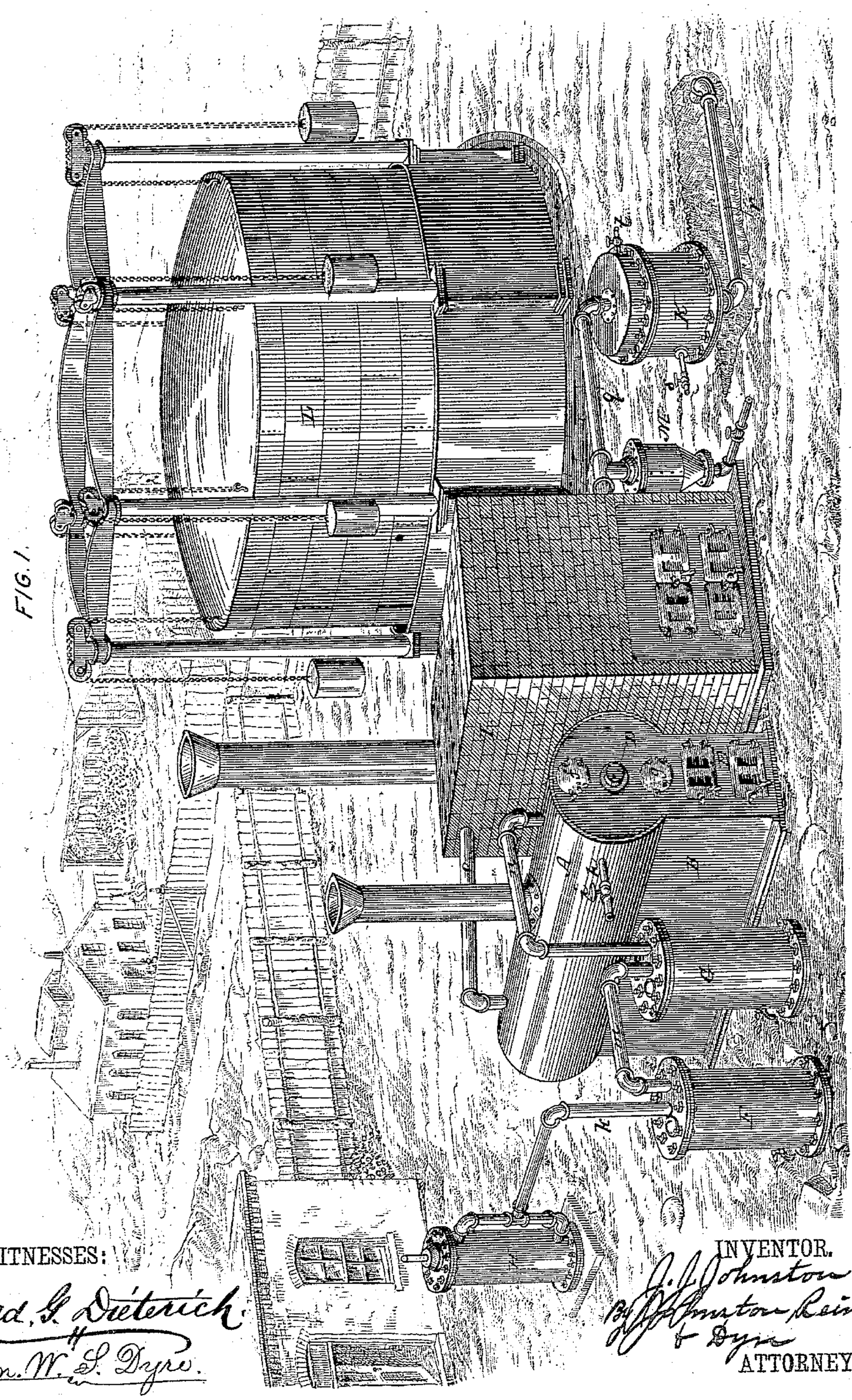
(No Model.) 3 Sheets—Sheet 1.

J. J. JOHNSTON.

PROCESS OF AND APPARATUS FOR MANUFACTURING GAS.

No. 356,587. Patented Jan. 25, 1887.

FIG. 1.



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(No Model.) 3 Sheets—Sheet 2.

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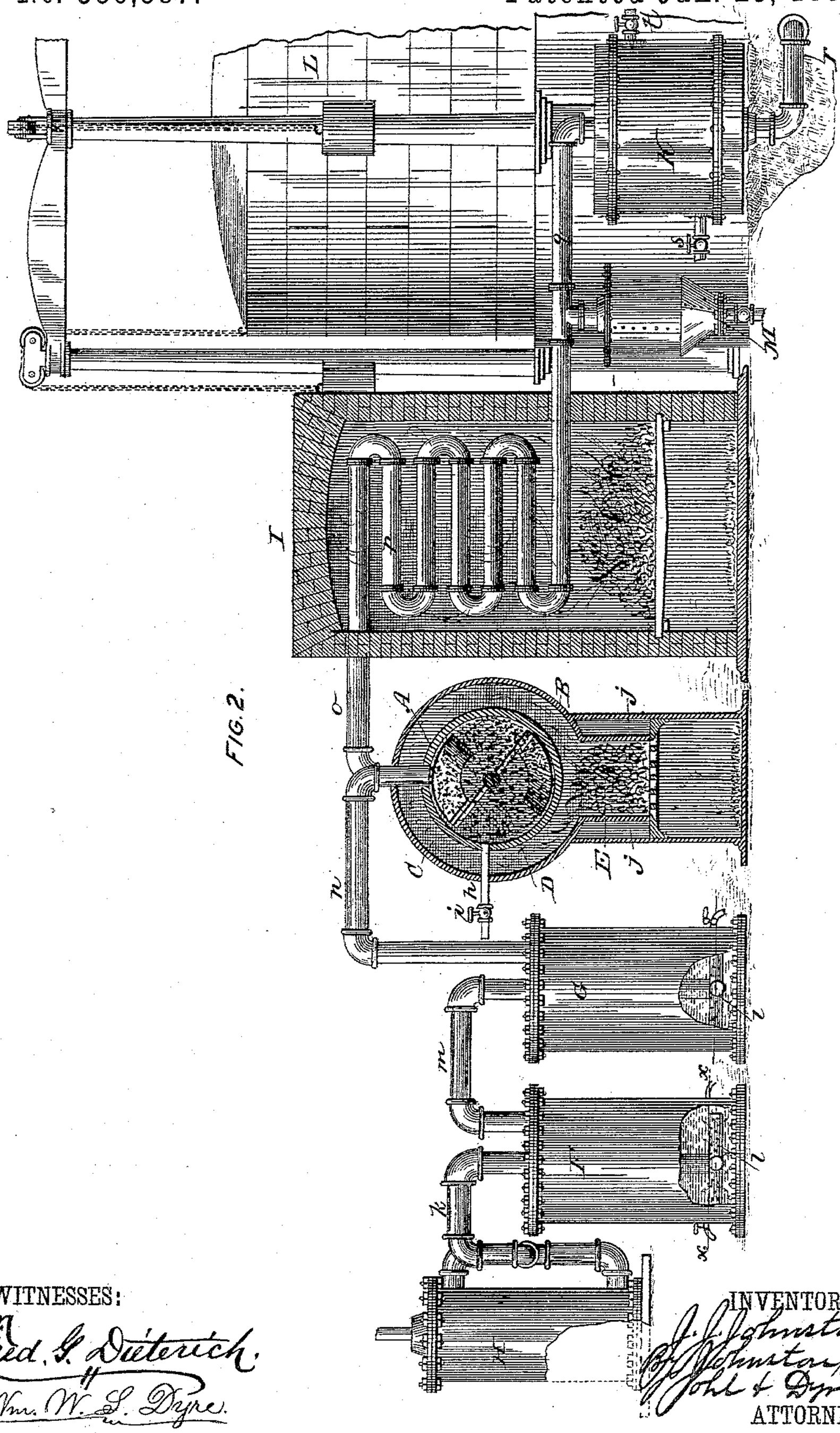

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(No Model.) 3 Sheets—Sheet 3.

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FIG. 3.

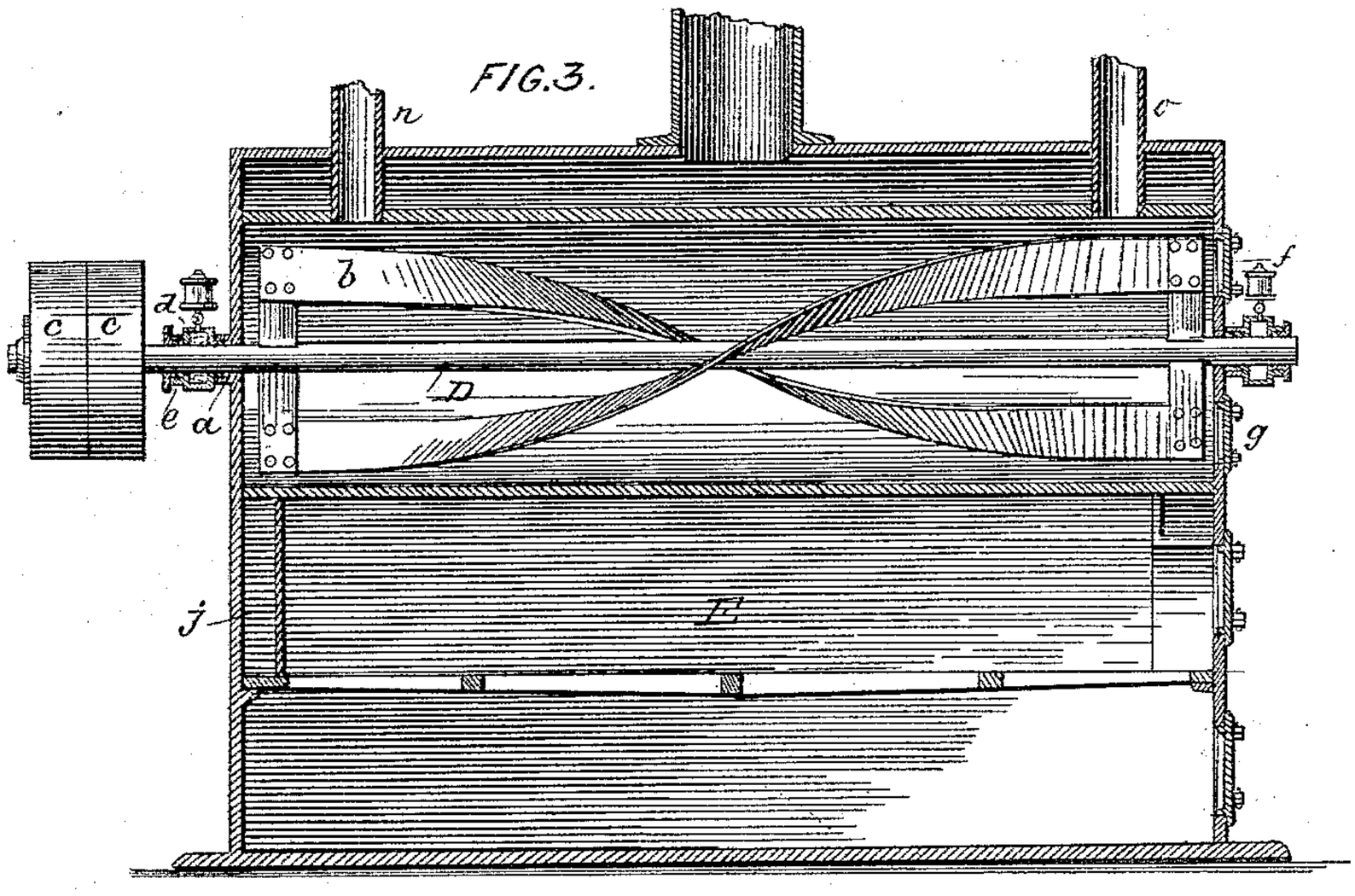


FIG. 4.

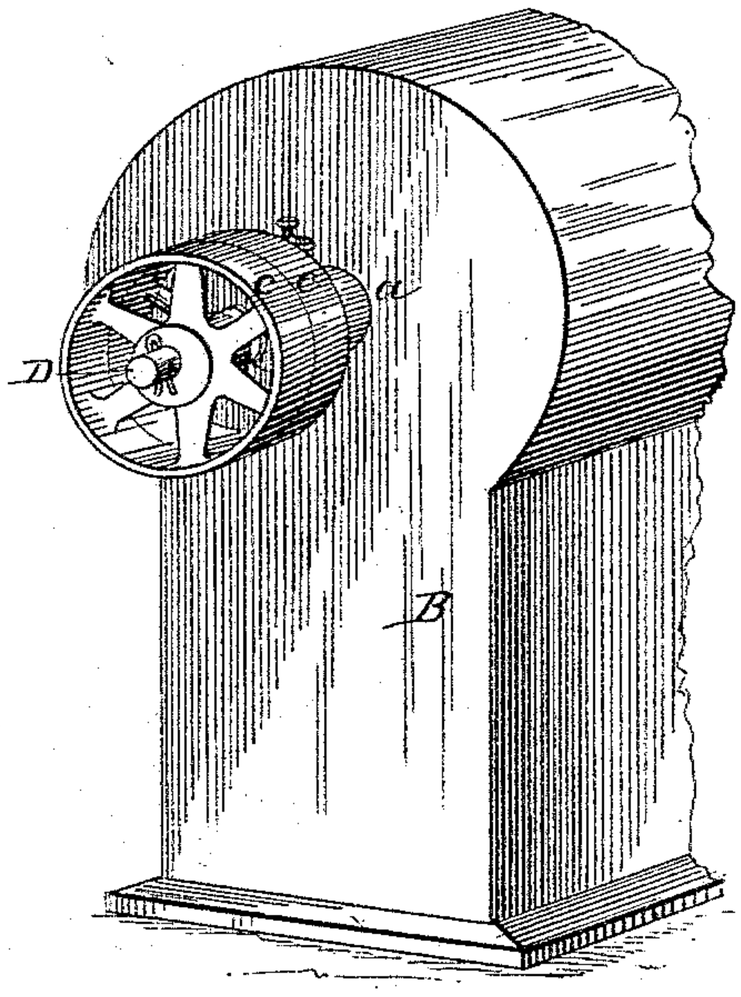
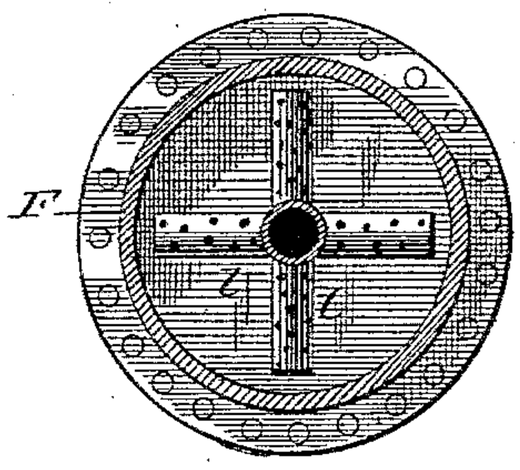


FIG. 5.



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UNITED STATES PATENT OFFICE.

JAMES J. JOHNSTON, OF COLUMBIANA, OHIO, ASSIGNOR OF ONE-HALF TO ALBERT C. ELLIS, OF PITTSBURG, PENNSYLVANIA.

PROCESS OF AND APPARATUS FOR MANUFACTURING GAS.

SPECIFICATION forming part of Letters Patent No. 356,587, dated January 25, 1887.

Application filed October 9, 1885. Serial No. 179,428. (No model.)

To all whom it may concern:

Be it known that I, JAMES J. JOHNSTON, a citizen of the United States, residing at Columbiana, in the county of Columbiana and State of Ohio, have invented certain new and useful Improvements in Process of and Apparatus for Manufacturing 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.

The invention relates to the process of and means for manufacturing gas which may be used for motive power or for heating and illuminating purposes, and has for its object the production of a superior quality of gas at a greatly-reduced cost as compared with the systems for making gas in general use.

In the prevailing practice of making gas from coal a very high degree of temperature is required to be applied to the coal (say from 900° to 1,000° Fahrenheit) before the gas commences to evolve, which is further heated from 1,400° to 1,800° Fahrenheit, and often more, before the gas becomes "fixed." By my process a comparatively low degree of heat (say from 400° to 600° Fahrenheit) is applied to the retort or still containing the carbonaceous matter to evolve gas.

The invention will be hereinafter fully described, and distinctly pointed out in the claims.

In the accompanying drawings, which form a part of this specification, Figure 1 represents a perspective view; Fig. 2, a longitudinal section; Fig. 3, a longitudinal section of the retort or still; Fig. 4, a rear end view of the still; Fig. 5, a horizontal section of one of the carburetors on the line *x x* of Fig. 2.

Reference being had to the drawings and the letters of reference marked thereon, A represents a retort or still contained within a furnace, B, and is arranged concentrically in the cylindrical portion thereof, so as to form an annular passage, C, for the products of combustion and cause them to surround the retort. A shaft, D, passes through the retort, and is journaled in each end, as shown at *a a*, and upon the shaft are secured two spiral blades, *b b*, curved in opposite directions. The end of the shaft D which projects out of the rear end of the still is provided with two pulleys, *c c*, adapted to be connected by suitable gearing to a power-shaft, (not shown,) and rotate the shaft D in opposite directions as the belt connecting the pulleys with the power-shaft is shifted. The journals *a a* in the ends of the still are provided with suitable stuffing-boxes, *d d*, containing a packing, and a gland, *e*, for the purpose of preventing the escape of any of the vapors from the still.

The front end of the still is provided with two sealing-doors—the upper one, *f*, for filling the still with carbonaceous matter, such as pulverized bituminous coal or oil-bearing shale. Any other carbonaceous matter may, however, be used; but I prefer those specified, as the best results have been obtained from their use. The lower door, *g*, is for removing said matter after all the gas has been evolved therefrom. A pipe, *h*, having a suitable valve, *i*, supplies the water required to moisten the carbonaceous matter contained in the still.

E represents the combustion-chamber of the furnace B, which is provided with dead-air spaces *j j j* upon its sides and rear end. The furnace B is provided with the usual appurtenances—such as a stack, grate-bars, doors, ash-pan, dampers, &c.—which need not here be described, as they are of ordinary and well-known construction.

F and G are carburetors, and H a double-acting air-pump, to which is attached a pipe, *k*, for conducting air into the carburetor F, from which it is discharged through perforated cruciform pipes *l* in the bottom of the carburetor, and passes up through the hydrocarbon oil, and is conducted through the pipe *m* into the next carburetor, G, from which it passes through pipe *n* into the still A, where it mingles with the vapors evolved from the heated carbonaceous matter, and is conducted through pipe *o* to the coil *p*, contained in the furnace I. From thence it passes by pipe *q* to the condenser K, where it is cooled, and finally through pipe *r* to the gasometer L for storage.

The carburetors F and G are provided with suitable inlet and discharge openings for the liquid hydrocarbon.

In another application, No. 192,892, filed

February 23, 1886, I have claimed the carburetors connected by pipes which extend from the top of one to or near the bottom of the next carburetor, in combination with a retort and a fixing-chamber.

While I have shown two carburetors, the number may be increased or diminished, as circumstances may require, and when desired to run the apparatus continuously an additional still may be employed, whereby one may be at work while the other is being discharged and refilled. To accomplish the latter object, it is only necessary to form branches in the pipe leading from the last carburetor to the stills, and provide them with valves for controlling the passage of the carbureted air.

In the line of the pipe *q* is connected a vessel, M, for collecting any refuse—such as coal-tar—which may be carried by the gas in its passage through the superheating-coil *p*, and is discharged through a pipe at its bottom.

The condenser is provided with a water-supply pipe, *s*, and a discharge-pipe, *t*.

The several parts of the apparatus being constructed substantially as described, the operation is as follows:

The still A is charged with carbonaceous matter—such as pulverized bituminous coal or oil-bearing shale—which is moistened with water from pipe *h*, and the carburetors F G with hydrocarbon, (crude petroleum-oil being preferred.) A fire is built in the furnace B and the contents of the still heated to about 400° Fahrenheit while the moistened carbonaceous matter is being agitated. This degree of heat having been continued about thirty (30) minutes, the matter in the still will become liquefied and will constitute coal-tar.

When a temperature of 400° Fahrenheit in the still has been reached, which is indicated by any suitable heat-measuring instrument applied thereto, (not shown,) the air-pump is put into operation and air from the surrounding atmosphere forced through the hydrocarbon oil in the carburetors F G and conducted into the still, when the temperature of the contents of the still is increased to about 600° Fahrenheit, never to exceed 700° Fahrenheit. The carbureted air, in passing through the heated carbonaceous matter in a state of agitation, combines with the vapors evolved therefrom and passes off through the pipe *o* to the coil *p* in the furnace I, where the gases will be superheated and fixed under a temperature of from 900° to 1,000° Fahrenheit. The gas is then conducted to the condenser, where it is cooled, and finally led to the gasometer or gas-holder.

During the operation of generating gas water is admitted to the still at intervals of thirty minutes (more or less) to keep the carbonaceous matter in a semi-liquid state until all of the vapors have been extracted therefrom, and to supply hydrogen and oxygen gas, which commingles with the gases evolved from the carbonaceous matter.

When all of the vapor is evolved from the carbonaceous matter in the still, the residue will be in the form of ashes, which are removed through the opening *g* and a fresh charge of the coal supplied, when the operation will be again repeated.

The apparatus may be varied in its capacity for making gas as the demand therefor may require.

I am aware that heretofore it has been proposed to vaporize liquid hydrocarbon by heating it and then to carry the vapor, by means of a body of highly-heated air, through a retort containing bituminous coal. In this instance the air is used only as a vehicle to conduct the vapor of hydrocarbon into the retort, and is not a body of carbureted air in the sense in which I use it. I am also aware that it has been proposed to heat air in a retort and then conduct it into another retort containing a solid hydrocarbon, where the heated air commingles with the vapor arising therefrom and is conducted to a third retort for fixing the gas. I am also aware that air has been passed through heated hydrocarbon oil and the gas into a retort containing coke, broken stone, or metal heated to white heat and destructive distillation. I do not therefore claim such as my invention.

Having thus fully described my invention, what I claim is—

1. The process of generating gas, which consists in charging a vessel with oil-bearing carbonaceous matter, moistening said matter, then heating it, conducting atmospheric air through liquid hydrocarbon and the carbureted air through the vessel containing the heated and moistened carbonaceous matter, and mingling it with the gases evolved therefrom, and finally subjecting the resulting gas to a higher degree of heat to fix it, substantially as described.

2. The process of generating gas, which consists in charging a vessel with bituminous coal or other oil-bearing carbonaceous matter, moistening said coal, then heating and agitating it; secondly, compressing atmospheric air and conducting it through liquid hydrocarbon, and the carbureted air through the vessel containing the coal while heated and agitated, and then conducting the resulting gas through a heater to fix it, substantially as described.

3. The process of generating gas, which consists in moistening and heating bituminous coal, carbureting air, then conducting the carbureted air through the coal and mingling it with the gases evolved therefrom, then superheating the resulting gas, and finally conducting the gas through a condenser into a suitable holder, substantially as described.

4. The combination of an air-pump, a carburetor or carburetors, a close chamber or still provided with a water-supply pipe, and a furnace for heating said still, substantially as described.

5. The combination of an air-pump, a car-

buretor or carburetors, a close chamber or still provided with a water-supply pipe, and an agitator and means for revolving the same, and a furnace for heating said still, substantially as described.

6. The combination of an air-pump, a carburetor or carburetors, a close vessel or still having a water-supply pipe, a furnace for heating said still, and a superheater, substantially as described.

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

JAMES J. JOHNSTON.

Witnesses:
A. C. JOHNSTON,
WM. W. S. DYRE.