No. 848,963. PATENTED APR. 2, 1907.

J. J. BUSENBENZ.

GAS MANUFACTURING APPARATUS.

APPLICATION FILED MAY 26, 1906.

5 SHEETS—SHEET 1.

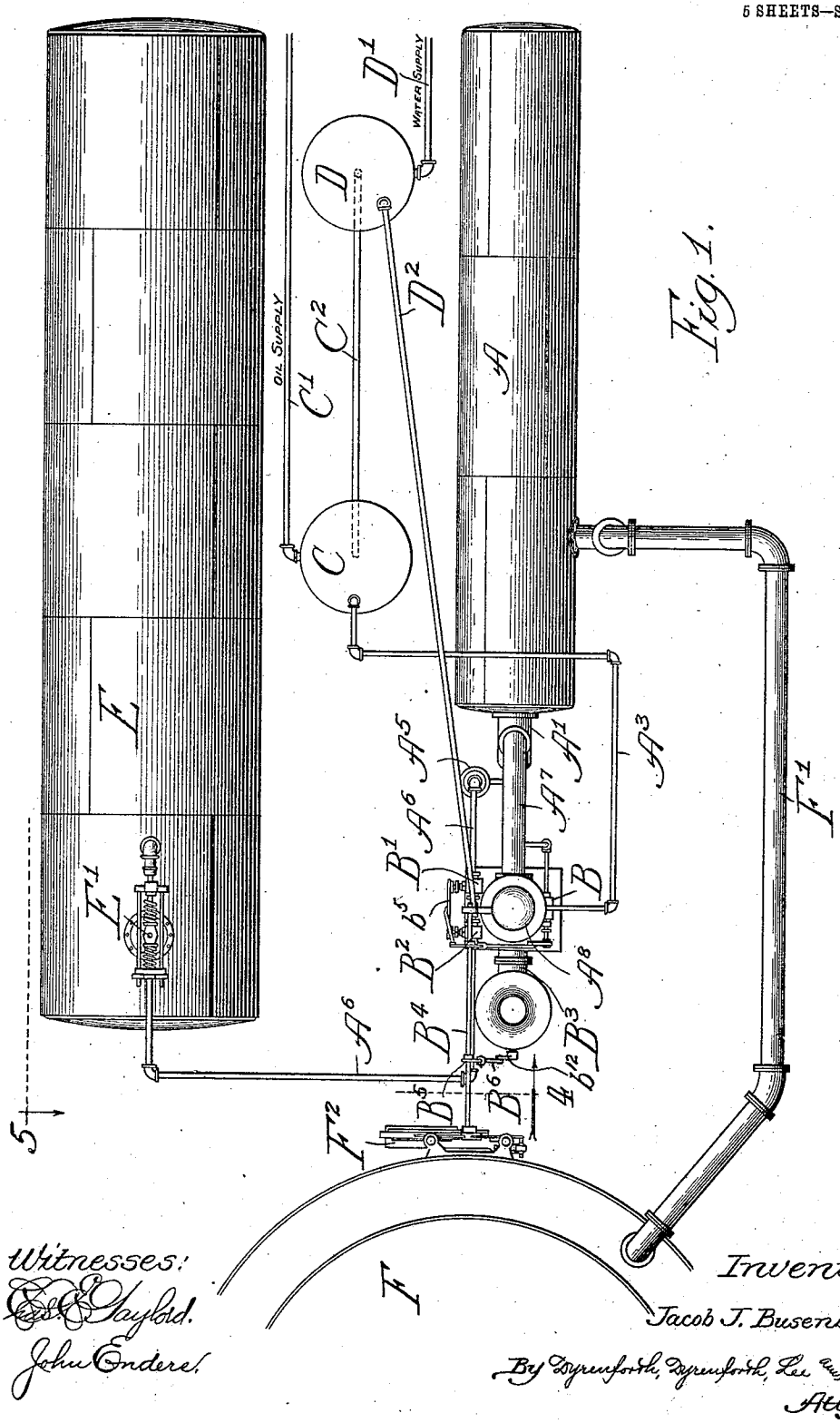

Fig. 1.

Witnesses:
E. E. Gaylord.
John Endere.

Inventor:
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By Dyrenforth, Dyrenforth, Lee & Wiles,
Attys.

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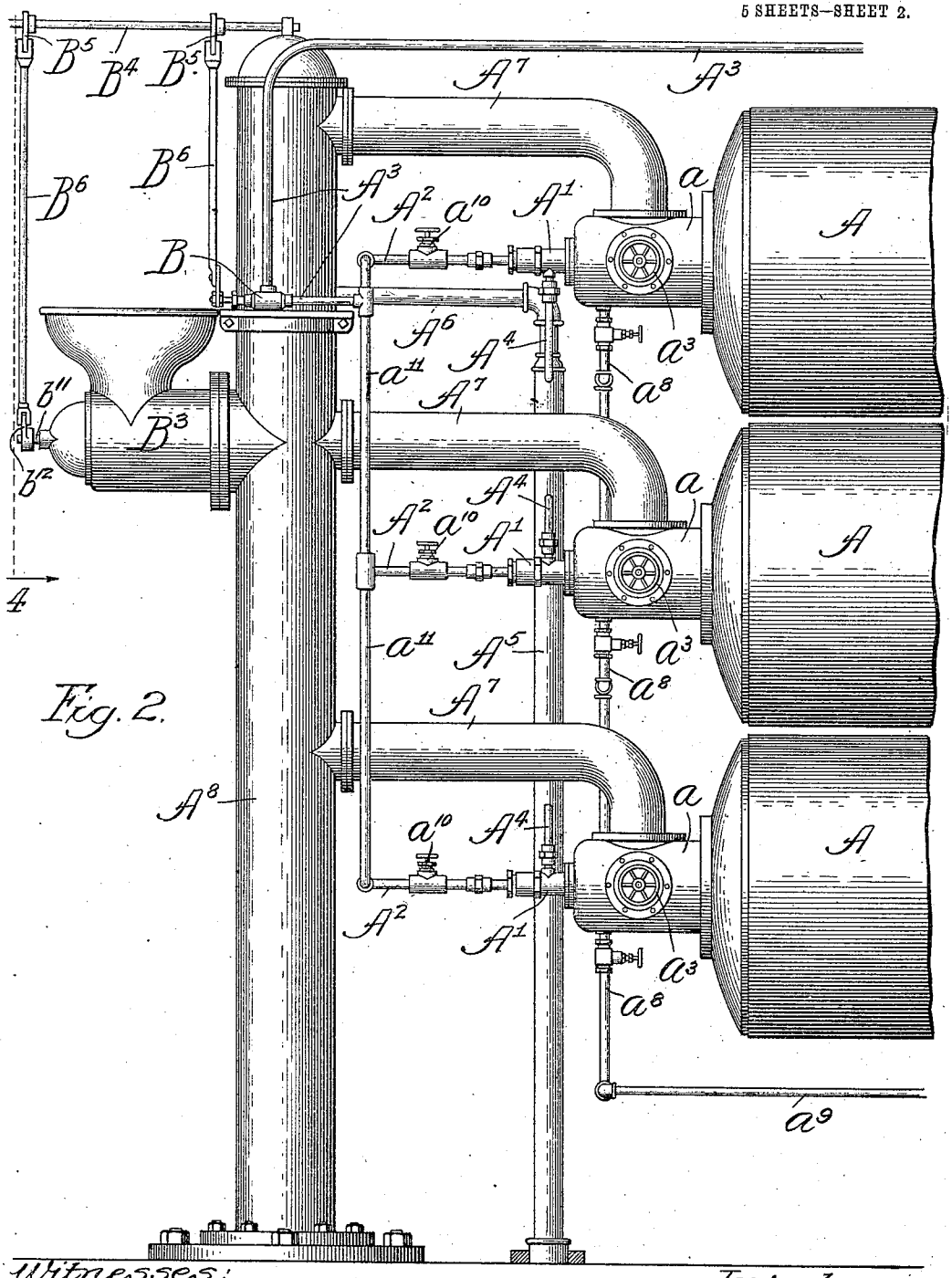

Fig. 2.

Witnesses:
E. C. Caylord.
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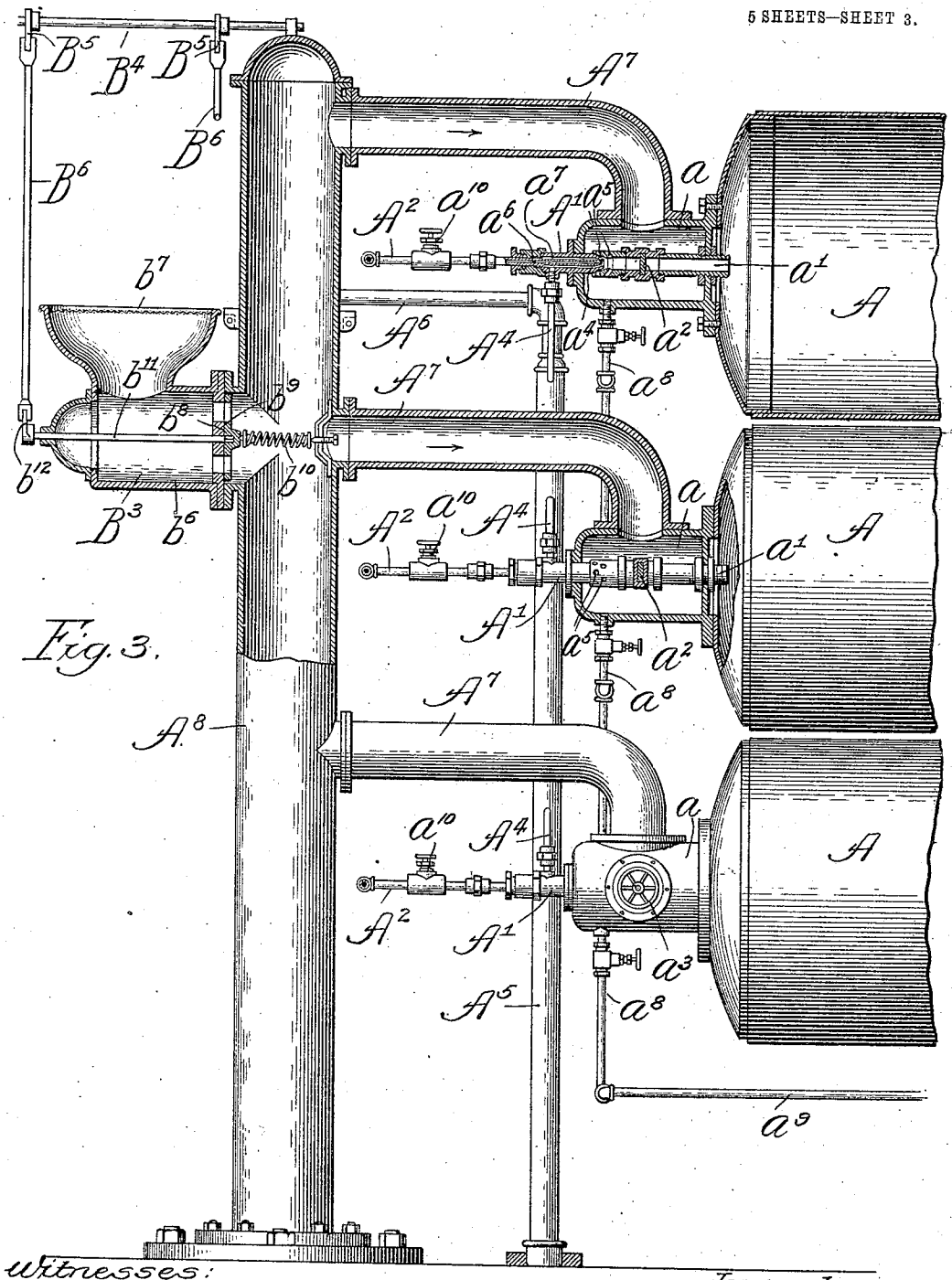

Fig. 3.

Witnesses:
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John Enders.

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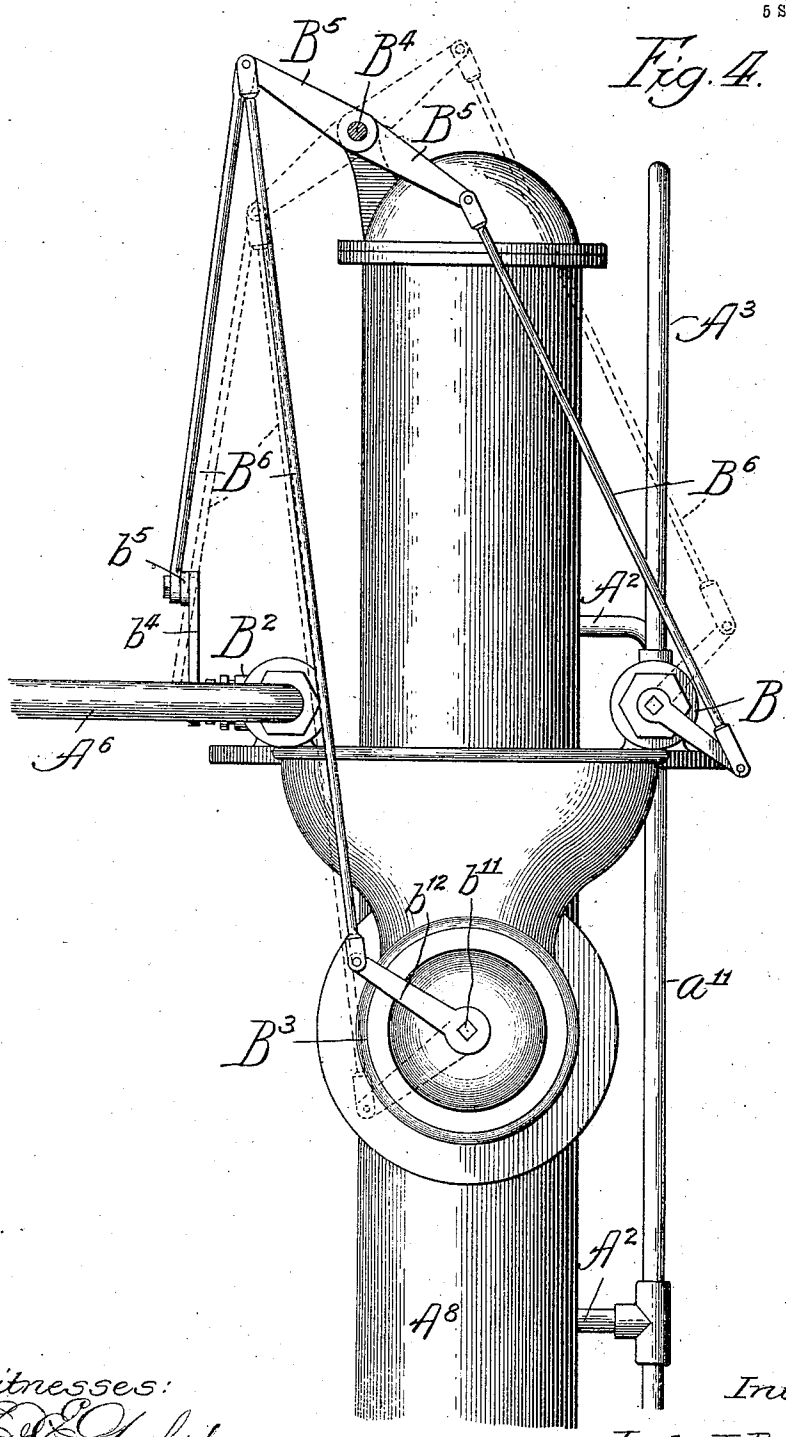
5 SHEETS—SHEET 4.

Fig. 4.



Witnesses:
Chas. E. Taylor.
John Enders.

Inventor:
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5 SHEETS—SHEET 5.

Fig. 5.

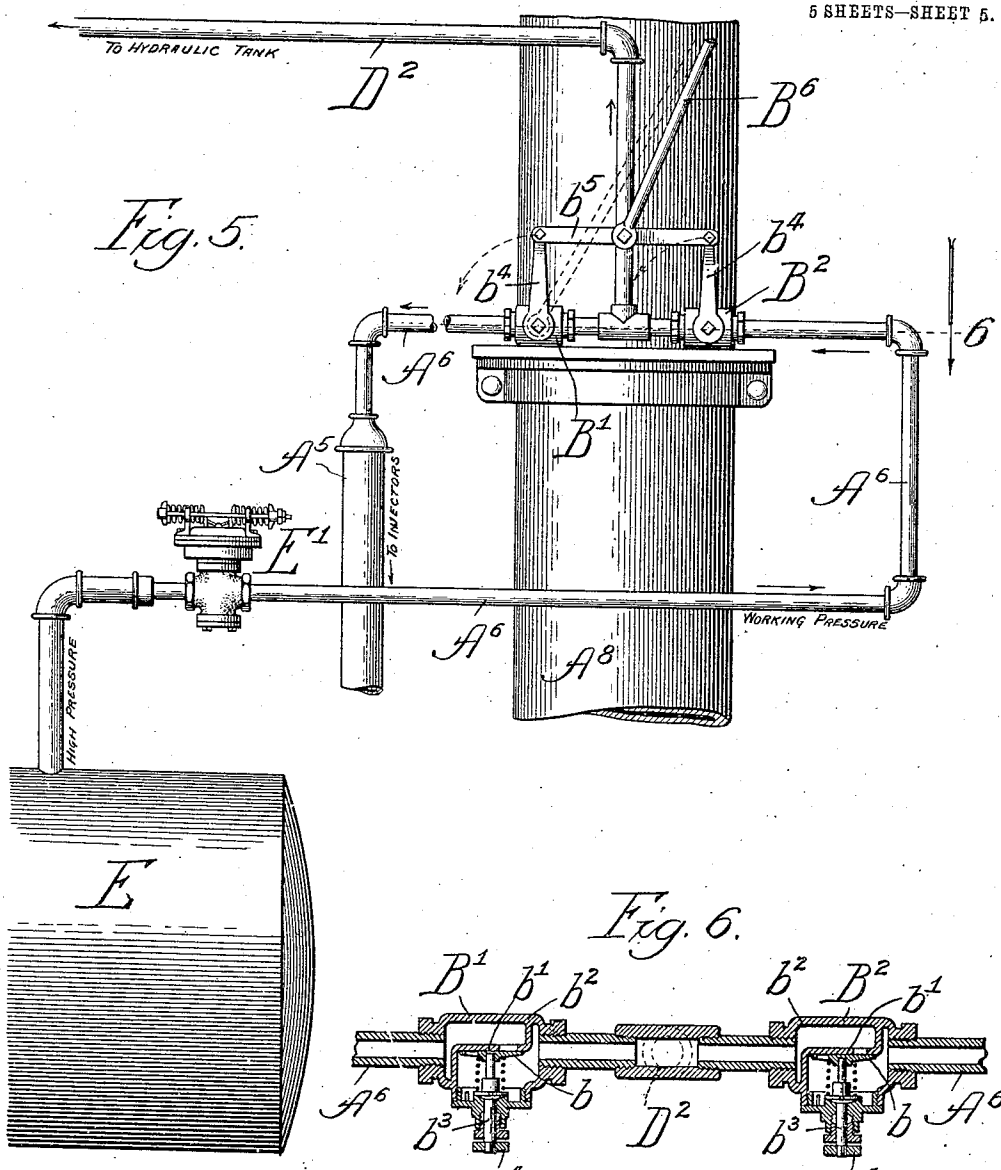

Fig. 6.

Witnesses:

Earl Gaylord.

John Enderi

Inventor:

Jacob J. Busenbenz.

By Byrnes, Byrnes, Lee & Wheeler.

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UNITED STATES PATENT OFFICE.

JACOB J. BUSENBENZ, OF CHICAGO, ILLINOIS, ASSIGNOR TO INDUSTRIAL GAS CONSTRUCTION CO., OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

GAS-MANUFACTURING APPARATUS.

No. 848,963. Specification of Letters Patent. Patented April 2, 1907.

Application filed May 26, 1906. Serial No. 318,825.

To all whom it may concern:

Be it known that I, JACOB J. BUSENBENZ, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Gas-Manufacturing Apparatus, of which the following is a specification.

My invention relates particularly to the manufacture of gas from volatile liquids, such as the hydrocarbon oils, alcohol, or the like.

My primary object is to provide improved apparatus for manufacturing and storing for current use a substantially fixed gas, dispensing with the use of heat in the generation of the vapor entering into the gas mixture, and providing for automatic operation of the apparatus and the formation of the mixture under such conditions as to insure always the proportions requisite to a fixed gas.

In the operation of the apparatus shown a volatile liquid, such as gasolene, and air are injected under corresponding pressures in atomizing relation into a mixer-chamber in the absence of heat, and air from the external atmosphere is drawn therewith into the mixer-chamber in sufficient quantity to form the proper admixture of air and vapor to form a fixed gas. The admission of the air under pressure, the oil under pressure, and the air drawn under suction from the atmosphere is automatically controlled by the movable member of a gas-holder, said gas-holder being in communication with the mixer-chamber. The source of oil-supply is an oil-tank, in which the oil is displaced by water from a water-tank under the same pneumatic pressure as that of the air, serving as an atomizing agent at the mixer-chamber.

The preferred construction is illustrated in the accompanying drawings, in which—

Figure 1 represents a plan view of gas apparatus constructed in accordance with my invention and operating upon the principle above described, a portion only of the gas-holder being shown; Fig. 2, a broken side elevational view showing the construction at the injection ends of the mixer-chambers, of which three are shown; Fig. 3, a broken vertical sectional view of the portion of the apparatus shown in Fig. 2; Fig. 4, a view taken as indicated at line 4 of Figs. 1 and 2 and showing in elevation an air-pipe through which air is introduced from the external atmosphere; Fig. 5, a broken side elevational view taken as indicated at line 5 of Fig. 1; and Fig. 6, a plan sectional view taken as indicated at line 6 of Fig. 5, said view showing the details of the valves controlling the air admitted to the injectors and to the hydraulic tank or water-tank.

In the construction illustrated, A represents a plurality of superposed mixer-chambers; A′, a series of injectors having oil-supply pipes A^2, receiving their supply from a common pipe A^3, and having compressed-air pipes A^4, receiving their supply from a common stand-pipe A^5, which in turn is supplied from a compressed-air pipe A^6; A^7, a series of air-conduits receiving their supply through a common stand-pipe A^8; B, an automatically-operated valve controlling the oil admission through the pipe A^3; B′ B^2, Fig. 5, a pair of automatically-actuated valves controlling the passage of the compressed air through the pipe A^6; B^3, an automatically-actuated valve controlling the admission of air from the external atmosphere to the stand-pipe A^8; B^4, an automatically-actuated rock-shaft controlled by the gasometer and equipped with a plurality of arms B^5, connected by links B^6 with the actuating-arms on the stems of the valves mentioned; C, an oil-tank serving as a source of supply for the oil-pipe A^3 and having a pipe C′, through which oil may be introduced, and a pipe C^2, through which water under pressure may be supplied; D, a combination hydraulic and pneumatic tank with which the pipe C^2 is in communication and which receives its water-supply through a pipe D′ and its air-pressure through a pipe D^2, which connects with the pipe A^6 between the valves B′ B^2; E, a tank containing air under high pressure, from which the pipe A^6 receives its supply through a reducing-valve E′ of common construction; F, a gas-holder receiving its supply from the mixer-chambers through a pipe F′, and F^2 means controlled by the movable member of the gas-holder for actuating the rock-shaft B^4 in one direction to close the valves B, B′, B^2, and B^3 when the holder is filled with gas and to open said valves when the gas-supply is nearing exhaustion.

The mixer-chambers A may be of any suitable construction. They are shown as comprising cylindrical tanks located one above the other. The injectors A′ are located one

above the other and connected with the adjacent ends of the tanks A. Each injector is located partially within a chamber a, connected with the tank end and forming a portion of the conduit A^7. A tube a', located within the chamber a, is equipped with a gate-valve a^2, having a stem projecting through a lateral wall of the chamber a and equipped with a hand-wheel a^3, by means of which the valve may be manually opened or closed. One end of the tube a' opens into the mixer-tank, and the other end thereof terminates near the opposite end of the chamber a and has entered therein a nozzle a^4. Adjacent to the point of the nozzle the tube a' is provided with air-inlets a^5. The nozzle has a central passage a^6 for oil, and this passage is in communication with the corresponding oil-pipe A^2. The nozzle also has an annular channel a^7 surrounding the oil-channel, and with said annular channel communicates the corresponding air-pressure pipe A^4. The annular channel converges at the point of the nozzle, so that the compressed air and the oil under pressure enter the tube a' in atomizing or vaporizing relation, and the external atmosphere is entrained at the point of the nozzle. The chambers a are equipped with drain-pipes a^8, which communicate with a common drain-pipe a^9. Each of the oil-admission tubes A^2 is equipped with a manually-operated valve a^{10}.

The connection of the oil-supply pipe A^3 with the branch supply-pipes A^2 is through a stand-pipe a^{11}, as shown in Figs. 2 and 4. It will be understood that the stand-pipe A^5 and the stand-pipe A^8 have dead ends at their lower ends.

The valve B is similar in construction to the valves B′ B^2. (Shown in detail in Fig. 6.) Each of the valves B B′ B^2 comprises a disk b, working on a seat b' within a casing b^2, and a stem b^3, equipped with an arm b^4. In the case of the valve B the arm b^4 is connected directly with one of the rods B^6, actuated by the rock-shaft B^4. In the case of the valves B′ B^2 the arms b^4 are connected, as shown in Fig. 5, by a link b^5 to the corresponding connecting-rod B^6. Thus one connecting-rod serves to actuate both of the valves B′ B^2.

The construction of the valve B^3 will be understood from Fig. 3. The casing b^6 constitutes an intake for the pipe A^8 and has an upturned orifice b^7, guarded by a screen. The valve-seat is designated b^8 and comprises a disk adjacent to whose inner surface is located a disk valve b^9, held firmly upon its seat by a spring b^{10}. The stem b^{11} of the valve extends through the disk b^8 and through the outer end of the chamber b^6 and is equipped with an arm b^{12}, connected with the corresponding link B^6, operated by the rock-shaft B^4.

The construction of the tanks C and D and their connections need not be described in detail further than to say that the pipes are usually equipped with manually-operated valves (not shown) to enable the oil and water to be drawn in and discharged at will. During the operation of the plant the pipes C′ and D′ are of course closed.

The construction of the compressed-air tank E is not essential. The construction of the reducing-valve E′ need not be described in detail, as any suitable reducing-valve may be employed to allow air to pass from the tank E into the pipe A^6 and assume a working pressure within said pipe of any desired amount.

The construction of the gas-holder F may be varied. Any suitable gas-holder having a movable bell or gasometer may be employed. Also the device F^2 for actuating the rock-shaft B^4 may be of any suitable construction. Preferably it is of the construction shown and claimed in my pending application, Serial No. 252,761, filed March 29, 1905, and it is sufficient to say that when the gasometer reaches the upper end of its movement the device F^2 operates to turn the rock-shaft B^4 in a direction to close the valves B, B′, B^2, and B^3, and when the gasometer reaches the lower end of its traverse the device F^2 operates to turn the rock-shaft B^4 in the opposite direction and open said valves.

The operation may be briefly summarized. The tank E is kept filled with air under a high pressure, being supplied from any suitable source. (Not shown.) Air from the tank E passes the reducing-valve E′ into the pipe A^6 and maintains within said pipe a suitable working pressure. Assuming the valves B′ B^2 to be open, the air-pressure from the pipe A^6 is admitted through the pipe D^2 to the hydraulic tank D, displacing the water in said tank and forcing it gradually into the tank C, where the water displaces the oil, forcing it through the pipe A^3 to the injectors, it being assumed that the manually-operated valves a^{10} are open and the automatically-actuated valve B is open. Pressure from the pipe A^6 is also admitted into the stand-pipe A^5, from which currents of compressed air pass through the annular passages of the injectors, meeting the streams of oil passing therethrough from the tank C and atomizing the oil. The injectors operate to draw in air through the conduits A^7, which are supplied from the stand-pipe A^8, it being understood that the valve B^3 is open during the process of manufacturing the gas. The oil and air passages through the injectors and the air-inlet passages a^5, through which atmospheric air is admitted, bear such relation to each other under the conditions of the working pressures upon the oil and air passing through the injectors that the oil is thoroughly vaporized, and just the right quantity of air is supplied to form a stable mixture or substantially fixed gas. This is ac-

complished without the application of heat, and herein lies a vast saving in the cost of operation, as well as a great simplification of the mechanism and an elimination of many serious difficulties heretofore encountered in the manufacture of gas from volatile liquids.

It will be understood that by means of the gate-valves a^2 and the manually-operated valves a^{10}, controlling the oil-pipes A^2, the operation at any injector may be stopped without affecting the operation of the remaining injectors. In equipping plants for municipal purposes it is customary to provide a plant having sufficient capacity to meet the needs at the time of installation, using only one of the injectors, thus providing for increased capacity as necessity may require.

In the practical operation of a plant of the construction illustrated it has been found that the apparatus will work automatically with the greatest certainty and regularity and that little attention on the part of an attendant is required.

The injector herein shown is illustrated and described in detail and fully claimed in my application, Serial No. 318,826, of even date herewith.

It is to be understood that the foregoing detailed description has been given for clearness of understanding only and that no undue limitation of the invention is intended thereby.

What I regard as new, and desire to secure by Letters Patent, is—

1. Apparatus for manufacturing gas from volatile liquid without the use of heat, comprising, in combination, a mixer-chamber, a movable gas-holder in communication with the mixer-chamber, an atomizing-injector connected with the mixer-chamber, liquid and air conduits connected with the injector, liquid and air supply sources connected with said conduits, pressure-regulating means controlling the pressure of air and liquid passing through the injector, valves for said conduits, and means controlled by the gas-holder controlling said valves.

2. The combination of a mixer-chamber, an injector connected therewith having liquid and air passages, means for introducing volatile liquid and air under common pressures and in atomizing relationship through the injector, a gas-holder in communication with said mixer-chamber, an air-conduit through which air may be drawn from the external air through said injector, a valve for said conduit, and means controlled by the gas-holder serving to close said valve when the gas-supply is sufficient and to open said valve when the gas-supply approaches exhaustion.

3. The combination of a mixer-chamber, an injecting device having a liquid-passage and an air-passage through which liquid and air may be introduced in atomizing relationship, an air-supply source communicating with said air-passage, a liquid-tank having connection with said liquid-passage and serving as a supply source for volatile liquid, a water-tank connected with said volatile-liquid tank, and an air-conduit connecting said air-supply source with said water-tank.

4. The combination of a mixer-chamber, an injecting device having a liquid-passage and an air-passage through which liquid and air may be introduced in atomizing relationship, an air-supply source communicating with said air-passage, a liquid-tank having connection with said liquid-passage and serving as a supply source for volatile liquid, a water-tank connected with said volatile-liquid tank, an air-conduit connecting said air-supply source with said water-tank, a gas-holder in communication with said mixer-chamber, a valve for said air-conduit, an air-intake for the passage of external air to the injecting device, a valve for said air-intake, and means controlled by the gas-holder and controlling said valves.

5. In apparatus for producing gas from carbonaceous liquid, the combination of a gas-holder having a movable member, a mixer-chamber in communication therewith, means for forcing into the mixer-chamber liquid and air under uniform common pressure and in atomizing relationship, the liquid and air orifices and the liquid and air pressures bearing a predetermined relation, whereby the proper atomizing and mixing effect is obtained, and means controlled by the movable member of the gas-holder serving to control the admission of the liquid and air to the mixer-chamber.

6. Apparatus for the purpose set forth, comprising a plurality of mixer-chambers, a plurality of injectors connected therewith, liquid and air conduits connected with said injectors, means for forcing liquid and air under pressure into the injectors, a series of air-conduits communicating with the injectors and with a common air-conduit, and a valved air-intake through which atmospheric air is supplied to said last-named conduit.

7. Apparatus for the purpose set forth, comprising a plurality of mixer-chambers, a plurality of injectors having liquid and air passages, means for supplying liquid and air under pressure to the injectors, a series of air-conduits connected with the injectors and with a common air-conduit, a valved inlet for said last-named conduit through which an induced flow of atmospheric air is admitted, and means for closing the liquid-passages of the individual injectors at will.

8. Apparatus for the purpose set forth, comprising a plurality of superposed mixer-chambers, a plurality of superposed injectors connected therewith, a stand-pipe for compressed air having branch passages connect-

ed with the injectors, an oil-supply pipe connected with the injectors, air-conduits connected with the injectors, a stand-pipe connected with said last-named conduits, and a valved inlet for said last-named stand-pipe.

9. Apparatus of the character set forth, comprising a mixer-chamber, an injector connected therewith having a liquid-passage and an air-passage, means for supplying liquid and air under pressure to the injector, valves controlling the passage of liquid and air to the injector, an air-conduit connected with the injector and having an inlet from the external atmosphere, a valve controlling said inlet, a gasometer in communication with the mixer-chamber, and a rock-shaft projecting from and controlled by the gasometer and controlling said valves.

10. Apparatus of the character set forth, comprising a mixer-chamber, an injector connected therewith comprising a tube communicating with the mixer-chamber and having an air-inlet near its outer end, a nozzle having liquid and air passages, a chamber inclosing said tube and into which said nozzle projects, a valve controlling the passage through said tube and having operating means projecting through a lateral wall of said chamber, and a valved air-conduit connected with said chamber.

11. Apparatus of the character set forth, comprising a plurality of superposed mixer-chambers, a plurality of injectors having air and liquid passages, a stand-pipe for compressed air connected with the air-passages of the injectors, a pipe communicating with said stand-pipe and having a valve, a series of air-conduits connected with the injectors, a stand-pipe connected with said air-conduits, an air-intake for said last-named stand-pipe equipped with a valve, a pipe communicating with the liquid-passages of the injectors and equipped with a valve, a gasometer communicating with said mixer-chambers, and controlling means for said valves controlled by said gasometer.

12. Apparatus for the purpose set forth, comprising a mixer-chamber, an injector connected therewith having a liquid-passage and an air-passage, a volatile-liquid tank connected with said liquid-passage, a water-tank connected with said volatile-liquid tank, a source of compressed-air supply, means of communication between said source of compressed-air supply and said water-tank and the air-passage of said injector, and pressure-reducing means controlling said means of communication.

13. In apparatus of the character set forth, the combination of a mixer-chamber, an injector connected therewith having a liquid-passage and an air-passage, a volatile-liquid tank connected with said liquid-passage, a water-tank connected with said volatile-liquid tank, a compressed-air tank, a pipe leading therefrom to said injector, a pair of valves connected with said pipe, a pipe leading from said first-named pipe between said valves to said water-tank, a gasometer connected with said mixer-chamber, and means controlled by said gasometer controlling said valves.

JACOB J. BUSENBENZ.

In presence of—
L. HEISLAR,
J. H. LANDES.