(No Model.) 4 Sheets—Sheet 1.

J. A. WATERS.

APPARATUS FOR MANUFACTURING GAS.

No. 554,326. Patented Feb. 11, 1896.

Fig. 1.

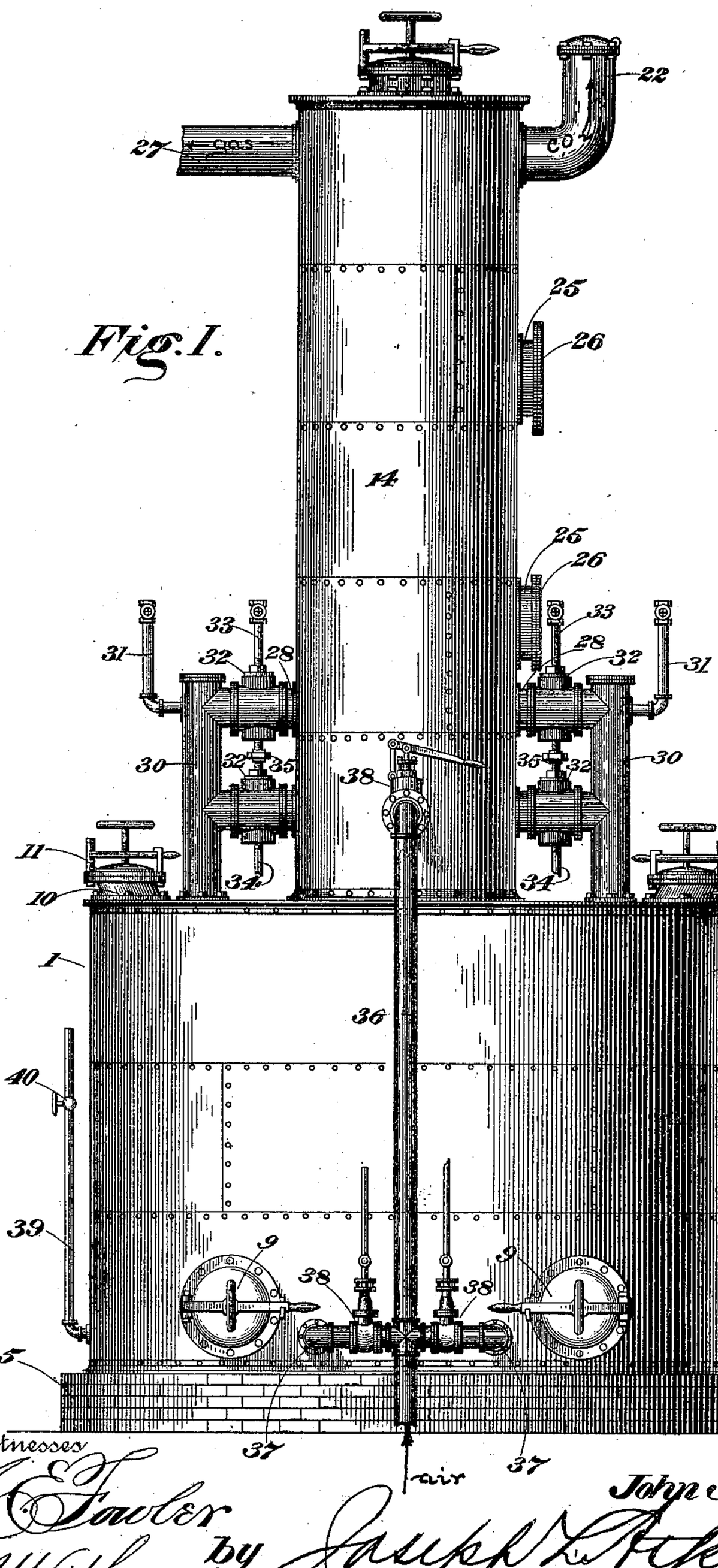

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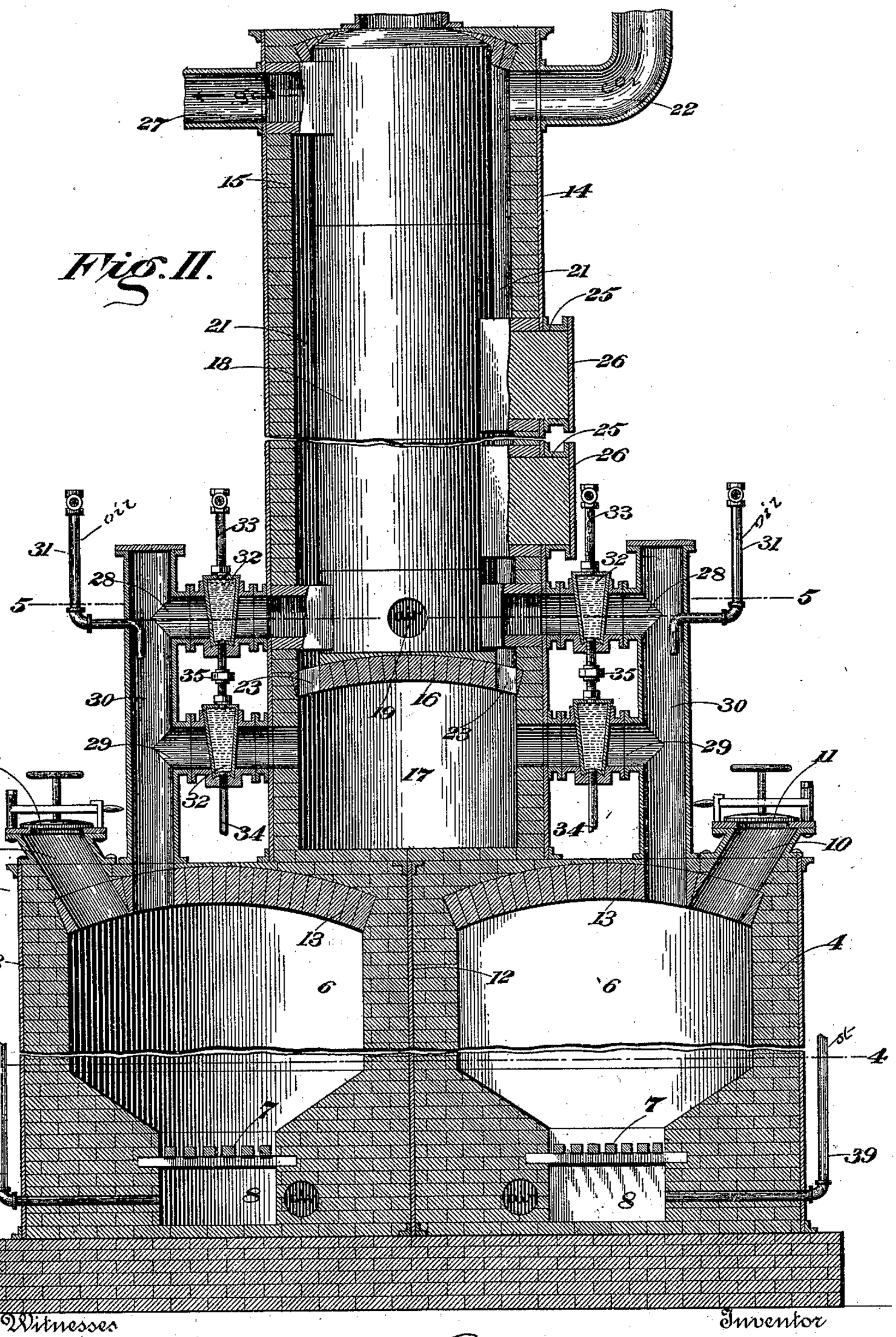
Fig. II.



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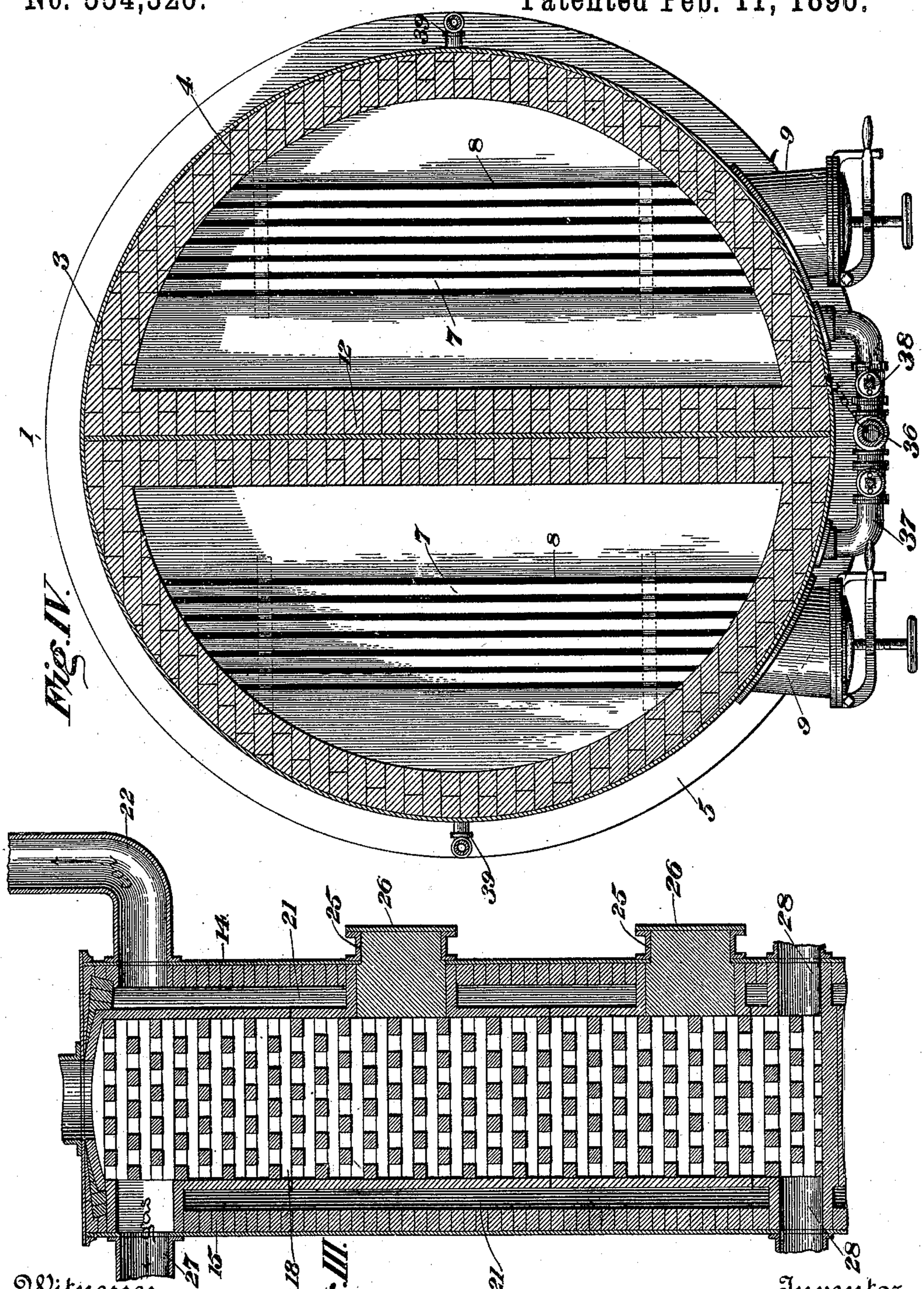

Fig. IV.

Fig. III.

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APPARATUS FOR MANUFACTURING GAS.

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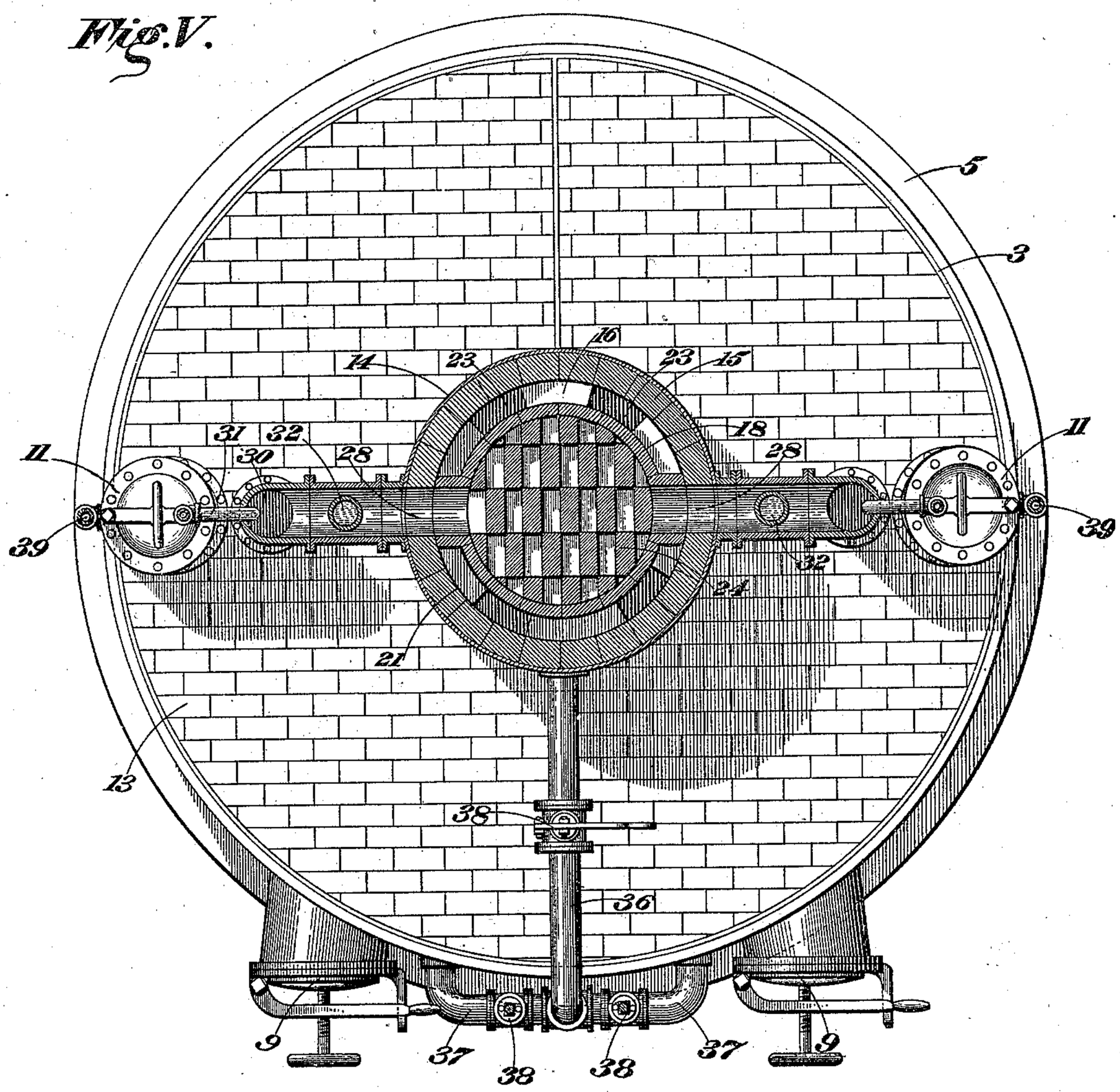
Fig. V.



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UNITED STATES PATENT OFFICE.

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APPARATUS FOR MANUFACTURING GAS.

SPECIFICATION forming part of Letters Patent No. 554,326, dated February 11, 1896.

Application filed June 21, 1894. Serial No. 515,268. (No model.)

To all whom it may concern:

Be it known that I, JOHN A. WATERS, of Stamford, county of Fairfield, State of Connecticut, have invented certain new and useful Improvements in Apparatus for the Manufacture of Gas, of which the following is a specification, reference being had to the accompanying drawings.

The object of my invention is to produce improved apparatus for the manufacture of gas, especially of the kind known as "water-gas," either for fuel or illuminating purposes, whereby its productive operation is made practically continuous and with great economy of time and fuel.

Heretofore in one method of manufacturing water-gas it has been customary to employ a single generator and fixing chamber or regenerator, the plan of operation being to reduce a mass of carbon in the generator to an incandescent state and heat the regenerator until the refractory material which it contains is raised to the required temperature. Then, by supplying steam to the generator, its decomposing gases, commingling with carbureting material, are conducted to the regenerator and there rendered homogeneous or fixed. In the manufacture of gas by this process a very high heat in both the generator and the regenerator is necessary, and consequently the actual period of gas production by the use of such former apparatus is limited. Among the reasons therefor are that during the early part of the gas-making process the carbureting material is converted into lampblack and that in the latter part of the process, the regenerator being cooled, the gases are not properly fixed and fall away. Consequently in the use of such other apparatus it becomes necessary to reheat the generator and regenerator as before, an operation which must be repeated after each gas-making period. The consequences of this process by old methods are a great waste of fuel and carbureting material and the production of an unsatisfactory gas. By my invention these objections are overcome and I have produced an apparatus adapted to make a thoroughly-fixed non-condensable gas by a practically continuous operation and with a minimum consumption of fuel and carbureting material.

In the accompanying drawings, Figure I is a side elevation of my complete apparatus. Fig. II is a central vertical section thereof with the regenerator shown in elevation. Fig. III is a view of the regenerator heating-chamber, showing also the regenerator in section. Fig. IV is a section on a line 4 4 of Fig. II, and Fig. V a section on the line 5 5 of Fig. II.

Referring to the figures on the drawings, 1 indicates the exterior generator-wall of my apparatus, which is preferably cylindrical and is composed preferably of a metal casing 3 and an interior lining of fire-brick 4, the whole being sustained upon a suitable foundation 5. Within the generator-walls are two entirely separate and independent generator-chambers 6, of suitable shape and dimensions, provided, respectively, with grate-bars 7, ash-pits 8, and doors 9 in the lower part, and in the upper part with fuel-supply inlets 10 provided with suitable self-sealing doors 11. They are separated from each other by a metal partition and by intermediate fireproof walls 12 of suitable thickness and are, respectively, provided with arched roofs 13. The walls 12 and the arches 13 should be specially constructed of sufficient strength to support a superimposed regenerator heating-chamber composed of an exterior metallic shell 14 and an interior lining 15 of fire-brick. This regenerator heating-chamber is preferably cylindrical. A special purpose of building it above the generators is to make the line of draft from the generators to the regenerator heating-chamber as direct as possible for both of the generators.

16 indicates an arch, which defines below it a combustion-chamber 17 and supports above it a regenerator or fixing chamber 18, preferably built in sections, as indicated by lines in the drawings, of fire-clay. The outside diameter of the chamber 18 is considerably less than the inside diameter of the regenerator heating-chamber, and the former is coaxial with the latter, so that an annular flue 21 surrounds the regenerator and affords free egress on all sides thereof for the ascent of the products of combustion from the combustion-chamber 17 to a stack 22, which may be provided with a cap, as shown, communication between the combustion-chamber and the flue 21 being established by a series of

openings 23 in the arch 16 adjacent to its periphery. The interior of the regenerator is in practice filled with the usual checker-work or other refractory material 24 common in regenerators.

Ports 25 that constitute branches of the walls of the regenerator project at intervals through the walls of the regenerator heating-chamber and afford means for supplying or removing the checker-work material to or from the interior of the regenerator. These ports are closed by plugs of fire-brick and by suitable doors 26.

A gas-outlet 27 communicates through the walls of the regenerator heating-chamber with the interior of the regenerator near its top. Supply-inlets 28 communicate, respectively, in like manner with the interior of the regenerator near its bottom and similar inlets 29 communicate, respectively, with the interior of the combustion-chamber 17. An inlet 28 and an inlet 29, respectively, establish communication preferably through a pipe 30 with one of the generators 6, a separate pipe and a pair of inlets being provided for each of the generators. Each of the pipes 30 should be arranged to open through the roof 13 of its generator near its middle, not only to afford ready means of egress of the products of combustion from the generator, but also in order that an oil-supply pipe 31, adapted to discharge carbureting material from a source of supply (not illustrated) to the interior of the pipe, may discharge it well into the body of the generator.

Suitable valves 32, preferably water-cooled, as by water-supply pipes 33 and 34, are located in each of the inlets 28 and 29, respectively, and are adapted, by suitable operating mechanism 35ª, to independently control the passages afforded through the respective inlets.

35 indicates a ball-joint independently connecting the intermediate supply-pipes of the valves 32.

Suitable provision for supplying forced draft to the interior of the ash-pits 8 and the combustion-chamber 17, respectively, is afforded by means of a blast-pipe 36 and its branches 37, that communicate with a source of air-supply. (Not illustrated.) The pipe 36 and its branches 37 are, respectively, controlled by valve-operating mechanism 38 of any suitable and ordinary construction. Each of the generators is provided with a steam-pipe 39 communicating, respectively, with a source of steam, (not illustrated,) and which gains access to the interior of the generators through the walls thereof and preferably enter beneath the grate-bars.

A valve 40 in each of the pipes 39, respectively, controls the passage of steam through it.

The operation of my apparatus is as follows: The generators are first filled, through the inlets 10, with coke, coal, preferably anthracite, or any other suitable fuel. The valves in the inlets 29 are opened and the fuel in the generators is ignited. An air-blast is then supplied from the branch pipes 37 and the pipe 36. The products of combustion from the body of fuel in the generator passing up through the inlets 29 enter the combustion-chamber 17, where combustion is completed by the secondary air discharged therein through the pipe 36, and, passing upward outside of the regenerator 18, raise the temperature thereof and of the checker-work within it to the required temperature. Under certain conditions, as in beginning the operation of my apparatus, it may be desirable to heat the regenerator by special means. I therefore provide for the chamber 18, near its bottom, an air-inlet 19, through which secondary air may be admitted to the interior of the regenerator for converting the lower part thereof into an auxiliary combustion-chamber. By the time the fuel in the generators is rendered incandescent the regenerator and its contents will have been properly heated. Thereupon the valves in the inlets 29 are closed and the valves in the adjacent inlets 28 are opened. Steam is then admitted by the operation of the valves 40 and is discharged into the incandescent mass of carbon in the generators. The hydrogen and carbonic oxide, decomposed by the action of the heated carbon from steam, pass upward through the pipes 30, commingling with the carbureting material discharged from the pipes 31 and, passing through the heated checker-work of the regenerator, are discharged as a stable, fixed and clean gas through the outlet 27. This process is continued until the gas-making period of the one generator has altogether or nearly expired, when the valve in the inlet 28 on one side is closed, the operation of the other generator being continued. One generator may be filled or refilled with fuel while the other is in operation. In this manner, after the initial heating, there is practically no loss of fuel during the time of preparation for each gas-making period, and the periods of gas-making are practically continuous. Moreover, by providing two separate conduits for the products of combustion and the gas, pollution of the checker-work that is consequent upon the passage of the products of combustion through it is entirely avoided. The checker-work is kept clean, in the best operative condition, and all loss either in time of operation or quality of the gas produced is eliminated.

I do not confine myself to the details of construction herein shown and described, but reserve the right to modify and vary them at will within the scope of my invention.

I am aware of Patent No. 512,950, dated January 16, 1894, for apparatus for distilling or gasifying hydrocarbons, said apparatus being particularly designed with a view to prevent the loss of aromatic hydrocarbons. Among the characteristics of my invention which distinguish it from the apparatus disclosed in said patent are the following: The relative arrangement of the parts is such that

no exhaust mechanism is required to draw the gases through the apparatus, and no separate furnace or fireplace for the burning of coke or other solid fuel is required to maintain continuous heat for the gases during their passage through the apparatus. Furthermore, with my apparatus the blast gases may be directed from both generators simultaneously into the regenerator and regenerator heating-chamber, while in said patent the valves necessarily cut off communication from one of the chambers A' A^2 when opening communication with the other.

What I claim, broadly, is—

1. In gas-making apparatus, the combination with the generators 6 6, of the superimposed combustion-chamber 17 and regenerator 18 the latter being surrounded by the annular flue or heating-chamber 21 and the roof of the chamber 17 having openings communicating with the chamber 21, the vertical pipes 30 each opening from the roof of a generator 6 and having the branch pipes 28 and 29 communicating respectively with the regenerator 18 and chamber 17, and valves 32 for independently controlling the pipes 28 and 29.

2. In gas-making apparatus, the combination with the generators 6 6, of the superimposed combustion-chamber 17 and regenerator 18 the latter being surrounded by the annular flue or heating-chamber 21 and the roof of the chamber 17 having openings communicating with the chamber 21, the vertical pipes 30 each opening from the roof of a generator 6 and having the branch pipes 28 and 29 communicating respectively with the regenerator 18 and chamber 17, the oil-supply pipes 31 leading into the pipes 30, and valves 32 for independently controlling the pipes 28 and 29.

3. In gas-making apparatus, the combination with the generators 6 6, of the superimposed combustion-chamber 17 and regenerator 18 the latter being surrounded by the annular flue 21 and the roof of the chamber 17 having openings communicating with the chamber 21, the vertical pipes 30 each opening from the roof of a generator 6 and having the branch pipes 28 and 29 communicating respectively with the regenerator 18 and chamber 17, valves 32 for independently controlling the pipes 28 and 29, and the air-blast pipes 36 and 37 for supplying air to the ash-pits of the generators and to the chamber 17.

4. In gas-making apparatus, the combination with the generators 6 6, of the superimposed combustion-chamber 17 and regenerator 18 the latter being surrounded by the annular flue or heating-chamber 21 and the roof of the chamber 17 having openings communicating with the chamber 21, the vertical pipes 30 each opening from the roof of a generator 6 and having the branch pipes 28 and 29 communicating respectively with the regenerator 18 and chamber 17, the valves 32 for independently controlling the pipes 28 and 29, and the air supply or inlet 19 for admitting secondary air to the bottom of the regenerator 18.

In testimony of all which I have hereunto subscribed my name.

JOHN A. WATERS.

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