(No Model.)

3 Sheets—Sheet 1.

J. M. ROSE.

APPARATUS FOR THE MANUFACTURE OF GAS.

No. 505,537. Patented Sept. 26 1893.

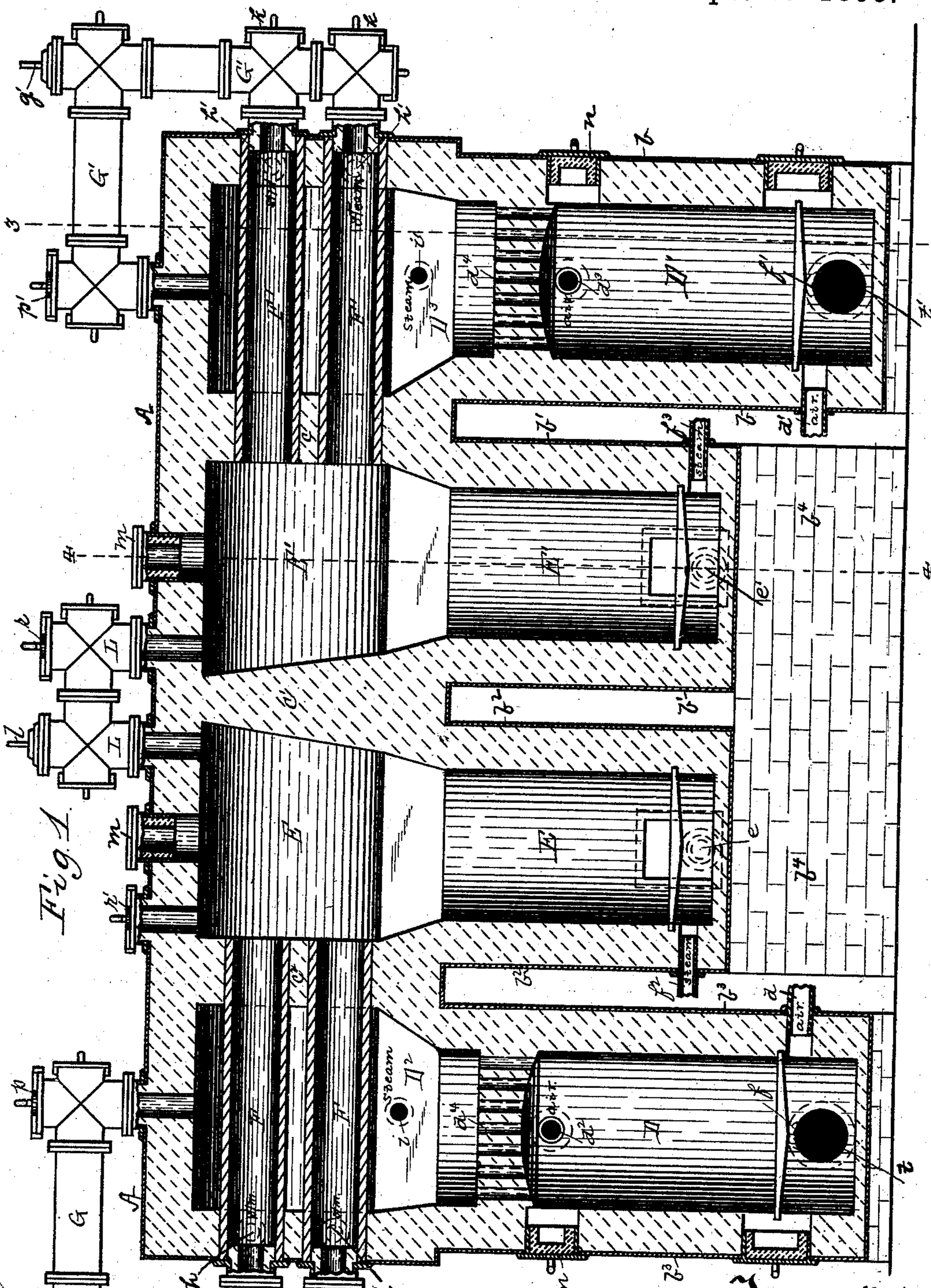

Fig. 1.

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Adolph Loth

Inventor.
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(No Model.) 3 Sheets—Sheet 2.

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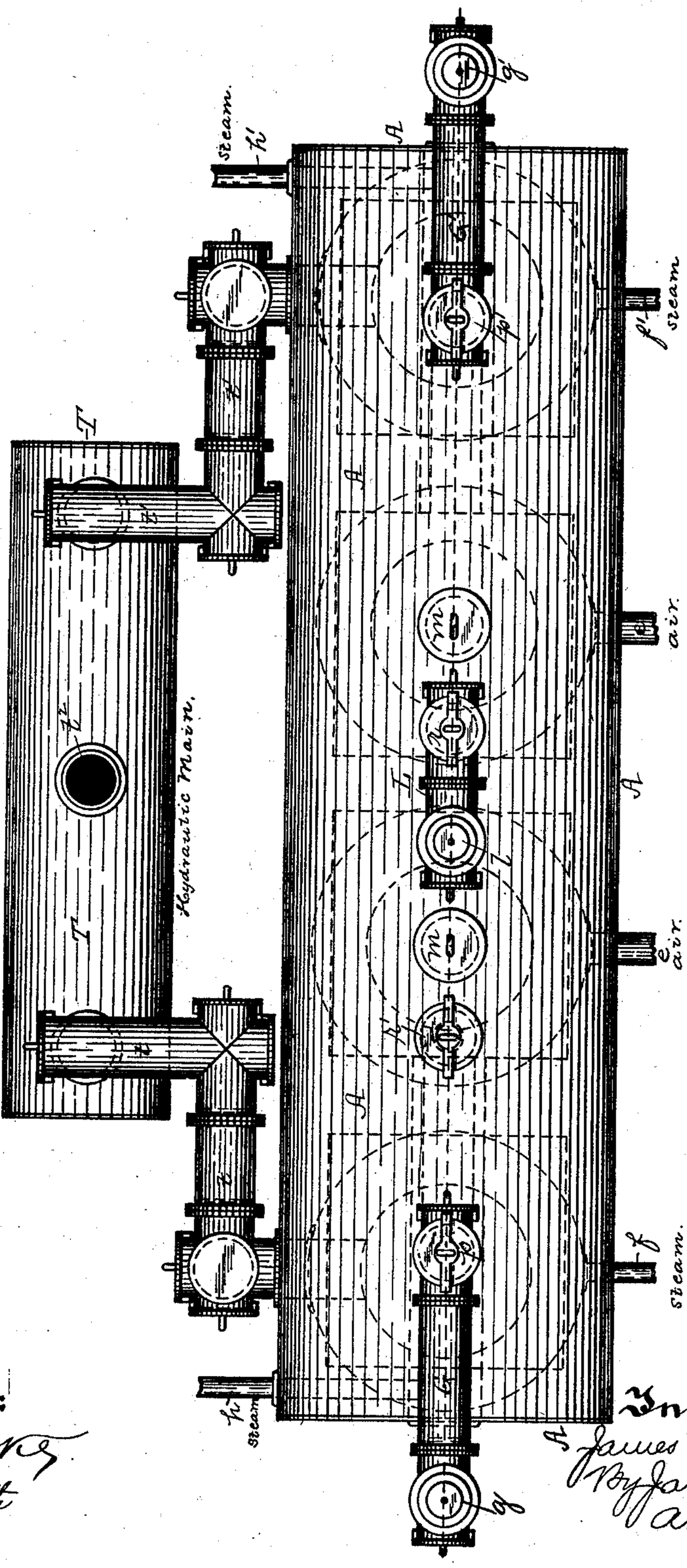

Fig. 2.

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3 Sheets—Sheet 3.

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APPARATUS FOR THE MANUFACTURE OF GAS.

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Fig. 4.

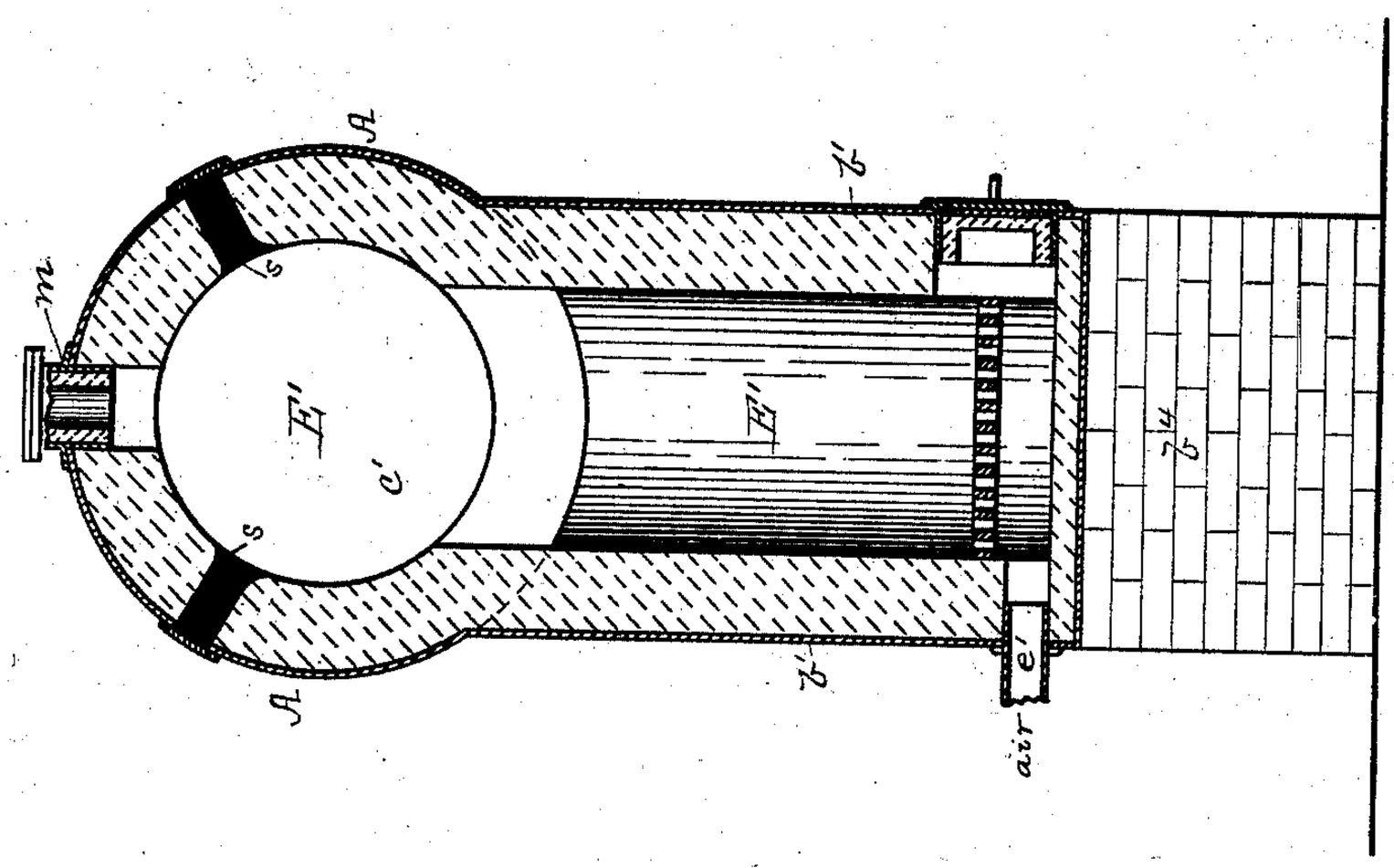
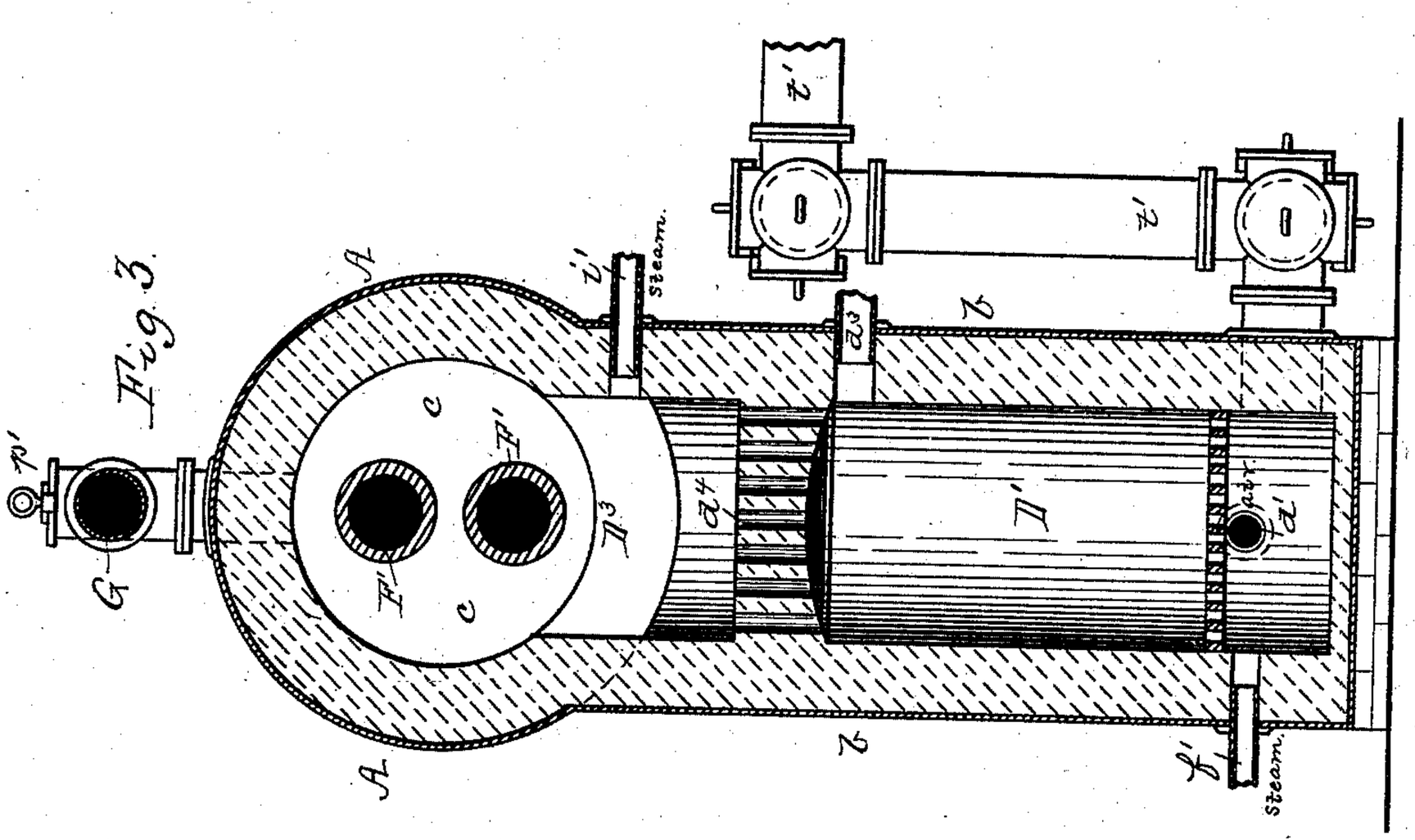


Fig. 3.



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UNITED STATES PATENT OFFICE.

JAMES M. ROSE, OF ALLEGHENY, PENNSYLVANIA.

APPARATUS FOR THE MANUFACTURE OF GAS.

SPECIFICATION forming part of Letters Patent No. 505,537, dated September 26, 1893.

Application filed January 6, 1890. Serial No. 336,011. (No model.)

To all whom it may concern:

Be it known that I, JAMES M. ROSE, a resident of Allegheny, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Apparatus for the Manufacture of Gas; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to apparatus for the manufacture of gas; its object being to provide an apparatus which is simple in construction, in which large or small bodies of coal or like carbonaceous material can be heated, as may be desired, according to the size of the apparatus, and in which large quantities of fuel gas may be formed, this fuel gas being composed, generally stated, of water gas and producer gas or generator gas, together with coal or distilled gas, and the gases formed may be enriched as may be desired with hydro-carbons.

In the apparatus embodying my invention, I employ a long horizontal casing, with four vertical casings or legs depending therefrom, the casings being suitably lined and partition walls being placed within the horizontal casing, so as to form what may be practically termed four vertical chambers, these chambers communicating with each other through suitable pipes, and the apparatus being provided with suitable horizontal cylinders for coking coal or driving off gases from carbonaceous or bituminous material, with suitable steam and air inlets and with eduction pipes, all as hereinafter fully set forth.

The particular improvements embodied in my invention will be hereinafter specifically claimed.

To enable others skilled in the art to make and use my invention, I will describe the same more fully, referring to the accompanying drawings, in which—

Figure 1 is a vertical section. Fig. 2 is a plan view. Fig. 3 is a cross section on the line 3—3 Fig. 1; and Fig. 4 is a cross section on the line 4—4 Fig. 1.

Like letters of reference indicate like parts in each of the views.

In forming the apparatus embodying my invention, I employ a long cylindrical casing A, which may be made of any desired size, according to the size of the apparatus desired, this casing being formed of boiler plate, riveted together and practically forming a horizontal structure, the end portions of which are either riveted or bolted to the cylinder. In the lower part of the casing there are formed four openings, as shown, and depending from the cylinder at these openings are the four cylindrical casings b b' b^2 b^3, which casings are riveted or bolted to the horizontal casing and form what might be termed four legs thereto, the two inner legs b' b^2 being preferably made shorter than the outer legs b b^3, and being supported on the foundation walls b^4. These casings are suitably lined with fire brick, and within the horizontal casing A are the division walls c c' c^2, dividing it into four chambers, which extend down into the casings b, b', b^2 and b^3, so forming the vertical chambers D D′ at the ends of the apparatus and the vertical chambers E E′ between the same, these chambers having what might be termed a "mallet" form, that is, having the cylindrical portions at the base, and the enlarged portions within the horizontal casing A, as clearly shown in Figs. 3 and 4, the enlargement being in the form of a short cylinder, and so imparting to the said chamber, the mallet like form. In the end chambers D D′, I generally form perforated arches d^4, though these arches may be omitted if desired, the arches, when employed, dividing the chambers into what might be termed cupola generators at the base, and heating chambers at the top, such heating chambers being marked D^2 D^3. The several vertical chambers have air inlets as at d d' e e', and in the upper parts of the chambers D D′ are formed air inlets d^2 d^3, these air inlets communicating with a suitable compressing engine or blower by pipes. The several chambers have also steam inlets at the bases thereof as at f f' f^2 f^3.

Extending longitudinally through the upper parts of the chambers D D′, that is, through the heating chambers D^2 D^3 are the horizontal cylinders F F′, these cylinders being supported in the end walls of the casing A, and in the division walls between the end chambers and the inner chambers, and extending through said walls. That is, the cylinders F F′ communicating with the inner chamber E,

pass through the heating chamber D^2 and open at the end of the horizontal casing A, the cylinders F′ F′ being similarly located in the chamber D^3. At the ends of the cylinder A, these chambers open into pipes which lead upwardly along the ends of the casing through valves and over the top of the casing, and communicate through the top of the casing A with the upper end of the heating chambers; these pipes being marked G G′ respectively, and the valve controlling the pipe G being marked *g*, while the valve controlling the pipe G′ is marked *g′*. These pipes and cylinders thus form a passage from the inner chambers to the top of the outer chambers, with which they communicate. Communicating with the outer end of each horizontal cylinder F F′ is a steam inlet *h* or *h′*, according to the end of the apparatus in which it is located, and in the heating chambers D^2 D^3, preferably under the horizontal cylinders, are the steam inlets *i i′*. In the pipes G G′ opposite the ends of the cylinders *f* are doors *k*, through which the cylinders may be filled with coal, coke or other carbonaceous material, or material containing bituminous materials, such as sand or shale impregnated with asphalt. The inner chambers E E′ communicate with each other through a pipe L, this pipe being located above the chambers and communicating therewith through the top wall of the cylinder A, and this pipe having the valve *l* for controlling the flow of the gases between said chambers. Located in the top wall of the chambers E E′ are the charging doors *m m* through which coal may be fed directly down into these chambers, and a large body of coal be maintained therein, the coal generally extending near the upper end of said chambers. The charging doors for the outer chambers D D′ are located in the side walls thereof, as shown in *n n*, these charging doors being placed below the perforated arches d^4, dividing said chambers into the cupola and heating chamber above referred to. Each of the vertical chambers is provided with a relief valve for the purpose of heating up the chambers or relieving them from heavy pressure, these relief valves in the outer or end chambers being located in the pipes G G′ as at *p p′*, and the relief valve *r* for one of the inner chambers being located in the pipe L, while the relief valve *r′* for the other inner chamber is located in the top wall thereof. Suitable poke holes for stirring up the body of coal in the inner chambers may be arranged as shown at *s* in Fig. 4, extending downwardly through the casing A, the apparatus on account of the cylindrical shape of the upper portions of these chambers giving free opportunity for the breaking up of the coal in case it should arch within the chambers.

Extending along the side of the apparatus is the hydraulic main T, the gas eduction-pipes *t t′* leading from the bases of the chambers D D′ respectively, and opening into the ends of the main T, and the gas passing from the central opening t^2 by a pipe to the storage tank, or gas main.

The operation of the apparatus as above described, is as follows: In heating up the apparatus, fires are started in all of the vertical chambers, the relief valves being open to permit of the escape of the products of combustion. Coal or coke, as the case may be, is added through the several charging doors to the different chambers, and air is fed to the chambers until the bodies of coal in the several chambers are raised to incandescence, air being fed to the products of combustion from the cupola generators D D′, so as to raise the chambers D^2 D^3 and the horizontal cylinders F F′ therein to a high heat. When the apparatus is heated up ready for gas making coal or coke or other such material, such as gravel, sand or shale containing bituminous substances, are fed to the horizontal cylinders. The relief valves of the inner chambers and also of the chambers D^2, are closed, the valves *g* of the pipe G and *l*, of the pipe L, are opened and the air blast is shut off from the chamber D and the chamber E. The air blast is continued in the cupola D′, the products therefrom being burned within the heating chamber D^3 and then permitted to escape through the relief valve *p′*, and this chamber and the horizontal cylinders therein, being thus held at a high heat. Steam is then admitted through the pipes *h′* at the ends of the horizontal chambers F′, and in passing through the coal or coke in said cylinders, it is decomposed, water gas being formed and the water gas passing into the upper end of the chamber E′. At the same time hydrocarbons may be fed to these horizontal cylinders such as through the pipe *h′* and be vaporized therein, the vapors so formed uniting with the gases generated in the apparatus. At the same time, the air blast is continued at the base of the chamber E′, and generator gas is formed in said chamber, this generator gas rising from the same and intermingling with the gases from the cylinders F′ in the upper part of said chamber E′. The gases then pass through the pipe L into the upper part of the chamber E, and steam is admitted at the base of this chamber, and in passing up through the body of coal therein, is decomposed, forming water gas, the water gas intermingling with the gases formed in the cylinders F′ and chamber E′, and flowing from the chamber E through the horizontal chamber F and thence through the pipe G into the upper end of the heating chamber D^2, passing down around the cylinders F and thence downwardly through the body of incandescent coke in the lower portion of said vertical chamber and through the eduction pipe *t* into the hydraulic main T, and thence through the pipe t^2 to the gas main or storage tank. The hot gases in passing through the body of

coal, coke or other material in the horizontal cylinders *f* and the heat generated around said cylinder acts to distill off from the coal any volatile gases, causing these gases to unite with the gases previously generated, and so adding to the gases formed, what might be termed coal gas, or if any bituminous substances are placed within said chambers, the gases are generated therefrom and carried by the gases passing through the said chambers into the heating chamber and are fixed in the body of incandescent carbon, in the chamber D. At the same time, steam is admitted through the steam entrance *i* in the heating chamber D^2, and this steam is decomposed either by the gases into which it enters, uniting with the carbonic oxide to form carbonic acid and so setting the hydrogen free, while the carbonic acid may be converted into carbonic oxide in the incandescent carbon in the chamber D, or the steam in passing through said body of incandescent carbon, is decomposed, forming a further body of water gas to be added to the gases previously formed. When the carbon in the chambers D and E is so lowered in temperature as to fail in their purpose of decomposing the steam or fixing the gases, the apparatus is reversed, the valve *g* being closed, the relief valve *p* opened, the relief valve *p'* closed, and the valve *g'* opened, the several points of entrance for steam and air being reversed in the same manner. Steam is then admitted at the ends of the chambers F, the gases formed entering into the upper end of the chamber E uniting with the generator gas formed therein, and passing into the chamber E' and uniting with the water gas formed therein and then passing through the horizontal cylinders F' and into the upper end of the heating chamber D^3 and thence through the body of incandescent carbon in the chamber D' and through the eduction pipe *t'* to the hydraulic main. In the first operation, the bodies of coal in the chambers D E are being cooled down, while the bodies of coal in the chambers D' E' are being brought to a high state of incandescence. When the apparatus is thus reversed, the bodies of coal in the chambers E' D' serve for the decomposition of the steam and for the fixing of the gases and the body of carbon in the chamber E is being gradually heated up by the air blast in forming generator gas, while the body of carbon in the chamber D is being consumed to raise the same to a high heat and to heat the horizontal cylinders F, the products of combustion from these chambers being permitted to escape. If it is found that sufficient heat is generated in the end chambers without consuming the gases for heating the retorts, the gases generated by the air blast at the base of said end chambers may be introduced into the body of gases generated, this being accomplished by closing the relief valve in the pipe G or G', and opening the valve *g* or *g'* in said pipe, according to the direction of the flow of the gases, when said generator gas will flow through the pipe into the horizontal cylinders, and thence intermingle with the other gases generated.

The form of generator chambers, such as illustrated in Fig. 4, has special advantages in the forming of water gas, as this mallet like chamber gives a large space above the vertical chamber in which the coal rests upon the walls of the chamber, and the steam, instead of passing up around said walls and escaping without being decomposed, or simply providing for the oxygen to unite with the hydrogen, is compelled, if it should pass up around the walls of the vertical portions of said chamber without being decomposed to pass through the body of coal in the head or enlargement thereof, and the decomposition of such steam is thereby insured. The apparatus as so constructed can be made exceedingly strong and in proportion to the capacity for the manufacture of gas can be built cheaply. At the same time it provides an apparatus which can be built of different sizes according to the amount of gas to be produced, the apparatus being adapted for successful operation when built within any reasonable dimensions. At the same time by the location of the fire chambers in line with each other, it provides a simple form of apparatus for the manufacture of the combined water gas, producer gas and distilled or coal gas, and for the maintaining of the proper temperatures in the different parts of the apparatus, while providing for the manufacture of very large bodies of gas.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. A gas making apparatus having a horizontal casing provided with a series of vertical casings depending therefrom, said casings being suitably lined, and having a division wall extending across said horizontal casing, between the vertical casings so as to divide it into chambers, and one of said chambers being provided with horizontal retorts or pipes supported in one wall of the casing, and the division wall, and said chambers having suitable supply and exhaust ports communicating therewith, substantially as and for the purposes set forth.

2. A gas making apparatus having a horizontal casing and a series of vertical casings depending therefrom, said casings being suitably lined, and having a division wall extending across the horizontal casing, and so dividing the apparatus into two vertical chambers, such as D, E, one or more horizontal cylinders extending through the vertical chamber D and communicating with the chamber E, and a pipe leading from the end or ends of said cylinders and communicating with the upper part of said vertical chamber D, substantially as and for the purposes set forth.

3. A gas making apparatus having the vertical chambers D E, the horizontal cylinders

F extending across the chamber D and having steam entrances *h* at their outer ends, and the pipe G communicating with the outer end or ends of the cylinders F and with the upper end of the chamber D, substantially as and for the purposes set forth.

4. The herein described gas apparatus formed of the horizontal casing A, having a series of vertical casings depending therefrom, said casings being suitably lined, division walls *c c' c²* in the horizontal casing, so dividing the apparatus into the four chambers D D' E E', the horizontal cylinders F, F', and communicating pipes G, G', and L between said several chambers, substantially as and for the purposes set forth.

In testimony whereof I, the said JAMES M. ROSE, have hereunto set my hand.

JAMES M. ROSE.

Witnesses:
WILBUR F. REEDER,
HENRY C. QUIGLEY.