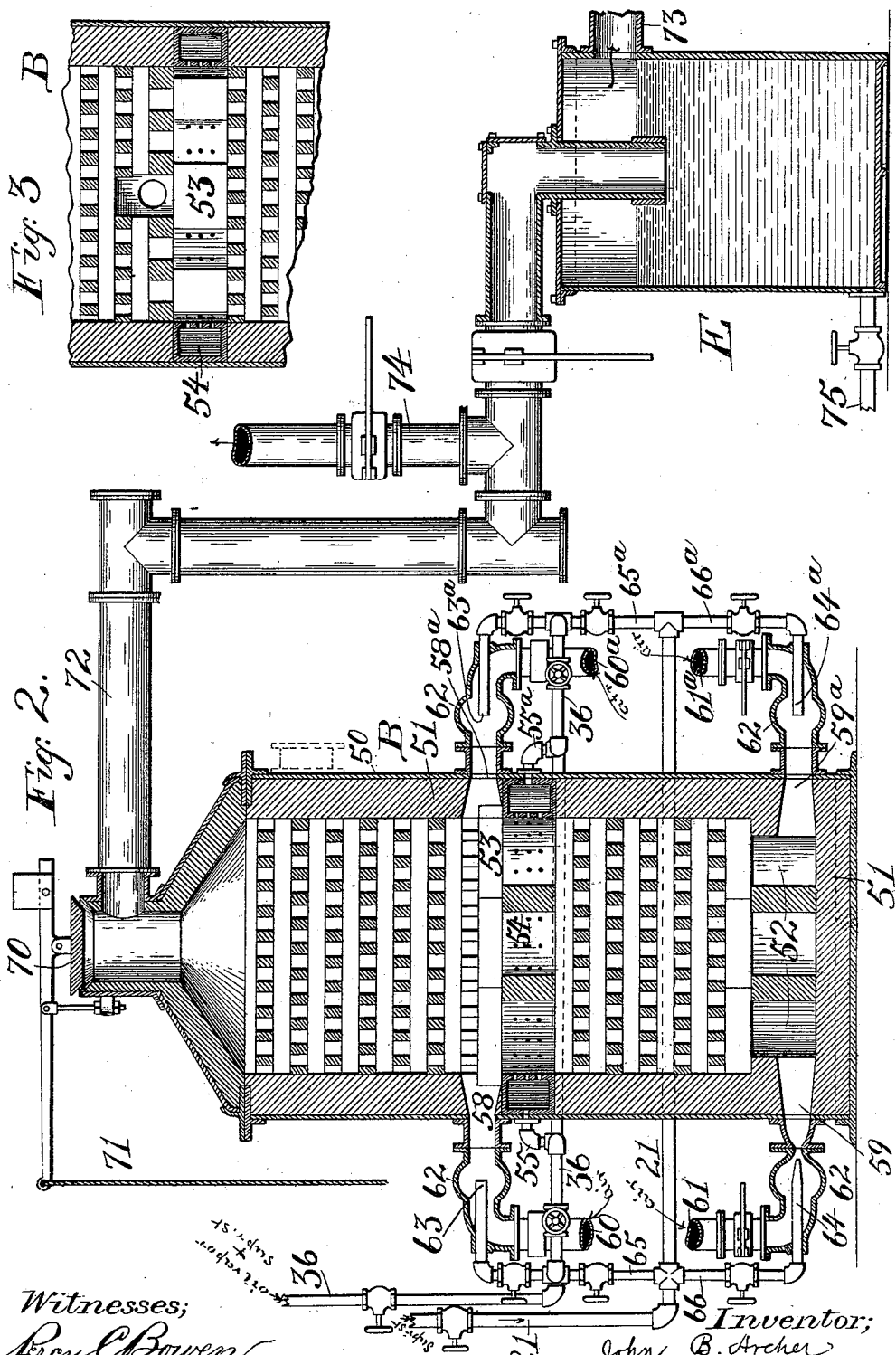
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(No Model.)

5 Sheets—Sheet 3.

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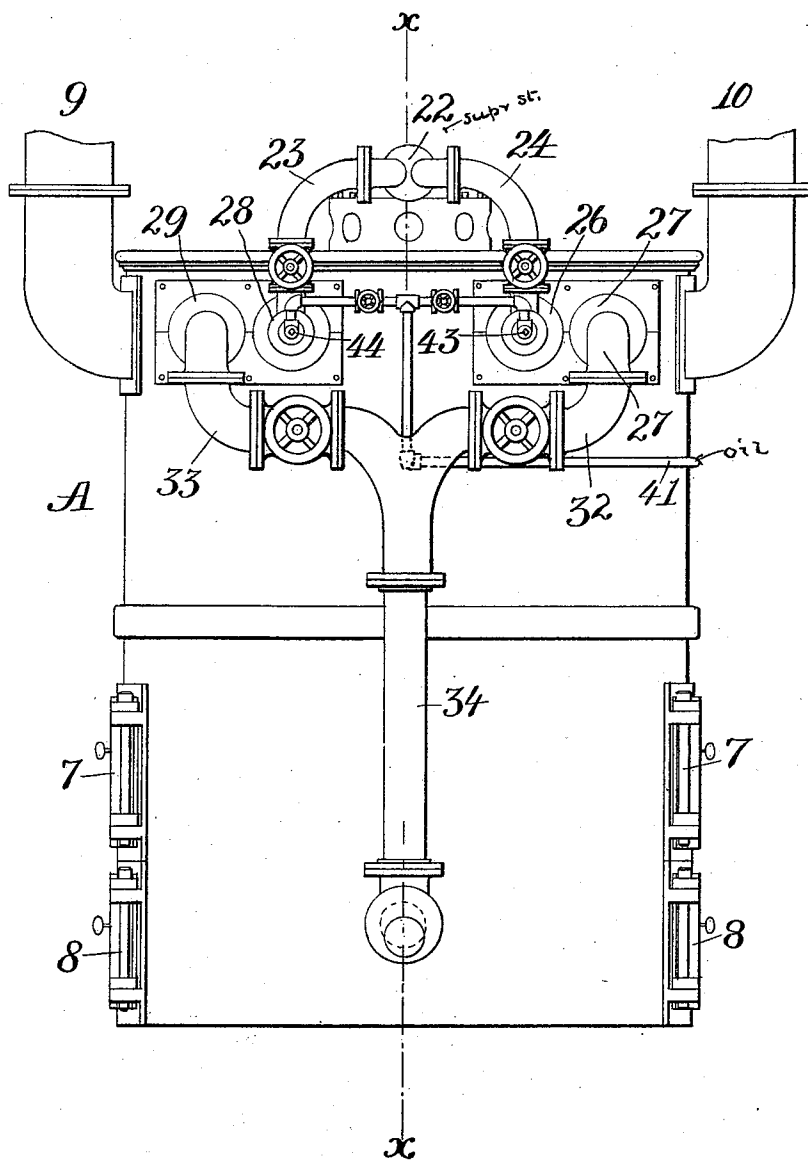


Fig. 4.

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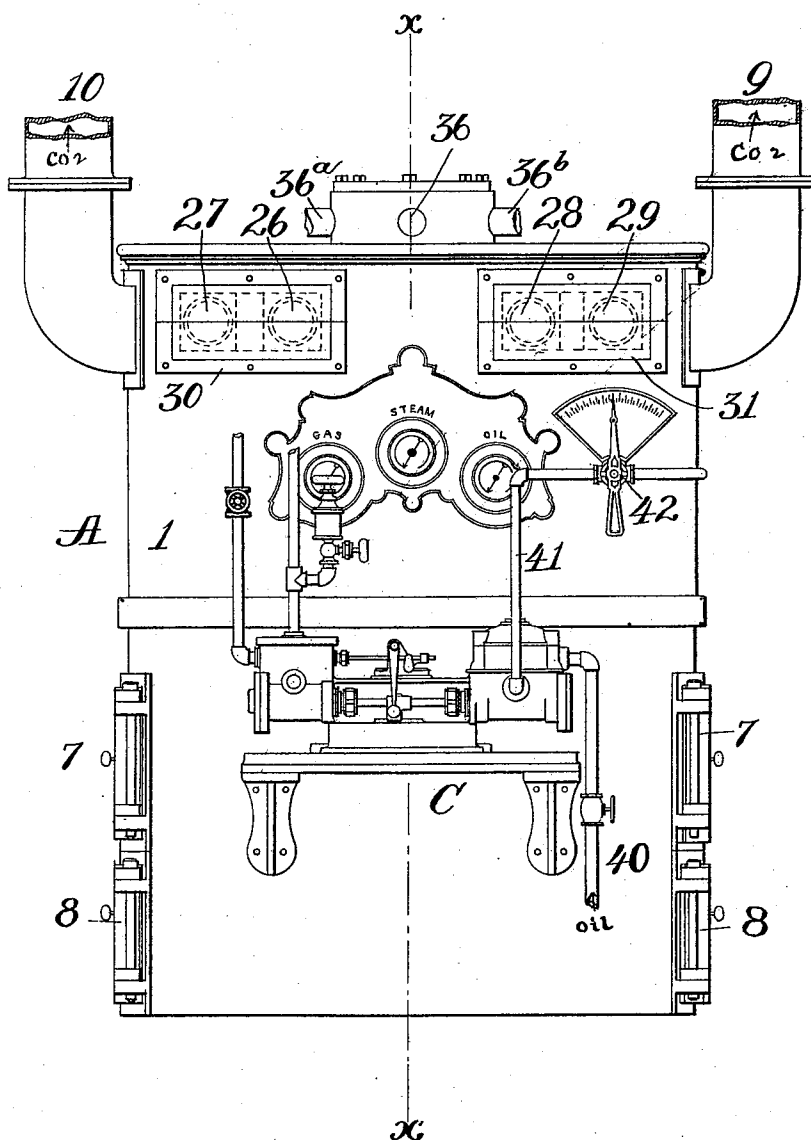


Fig. 5.

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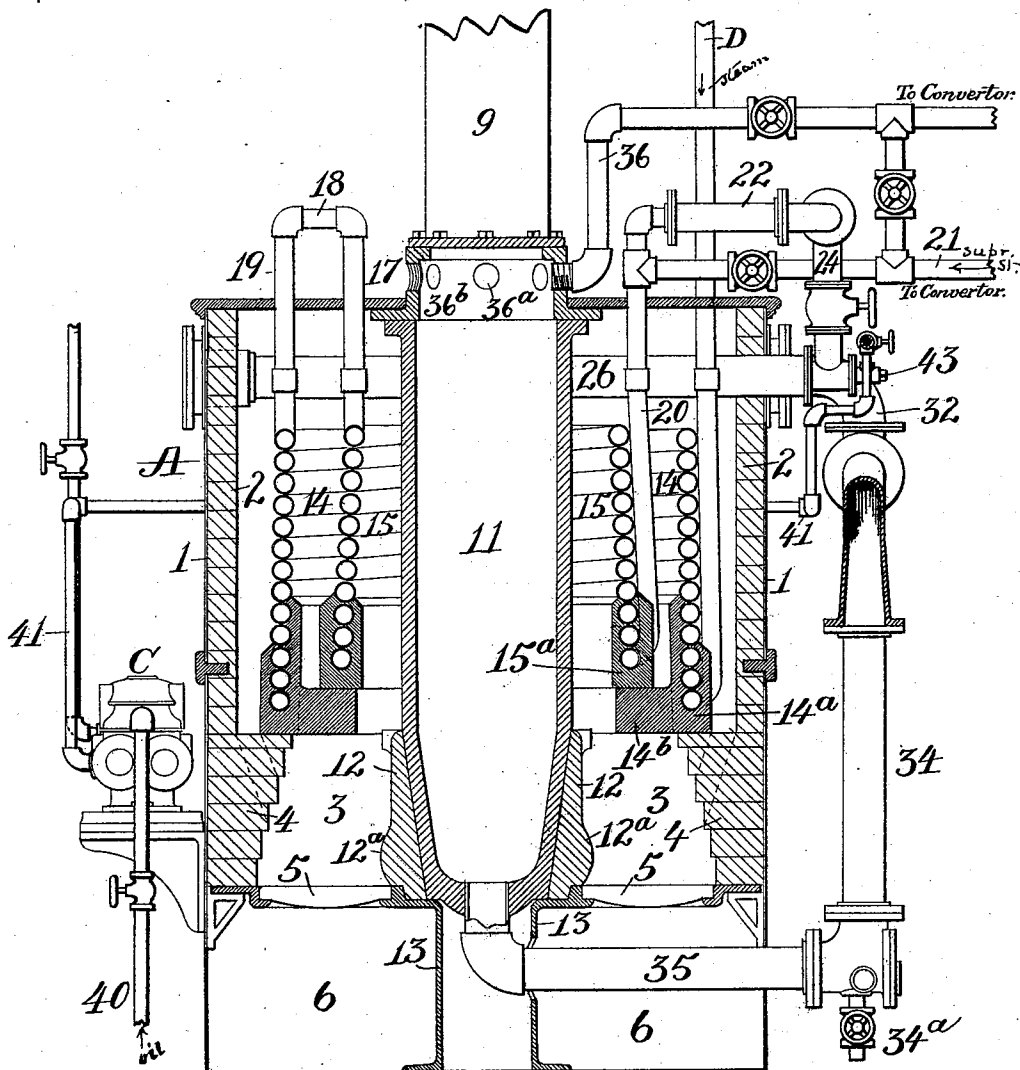


Fig. 6.

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UNITED STATES PATENT OFFICE.

JOHN B. ARCHER, OF WASHINGTON, DISTRICT OF COLUMBIA.

APPARATUS FOR THE MANUFACTURE OF GAS.

SPECIFICATION forming part of Letters Patent No. 505,998, dated October 3, 1893.

Application filed April 20, 1892. Serial No. 429,941. (No model.)

To all whom it may concern:

Be it known that I, JOHN B. ARCHER, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Apparatus for the Manufacture of Gas; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to the manufacture of gas according to that class of processes in which the inter-decomposition of oil and water is effected, and in which the gaseous products in a measure result from the interaction of steam and carbon; and my invention consists in an improved apparatus for the economical manufacture of gas, by converting, in a gradual manner, steam or vapor of water and hydrocarbon oil into a fuel or illuminating gas that may be used for heating purposes, or further refined in suitable converters to produce an illuminating and domestic fuel gas, the conversion being accomplished by the aid of certain new and useful devices and combinations to be hereinafter described and claimed.

This invention relates specially to certain improvements on the devices shown in Letters granted to me, numbered and dated as follows:—No. 433,926, granted August 5, 1890; No. 434,621, granted August 19, 1890; and No. 435,720, granted September 2, 1890.

In the accompanying drawings, in which similar letters and numerals refer to similar parts throughout the several views thereof—Figure 1 is a front elevation of the gas producer, and a converter, and illustrates the method of connecting the two. Fig. 2 represents a sectional elevation of the converter and the drip chamber connected thereto. Fig. 3 represents a section of the middle portion of the converter by a plane at right angles to the plane of section as illustrated in Fig. 2; said Fig. 3 illustrates the hollow perforated ring about the middle of the converter. Fig. 4 represents a side view of the producer as seen from the right in Fig. 1. Some of the pipe connections are omitted. Fig. 5 represents a side view of the producer as seen from the left in Fig. 1; and Fig. 6 represents a ver-

tical section of the producer along the line x in Figs. 4 and 5.

A represents the producer, B the converter, C the oil pump, D the steam pipe connected to any suitable supply of steam (not shown), and E the drip chamber.

The producer is approximately cylindrical in shape, and has an outer metal shell or casing 1, an inner wall or lining 2 of fire brick, a fire box 3 having overhanging sides 4 of refractory material, grate bars 5 and annular ash-pit 6. Doors 7 and 8 open into opposite sides of the fire box, and ash-pit respectively. The products of combustion escape through the smoke pipes 9 and 10. On the interior of the producer the retort 11 rests in the cast iron ring 12 thickened at 12^a at the place where the fire is hottest to prevent excessive heat from reaching the retort. This ring 12 rests upon the annular support 13 which forms the inner wall of the ash-pit.

14 and 15 are two superheating coils which are arranged the one within the other. The lower ends of these coils are protected against burning out from the excessive heat of the furnace by cast iron jackets 14^a and 15^a cast thereon; the jacket 15^a of the inner coil rests on a shoulder 14^b of the jacket of the outer coil. The outer coil is connected at its base to the steam pipe D; and the two coils are joined together at their upper ends by the pipes 17, 18, and 19. A pipe 20 connects the lower end of the coil 15 to the pipe 21 leading to the converter, and also to the pipe connected by the pipes 23 and 24 to the transverse pipes or retorts 26 and 27, 28 and 29, each pair of which communicate with each other through chambers 30 and 31. The pipes 27 and 29 are connected at their ends opposite the chambers 30 and 31 to the pipes 32 and 33 which join the pipe 34 leading past the drain pipe 34^a to the pipe 35 opening into the bottom of the retort 11. The top of said retort has one or more pipes 36, 36^a, 36^b, 36^c, &c., which may be connected to a similar number of converters. The oil comes through the pipe 40 from a tank (not shown) to the pump C by which it is pumped through the pipe 41 by the hair valve 42 to the injectors 43 and 44 opening into the superheating pipes or retorts 26 and 28.

The converter B has an outer metallic shell 50 lined with refractory material 51. A combustion chamber 52 is provided at the bottom of the converter and a mixing chamber 53 about half way up divides it into two nearly equal compartments each of which is filled with a checker work of tiles and iron bars, or preferably tiles covered with roughened iron shells, ample space being left in the interstices of said checker work for the gases to pass through freely. Around the lower portion of the central mixing chamber a hollow annular flue 54 is placed, having a number of perforations on the interior thereof opening into said mixing chamber. Pipes 55 and 55^a connect the interior of this flue with the pipe 36 leading from the top of the retort 11 of the producer. Four inlet openings 58, 59, 58^a and 59^a are formed through the walls of the converter opening into opposite sides of the chambers 52 and 53 respectively. Into the openings the air pipes 60 and 60^a, 61 and 61^a open; each of said air pipes having an enlarged chamber, into which chamber the pipes 63 and 63^a, 64 and 64^a open respectively. These pipes are each connected to both of the pipes 36 and 21 from the producer as shown. The pipe 64 is shown arranged so as to act as an inspirator for sucking air into the chamber 52 and the pipe 64^a may be arranged in the same way if it be desired.

The various pipes 60^a, 61^a, &c., may be omitted entirely if desired, confining the connections from the producer and the air to one side of the converter only, as shown in Fig. 1. All of the pipes connected to the converter or the producer are controlled by suitable valves.

The top of the converter is closed by a weighted valve 70 which may be lifted by means of the cord 71. The pipe 72 leads from near the top of the converter to a drip tank E, where the gas bubbling up from beneath the surface of the water is carried off by the pipe 73.

74 is a blow pipe which should preferably be provided with a safety valve to blow off when the pressure of the gas becomes excessive, and 75 is a drain pipe to the drip tank.

A door 80 is provided in the base of the converter for kindling the fire, and also for access to the interior, and doors 82 are provided for access to the tile work for inspection and repair. Peep holes 83 are also provided to inspect the color (which should be about clear orange) of the tiles, and hence to determine the temperature of the interior of the converter.

The process is as follows:—Fires being started in the fire box 3, steam is admitted through the pipe D to the base of the coil 14, and winding its way up through this coil it passes through the pipes 19, 18, and 17 down through the coil 15, and up through the pipe 20, whence part of the superheated steam

goes directly to the base of the converter through the pipe 21, while the remainder passes through the pipe 22 and branch pipes 23 and 24 into the front ends of the pipes 26 and 28 respectively. Oil is at the same time injected into the said pipes, and by the action of the superheated steam and the hot pipes 26 and 28 the oil is completely vaporized. The steam and oil mixed pass through the pipe 26 or 28, the chambers 30 or 31, and returns by the pipe 27 or 29, as the case may be, and through the branch pipes 32 and 33 into the vertical pipe 34 and horizontal pipe 35 up into the retort 11 situated in the center of the combustion chamber 3. Here the mixed steam and oil are highly heated and reacting upon each other form a suitable fuel gas. In order to fix this gas and render it better suited for use as a fuel, or as an illuminant, it is carried over to the converter by the pipe 36. It will be evident that the proportions of the steam and oil may be varied by adjusting the proper valves. The converter having been heated up to the desired temperature, as will be hereinafter described, has a regulated amount of superheated steam admitted from the pipe 21 through the pipes 66, 66^a, and 64 and 64^a to the lower chamber 52 of the converter. This steam passing upward through the checker work has its oxygen largely abstracted by the heated iron and enters the chamber 53 containing a large proportion of hydrogen gas. Here the hydrogen mixes intimately with the steam and oil vapor entering through the pipes 36, 55, and 55^a and the perforations in the annular flue 54. This intimate mixture of hydrogen gas and steam and oil vapor is deprived of more oxygen by the heated iron in the upper half of the checker work. The hydrogen is carburated, while the gas passing through the pipes 72 and 73 contains a very small proportion of oxygen and a very large proportion of hydrogen and hydrocarbons. The gas is thoroughly fixed in the upper tier of checker work.

It will be seen that the relative proportion of the superheated steam and of the mixture of steam and oil, admitted to the converter may be varied at will, and thus the gas may be adapted for heating and illuminating purposes, the illuminating properties being dependent mainly upon the amount of carbon present.

34^a and 75 are pipes for draining off any tarry matter from the pipes 34 or the tank E respectively. The drip tank E is for washing and cooling the gas.

In order that the converter may be heated up by the gas made in the producer, I connect the pipe 36 with the pipes 66 and 66^a, by the pipes 65 and 65^a all of said pipes having stop valves as shown. When it is desired to heat up the converter the pipe 72 is closed by its valve, the valve 70 is raised well clear of its seat, the air pipes 60 and 60^a, and 61 and 61^a are opened, a small fire is kindled in the

chamber 52, and the mixed steam and oil are turned on through the pipes 64 and 64^a. The mixed air and gases burn fiercely in and through the checker work, the products of combustion escaping through the top of the converter. When the desired temperature is reached, which may be noted either by a pyrometer or by the color of the tiles in the checkerwork,—which should be a clear orange, the combustion is stopped, the air pipes are shut off, the valve 70 closed, the pipes 65 and 65^a are closed, and the process of conversion as before described may be begun. In order that one converter may be in use while another is being heated up, or in other words in order to make the process continuous, the converter should preferably be connected to the producer in pairs. When the checker work of the converter becomes too cool to fix the gas, the fuel-gas and air are again admitted to the chamber 52 and ignited and the process of heating up is again repeated.

It will be noted that in the process of conversion the iron surfaces in the lower part of the converter will be most oxidized, they being exposed to the superheated steam alone; while in the subsequent heating up, these iron surfaces will return some of their oxygen to the carbon in the gas and will be partially reduced, and their efficiency for withdrawing the oxygen from the steam is thus restored.

Having thus described my invention, what I claim, and desire to secure by Letters Patent of the United States, is—

1. In an apparatus of the character described a converter having a combustion chamber in the lower part thereof, a tier of checkerwork of tiles of fire clay and iron above said combustion chamber, a mixing chamber above said checkerwork, an annular flue around the exterior of the mixing chamber, perforations through the inner wall of the said flue opening into the said mixing chamber, inlets 58 and 58^a immediately above

the said annular flue, another tier of checkerwork of tiles of fire clay and iron above the said mixing chamber, a chamber above the checkerwork to receive the gas, a valve in the top of the converter to let off the products of combustion, a pipe leading from the upper chamber to carry off the gas, pipes leading from a source of superheated steam and hydrocarbon gas into the combustion and mixing chambers and the perforated annular flue, and air inlets for the said chambers, substantially as and for the purposes described.

2. In an apparatus of the character described the combination with a converter having a combustion chamber in the lower part thereof, a tier of checkerwork of tiles of fire clay and iron above said combustion chamber, a mixing chamber above said checkerwork, an annular flue around the exterior of the mixing chamber, perforations through the inner wall of the said flue opening into the said mixing chamber, inlets 58 and 58^a immediately above the said annular flue, another tier of checkerwork of tiles of fire clay and iron above the said mixing chamber, a chamber above the checkerwork to receive the gas, a valve in the top of the converter to let off the products of combustion, a pipe leading from the upper chamber to carry off the gas, pipes leading from a source of superheated steam and hydrocarbon gas into the combustion and mixing chambers and the perforated annular flue, and air inlets for the said chambers, of a drip chamber E a pipe 72 connecting said drip chamber with the gas chamber above the checkerwork, and a blow pipe 74, substantially as and for the purposes described.

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

JOHN B. ARCHER.

Witnesses:

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PERCY C. BOWEN.