No. 687,823. Patented Dec. 3, 1901.

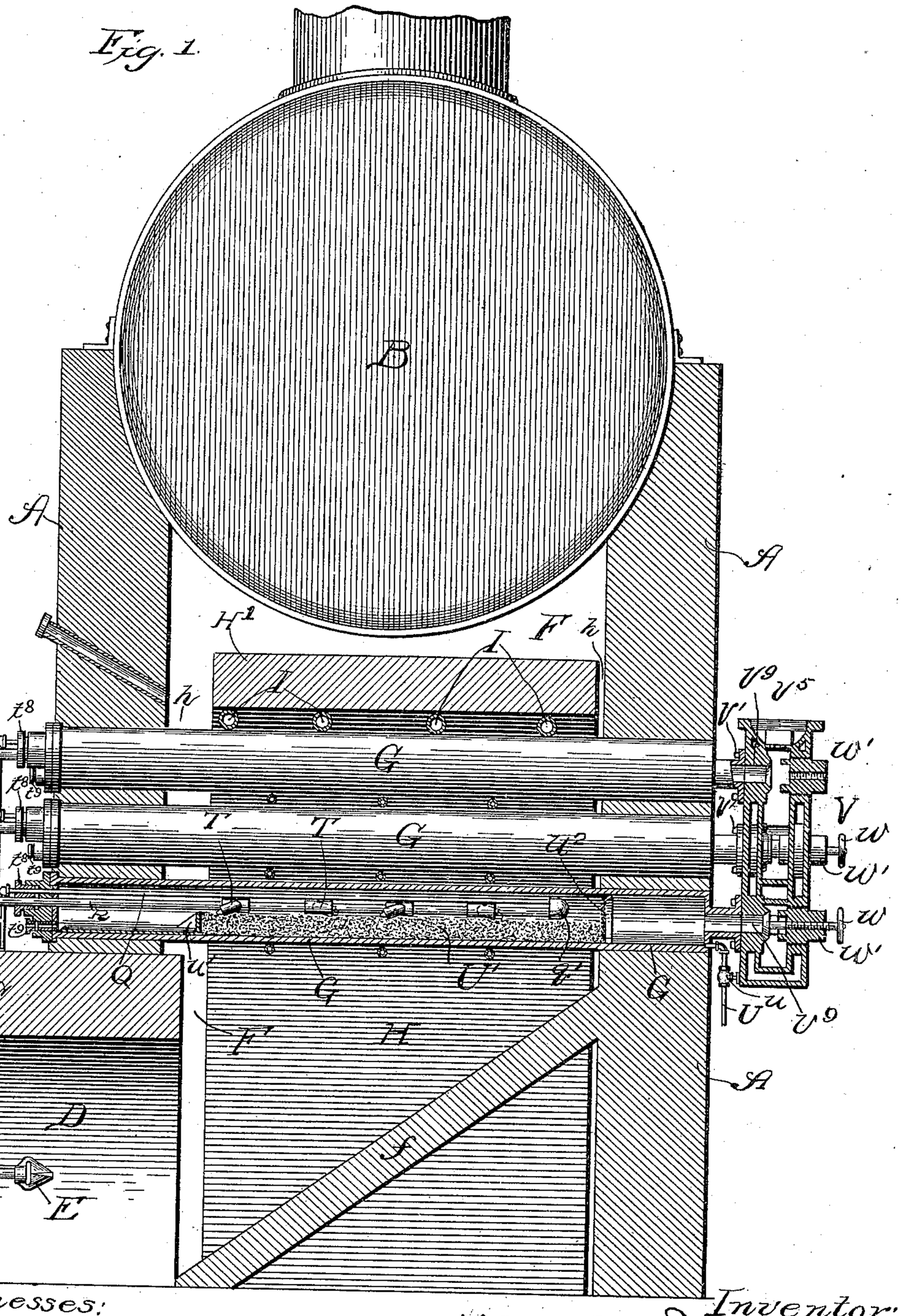
W. J. FAULKNER.

GAS GENERATING APPARATUS.

(Application filed July 8, 1901.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 1.



Witnesses:
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L. A. Adams.

Inventor:
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By Charles Turner Brown.
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4 Sheets—Sheet 2.

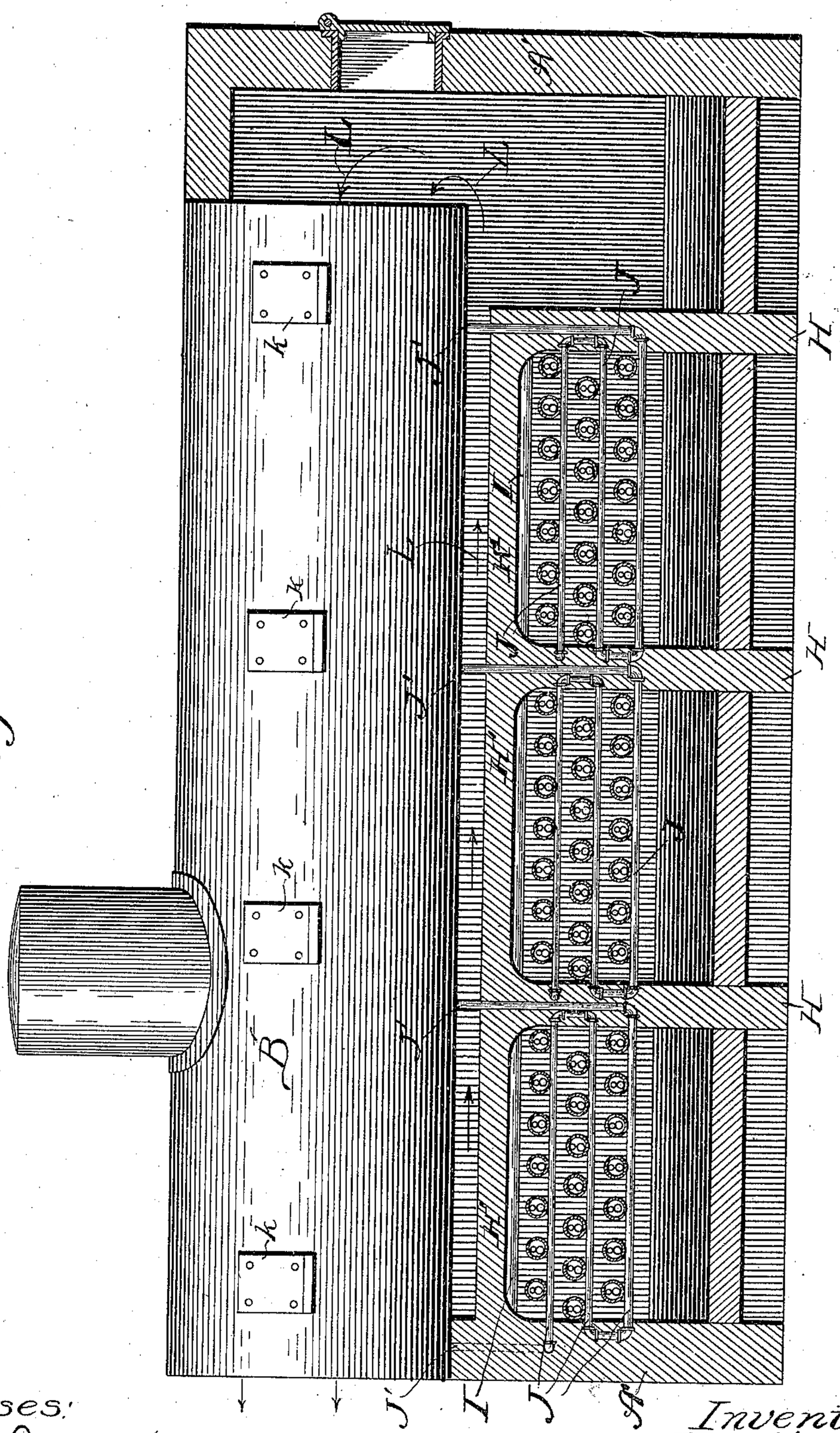

Fig. 2.

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(No Model.) 4 Sheets—Sheet 3.

Fig. 3.

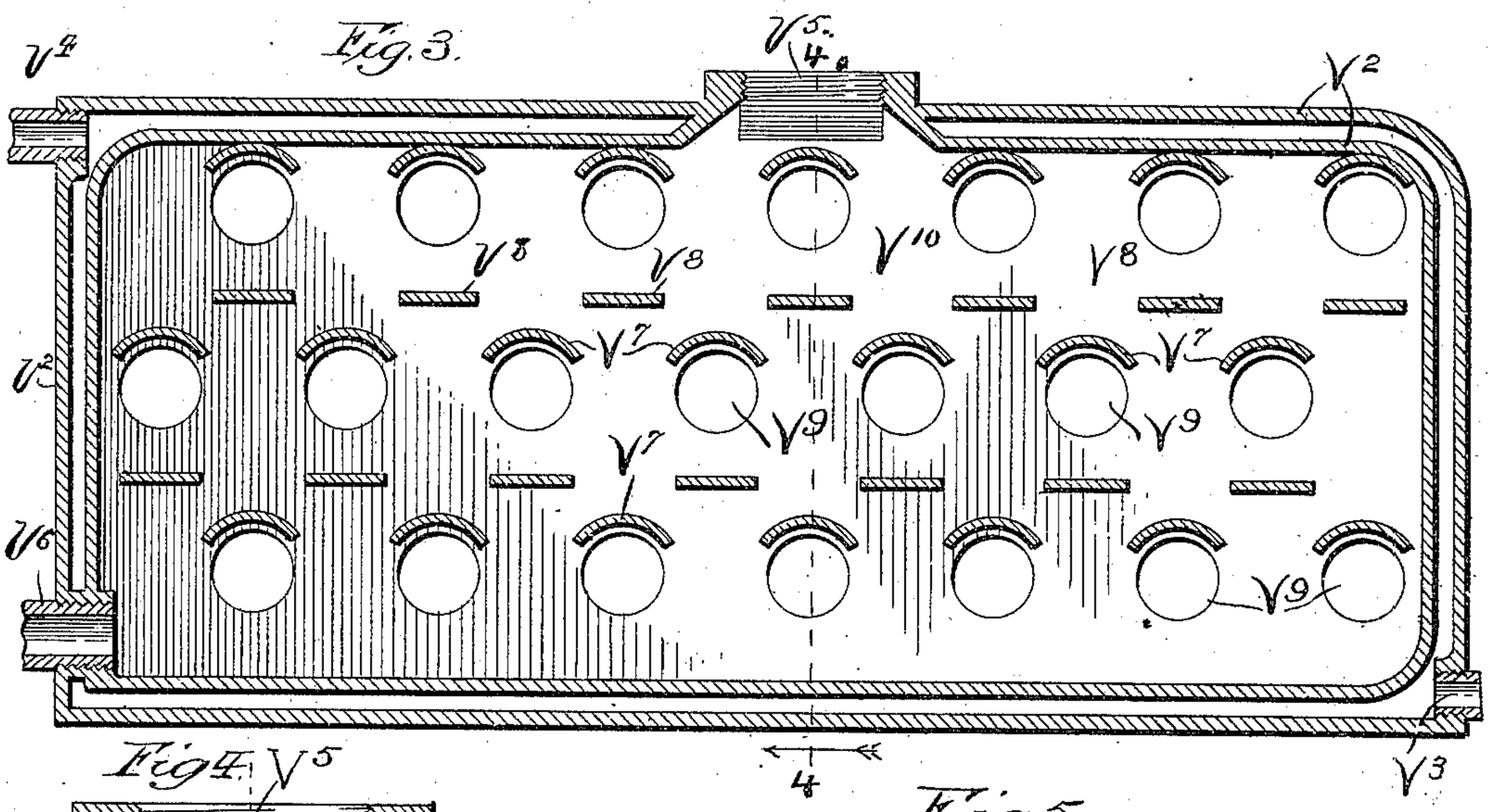


Fig. 4.

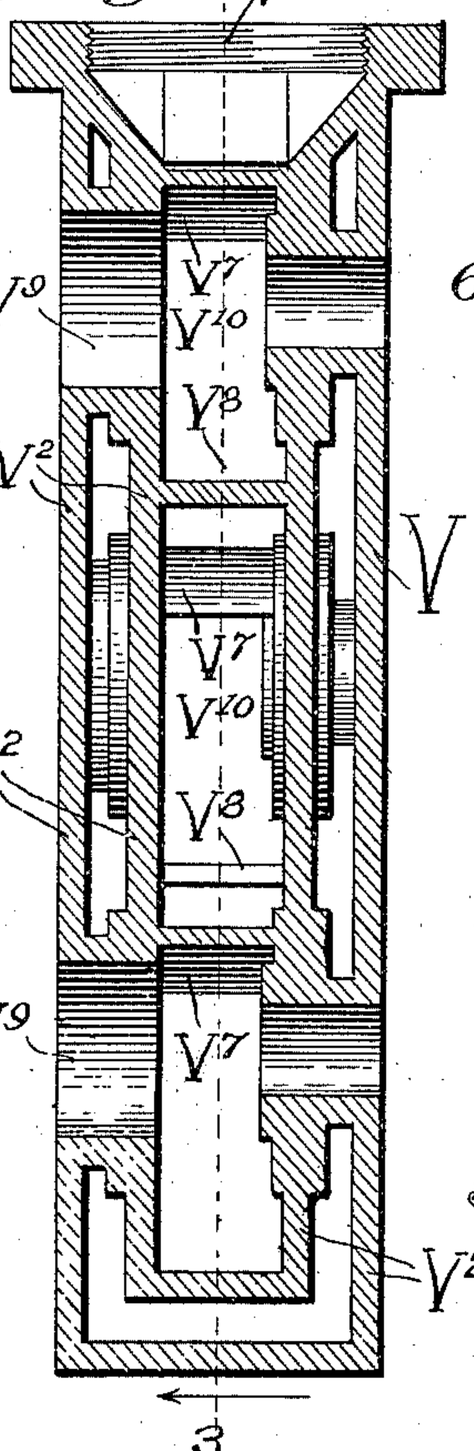


Fig. 5.

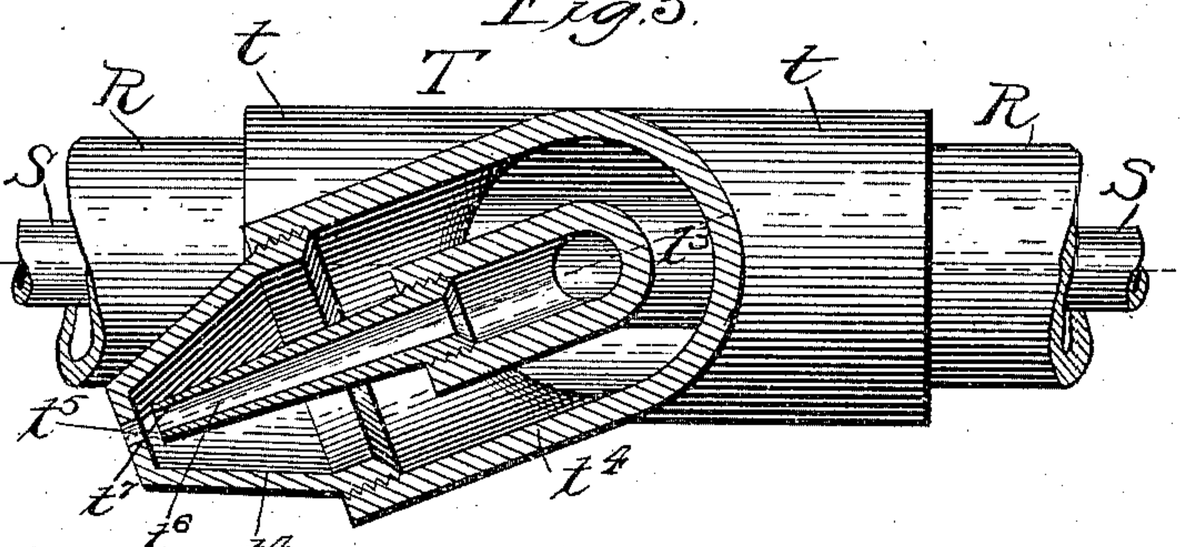
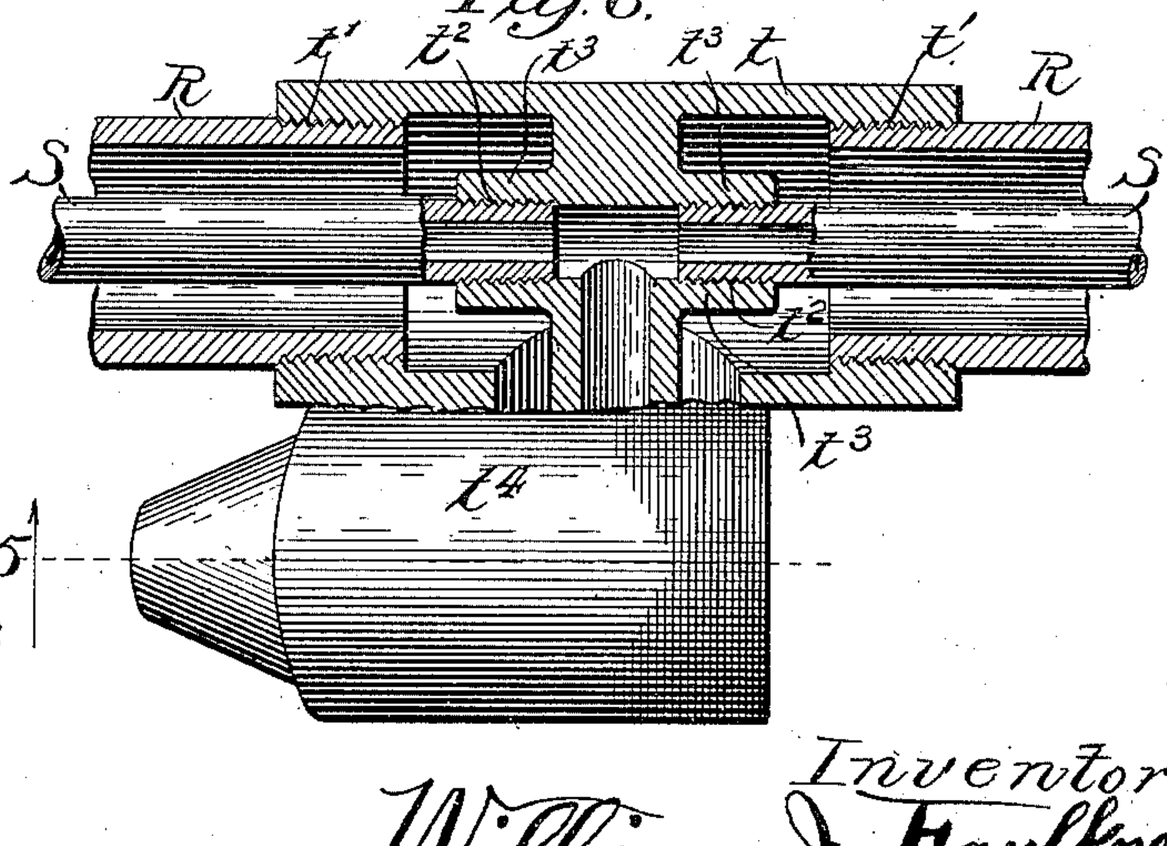


Fig. 6.



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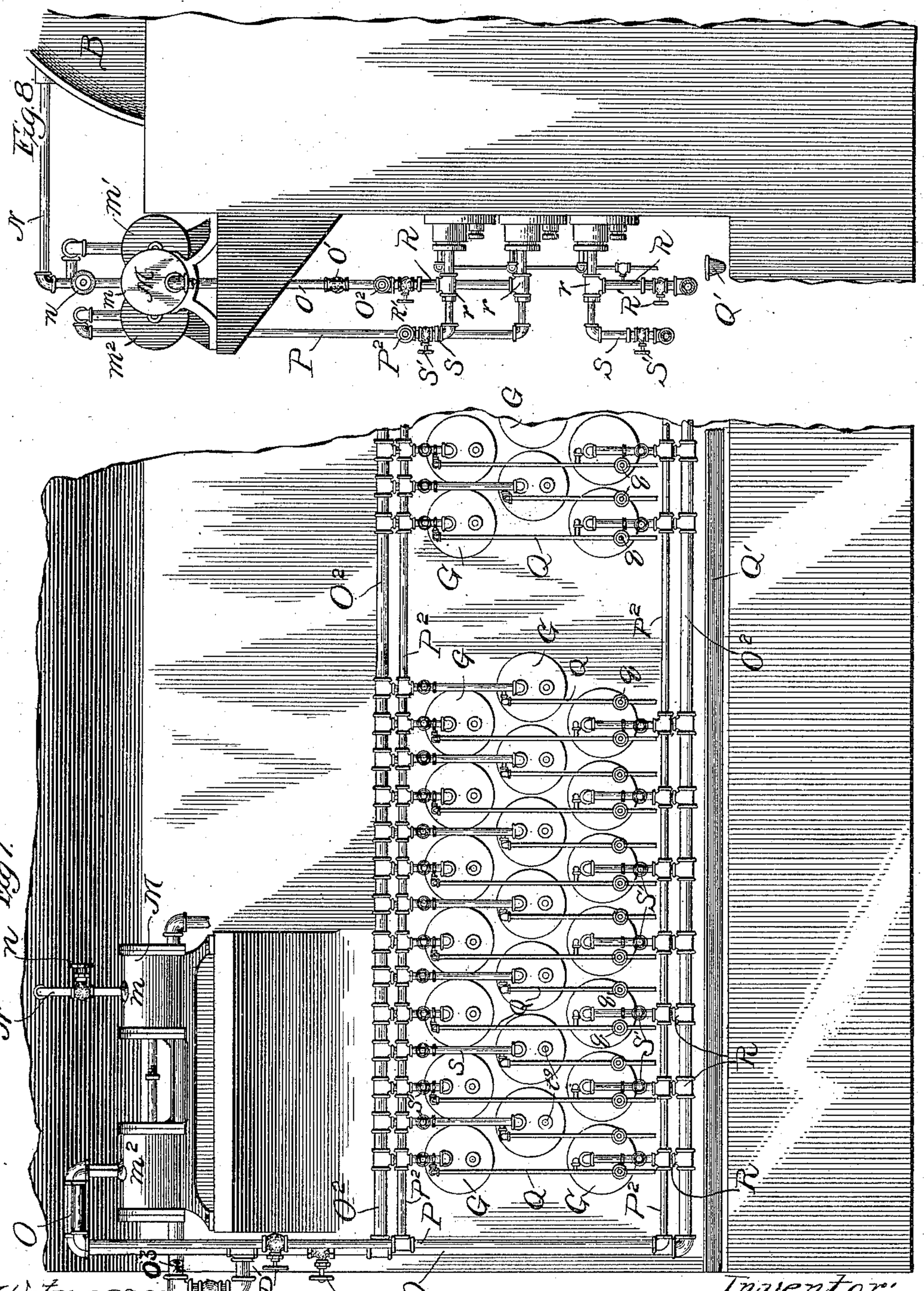
(No Model.) 4 Sheets—Sheet 4.



UNITED STATES PATENT OFFICE.

WILLIAM J. FAULKNER, OF CHICAGO, ILLINOIS.

GAS-GENERATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 687,823, dated December 3, 1901.

Application filed July 8, 1901. Serial No. 67,458. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM J. FAULKNER, a citizen of the United States, and a resident of Chicago, Cook county, State of Illinois, have invented certain new and useful Improvements in Gas-Generating Apparatus, of which the following, when taken in connection with the drawings accompanying and forming a part hereof, is a full and complete description sufficient to enable those skilled in the art to which it pertains to understand, make, and use the same.

This invention relates to apparatus for generating inflammable gas in a retort from oil (including crude petroleum and its distillates) and water by means of heat applied to such retort, on the outside thereof, as from a furnace.

The object of this invention is to obtain an apparatus whereby oil (including crude petroleum and its distillates) and water may be simultaneously and in suitable proportions introduced into a highly-heated retort under conditions which shall insure the intermittent introduction thereof in liquid form to a decomposing degree of heat, thereby converting the mixture of water and oil into its gaseous elements with the carbon of such oil held in suspension in such gaseous elements in a state of comminution, producing what is known in the art as a "fixed" gas.

Another object of this invention is to obtain an apparatus of the kind described in which the liquid introduced shall be discharged over a comparatively large area and in a finely-divided condition.

Another object of this invention is to obtain in an apparatus of the kind described means whereby the heat generated in the furnace of the retorts shall be economically disposed of, first, in and about such retorts, and, secondly, in the production of steam from water after such heat has passed beyond the retorts.

A further object of this invention is to obtain an apparatus of the kind described wherein the temperature of the water and oil (including crude petroleum and its distillates) introduced into the retort may be varied at the option of the person operating such apparatus; and a further object of the invention is to obtain an apparatus of the kind described whereby a series of retorts shall be used, the several retorts so connected up that any one thereof may be disengaged from the remaining ones, removed from the apparatus, and replaced by another retort without interfering with the operation of the remaining ones thereof while such separation, removal, and substitution is being accomplished.

Another object of the invention is to obtain an apparatus of the kind described in which when by inadvertence or mistake the heat in the retorts, or any thereof, is not maintained at a sufficiently high temperature and all or any of the gas made contains vapor that such vapor and the oil or the oil-tar and water resulting as such vapor is cooled will be separated from the fixed gas, which is made and withdrawn from the apparatus, while such fixed gas is discharged from the apparatus in the ordinary manner.

Another object of the invention is to obtain an apparatus of the kind described in which any liquid contained in the retorts or any of them while the same are in operation may be withdrawn therefrom before the same is converted into vapor or gas.

In the drawings referred to as forming a part of this specification, and in which a reference-letter applied to designate a given part is used to indicate such part through the several figures wherever the same appears, Figure 1 is an end elevation of a boiler attached to the apparatus for the purpose of utilizing heat passing from the furnace of the apparatus to beyond the retorts and a vertical cross-sectional view of the combustion-chamber, the furnace or retort chamber, and the combined mixing, cooling, and condensing chamber of the apparatus, showing the retorts and the supply and discharge pipes thereof, one of such retorts being shown in longitudinal section and the remaining ones in side elevation. Fig. 2 is a vertical longitudinal section of the apparatus, showing the boiler referred to in Fig. 1 in side elevation with the retort-chambers of the furnace in vertical longitudinal section and the retorts in such chambers in lateral section and showing supports of the several retorts in side elevation. Fig. 3 is a vertical longitudinal section, on an enlarged scale, of the combined mixing, cooling, and condensing chamber of the apparatus on

line 3 3 of Fig. 4 viewed in the direction indicated by the arrows, showing the baffle-plates therein in cross-section. Fig. 4 is a vertical lateral section of such combined mixing, cooling, and condensing chamber, on a scale enlarged from the one of Fig. 3, on line 4 4 of such Fig. 3 viewed in the direction indicated by the arrows, showing the double walls thereof in cross-section, some of the baffler-plates in side elevation and some in longitudinal section. Fig. 5 is an enlarged detail view of the combined coupling and feeder, of which a plurality are placed in each retort of the apparatus, the feeder part thereof being shown in vertical longitudinal section on line 5 5 of Fig. 6 and viewed in the direction indicated by the arrow and the coupling part in side elevation, with a portion of the connecting supply-pipes attached to such coupling also in side elevation. Fig. 6 is an enlarged detail view of the combined coupling and feeder shown in Fig. 5, the feeder part thereof being shown in top plan view and the coupling part with connecting supply-pipes in longitudinal section, on line 6 6 of Fig. 5 viewed in the direction indicated by the arrow. Fig. 7 is a side elevation of a portion of the apparatus, showing in front elevation one of the banks or batteries of retorts with the several connecting liquid supply and discharge pipes thereof in front elevation and the feed-pump of the apparatus in side elevation; and Fig. 8 is an end elevation of a portion of the apparatus, showing in side elevation so much of the ends of one bank or battery of retorts as projects beyond the side walls of the apparatus and the liquid supply and discharge pipes thereof in side elevation and the feed-pump of the apparatus in end elevation.

A A are the side walls of the furnace and the supporting-walls of the boiler B, and A′ A′ are the end walls of the furnace.

C is the wall of the combustion-chamber D, and E is a burner which may be used in the combustion-chamber to generate heat for the apparatus.

F is the furnace of the apparatus, and *f* is an inclined bottom to the furnace F, designed to direct the heat upward against the retorts G G.

H H H are vertical walls, and H′ H′ H′ are arches, preferably flat, connecting the vertical walls H H H. The vertical walls H H H do not extend the entire width of the furnace F, as is well shown in Fig. 1 of the drawings, nor do they extend the entire height of the furnace, as is well shown in Figs. 1 and 2 of the drawings. Such vertical walls H H H do extend so that arches H′ H′ H′, supported thereby, are above the banks or batteries of retorts G G.

h h are passage-ways through which the products of combustion or partial combustion in the combustion-chamber of the furnace may pass from between the vertical walls H H and from underneath the arches H′ H′ to above such arches and between them and the boiler B. The vertical walls H and arches H′ H′ may be built of fire-brick, the purpose thereof being to retain in as close contact to the retorts G G G and for as long a time as possible the heated contents of the furnace.

When arches H′ H′ are flat arches, I prefer to strengthen them by the use of the hollow pipes I I I, through which pipes water may be forced to prevent the burning thereof in the operation of the apparatus.

J J are water-pipes extending horizontally between the vertical walls H H and also between one of such vertical walls and one of the end walls A′ A′ of the furnace and forming support between side walls A A for the retorts G G. These pipes J J are not essential as supports to such retorts; but I prefer to use them and to connect them to the boiler B, as at J′ J′ in Fig. 2, as by so doing the water flowing through such pipes J J is heated and returned to the boiler B at a high temperature.

k k are anchor-plates on boiler B, attaching such boiler to the side walls of the furnace. B may be the ordinary flue-boiler, and the products of combustion or partial combustion in the furnace F may, after leaving such furnace and impinging upon the under side of such boiler, pass through the flues thereof in the direction indicated by the arrows L L in Fig. 2 of the drawings.

M, Figs. 7 and 8, is the feed-pump of the apparatus and is preferably provided with steam-cylinder *m*, water-cylinder *m′*, and oil-cylinder m^2.

N is the steam-supply pipe from the boiler B to the steam-cylinder *m* of the pump and is provided with valve *n*.

P is the oil-supply pipe from cylinder m^2 to the several retorts, and O is the water-supply pipes from cylinder *m′* to such retorts.

O′ is a valve in pipe O, and P′ a valve in pipe P.

O^3 is a water-supply pipe to cylinder *m′* of the pump, and O^4 is a pipe around the pump from supply-pipe O^3 to supply-pipe O.

When the apparatus is being heated preparatory to making gas, the several supply-pipes in the retorts are protected from burning by permitting water to flow through the by-pass O^4 and supply-pipes O O^2 into the retorts.

To describe the manner in which the water and oil supply pipes are connected to communicate with the respective retorts G G G and also to describe the manner in which the discharge-pipes Q Q, provided, respectively, with valves *q*, are connected to such retorts, the construction of the retorts in detail will be given, referring to Figs. 1, 5, 6, 7, and 8. To the horizontal branches pipes O^2 O^2 of the water-supply pipe O there are connected the pipes R R, provided, respectively, with the valves R′ R′, and to the horizontal branches

P^2 P^2 of the oil-supply pipe P there are connected the pipes S S, provided, respectively, with the valves S′ S′. (See Figs. 1, 7, and 8.)

T T are combined couplings and feeders in retorts G G. A pipe R corresponding with a given retort passes through one end of the retort and to the coupling part *t* of one of the combined coupling and feeders T T, being attached, as by an ordinary screw-joint *t′*, to the outer shell of such coupling part, as is shown in Figs. 5 and 6. The pipe S corresponding to a given retort G connects with and passes through the T *r* of the corresponding pipe R and extends within pipe R (in the retort) to the coupling part of the combined coupling and feeder T, being connected as by screw-threads t^2, Fig. 6, to the inner shell t^3 of such coupling part *t*. From the outer shell of the part *t* there is a communicating passage-way to water-discharge end t^4 (having aperture t^5) of the combined coupling and feeder T, and from the inner shell t^3 there is a communicating passage-way to the oil-discharge end t^6 (having aperture t^7) of such combined coupling and feeder. The aperture t^7 is located in water-discharge end t^4, adjacent to the aperture t^5 of such end, so that the oil delivered from the oil-supply pipes to the inner shell of the combined coupling and feeder is discharged into the water about to be discharged through aperture t^5 into the retort. The purpose of this discharge of such oil in such water is to obviate the stopping of apertures t^5 t^7, or either of them, by the deposit of carbon therein.

t^8, Fig. 1, represents stuffing-boxes in the ends of retorts G, respectively, through which stuffing-boxes the feed-supply pipes R R extend, respectively, and t^9 t^9 are peek-holes in such ends.

The water-discharge pipe Q, hereinbefore referred to, is connected to the water-supply pipe R, at the extreme inner end of such water-supply pipe, as by the reducing-L *q′*, Fig. 1, so that the water passing through such supply-pipe R and not delivered therefrom into the retorts by means of the combined coupling and feeders T T, as last-above described, may be controlled by the valve *q* (see Fig. 7) in such discharge-pipe Q.

The discharge-pipes Q may deliver their contents into the drip pan or gutter Q′, Figs. 7 and 8, and by observing the temperature of the water delivered from the discharge-pipes Q Q the temperature of the water and oil delivered into the retorts may be closely determined.

U is the discharge-pipe in the end of the several retorts G G, respectively, adjacent to the combined mixing, cooling, and condensing chamber V and is provided with a valve *u*. Any liquid contents of any of the retorts G G G may be withdrawn therefrom at any time through the pipe U corresponding thereto.

U′ is material partially filling the several retorts, preferably consisting of iron punchings or other good heat-conducting material, which is maintained at a high temperature in the operation of the apparatus and onto which the oil and water or water desired to be decomposed and converted into a fixed gas is directed in a finely-comminuted condition at regular intervals—that is, intermittently by the action of the pump—through the several combined coupling and feeders T T and in such manner as to be delivered onto as great a surface area of such material as possible. The material U′ is held in place in the retorts G G by the slide *u′* and sieve u^2, Fig. 1.

The retorts G G are respectively attached to the combined mixing, cooling, and condensing chamber V, as by bolts V′, Fig. 1, and any one of such retorts may be withdrawn from the furnace of the apparatus by taking out such bolts and disconnecting the supply-pipes of the retort and another retort substituted therefor. When one of such retorts is desired to be removed while the apparatus is in operation, such removal may be accomplished, as described, and without interfering with such operation of the apparatus by first closing the valve W of said retort. (See Fig. 1.)

The combined mixing, cooling, and condensing chamber V is provided with double walls V^2 V^2, between which water may continuously flow to regulate the temperature of the contents thereof, as through inlet and outlet V^3 V^4.

V^5 is the gas-outlet of the combined mixing, cooling, and condensing chamber V. V^6 is a cleaning-outlet thereto, (see Fig. 3,) and V^7 V^8 are baffle-plates therein. Baffle-plates V^7 are placed over the gas-inlets V^9 V^9 from the respective retorts G G, (see Fig. 3,) and valves W W seat to close gas-intlets V^9 V^9, respectively, (see Fig. 1,) and W′ is the stuffing-box to the stem of valve W. A valve W, corresponding to a given retort G, is opened when such retort is in operation making gas and closed when not making gas, the apparatus being in operation with other retorts making gas.

The operation of the apparatus is as follows: Heat is supplied to the furnace F, as by the burning of oil or other fuel in burner E, and when by observation through peep-holes t^9 t^9 the retorts G G are sufficiently heated oil and water or water only, as preferred, are supplied to the retorts through the combined coupling and feeders T, as by means of pump M and the connecting supply-pipes. The liquid delivered to the retorts is not delivered in a continuous flow, but intermittently, because of the use of pump M, as described, and from such intermittent delivery not only may the highly-heated material U′ U′ in the several retorts regain its initial temperature, insuring decomposition of the oil and water or water so delivered thereinto and the production of a fixed gas, but also such liquid is delivered upon different parts of such material U′ instead of upon a single place, as would

occur with a constant current or flow of the liquid into the retort. The apertures in the feeder's end of the combined coupling and feeder are very small to deliver the liquid into the retort in the form of a finely-divided spray. The minute subdivision of the oil and water or water thus obtained and the prevention of particles of oil from coming in contact with the walls of the outer aperture of such feeder constitute material features of the invention also, as does the alternate arrangement of the combined coupling and feeders on opposite sides of the supply-pipe to discharge in opposite directions and adjacent to the walls of the retorts, respectively. Valves W being open, the gas made is delivered from the several retorts G G into the combined mixing, cooling, and condensing chamber V through V^9. The water circulating between the walls V^2 V^2 of the combined mixing, cooling, and condensing chamber V maintains a lower temperature in the inner and gas chamber V^{10} than obtains in the several retorts, and the gas delivered from such retorts into such chamber is thereby cooled and cleaned and such gas is discharged from such chamber V^{10} through passage-way V^5 in condition for use. Any material deposited in such gas-chamber V^{10} may be taken therefrom through outlet V^6 when desired, such outlet of course being opened only when chamber V^{10} is being cleaned of material deposited therein, as described. The baffle-plates V^7 V^8 in gas-chamber V^{10} tend to thoroughly mix the contents of the several retorts as such contents are discharged into such chamber to maintain a uniform temperature throughout the chamber and also to collect any moisture or vapor that may be in the gas. The sieves u^2, hereinbefore described, also serve as partial mixers of the gas made and as collectors of vapor or moisture.

The boiler B is not an essential feature of this invention, but is an economical adjunct of an apparatus embodying the invention, and where the boiler is omitted an arch may be substituted therefor.

The duration of the time in which oil and water or water are delivered into the retorts and of the time during which no discharge is made is determined by the stroke of the pump, and such intervals may be made longer or shorter by lengthening or shortening the movement of the pump.

Having thus described the apparatus embodying my invention and its operation, what I claim is new, and desire to secure by Letters Patent, is—

1. In a gas apparatus, the combination of a furnace consisting of side and end walls, additional walls between and parallel with the end walls, and arches connecting such parallel walls, and provided with communicating passage-ways from the chambers below the arches to the chamber above such arches, with a boiler above the arches and series of gas-retorts beneath the arches extending laterally through the side walls of the furnace, supply-pipes to the respective retorts and a plurality of feeders in each retort connected alternately to the sides of the supply-pipe therein; substantially as described.

2. In a gas apparatus, the combination of a furnace consisting of side and end walls, additional walls between and parallel with the end walls and arches connecting such parallel walls, such furnace provided with communicating passage-ways from the chambers below the arches to the chamber above such arches, with a boiler above the arches, series of gas-retorts beneath the arches extending laterally through the side walls of the furnace, oil and water supply pipes to the respective retorts, the oil-supply pipe incased within the retort by the water-supply pipe, a return-bend and a regulating-pipe in the retort connected to the end of the water-supply pipe, and a plurality of feeders in each retort connected alternately to opposite sides of the supply-pipes in the retort, such feeders, respectively, consisting of a water-discharge nozzle and an oil-discharge nozzle incased in the water-discharge nozzle and arranged to discharge oil into the water in the water-nozzle prior to the discharge of water from such nozzle into the retort; substantially as described.

3. In a gas apparatus, a furnace consisting of side and end walls, additional walls between and parallel with the end walls and arches connecting such parallel walls, such furnace provided with communicating passage-ways from the chambers below the arches to the chamber above such arches, in combination with a series of gas-retorts beneath the arches extending laterally through the side walls of the furnace, a combined mixer, cooler and condenser and a connection between the respective retorts and such combined mixer, cooler and condenser, whereby communicating passage-ways are obtained, valves seating to close such communicating passage-ways respectively, oil and water supply pipes to the respective retorts the oil-supply pipe within the retort incased by the water-supply pipe, a return-bend to the water-supply pipe, and a pipe connected thereto extending to outside the retort and provided with a valve, a plurality of feeders in each retort connected alternately to opposite sides of the supply-pipes in the retorts, such feeders, respectively consisting of a water-discharge nozzle and an oil-discharge nozzle incased in such water-discharge nozzle and such nozzle arranged to discharge oil into the water about to be discharged into the retort prior to such discharge; substantially as described.

4. In a gas-making apparatus, the combination with a retort of a water-supply pipe and an oil-supply pipe therefor, such oil-supply pipe incased the entire length thereof within the retort by the water-supply pipe, and a combined coupling and feeder, to the

coupling part whereof the supply-pipes are attached and the feeder part consisting of a water-nozzle discharging into the retort and an oil-nozzle discharging into the water-nozzle adjacent to the discharge-opening thereof; substantially as described.

5. In a gas-making apparatus, the combination with a retort of a water-supply pipe and an oil-supply pipe, such oil-supply pipe inclosed its entire length within the retort by the water-supply pipe, the water-supply pipe provided with a passage-way communicating with the retort and the oil-supply pipe provided with a passage-way communicating with the water-supply pipe adjacent to the passage-way in such water-supply pipe, means to obtain a determined pressure to the contents of the water-supply pipe and means to obtain a determined pressure to the contents of the oil-supply pipe; substantially as described.

6. In a gas-making apparatus, the combination with a retort and the oil and water supply pipe therein, of a plurality of combined coupling and feeders, to the coupling part of each whereof the supply-pipe is attached to bring the several feeder parts alternately on opposite sides of the supply-pipe and to discharge into the retort in opposite directions, the feeder part of each of such combined coupling and feeders consisting of a water-nozzle discharging into the retort and an oil-nozzle discharging into the water-nozzle adjacent to the discharge-opening thereof, whereby the oil discharged into the retort is surrounded by water as it passes through the water-nozzle of the feeders; substantially as described.

7. In a gas-making apparatus, the combination with a retort of a water-supply pipe and an oil-supply pipe therefor, such oil-supply pipe incased the entire length thereof within the retort by the water-supply pipe, and a return-pipe communicating with the inner end of the water-supply pipe, with a valve to control the flow of water through such return-pipe independently of the flow of the water and oil into the retort, and a combined coupling and feeder, to the coupling part whereof the supply-pipes are attached and the feeder part consisting of a water-nozzle discharging into the retort and an oil-nozzle discharging into the water-nozzle adjacent to the discharge-opening thereof; substantially as described.

8. In a gas-making apparatus, the combination with a retort and the oil and water supply pipe therein, of a return-pipe communicating with the inner end of the water-supply pipe, with a valve to control the flow of water through such return-pipe independently of the flow of the water and oil into the retort, a plurality of combined coupling and feeders, to the coupling part of each whereof the supply-pipe is attached to bring the several feeder parts alternately on opposite sides of the supply-pipe and to discharge into the retort in opposite directions, the feeder part of each of such combined coupling and feeders consisting of a water-nozzle discharging into the retort and an oil-nozzle discharging into the water-nozzle adjacent to the discharge-opening thereof, whereby the oil discharged into the retort is surrounded by water as it passes through the water-nozzle of the feeders; substantially as described.

9. In a gas-making apparatus, the combination with a retort of a water-supply pipe and an oil-supply pipe therefor, such oil-supply pipe incased the entire length thereof within the retort by the water-supply pipe, and a combined coupling and feeder, to the coupling part whereof the supply-pipes are attached and the feeder part consisting of a water-nozzle discharging into the retort and an oil-nozzle discharging into the water-nozzle adjacent to the discharge-opening thereof, and means to intermittently supply pressure to the contents of the oil and water supply pipes; substantially as described.

10. In a gas-making apparatus, the combination with a retort and the oil and water supply pipes therein of a plurality of combined coupling and feeders, to the coupling part of each whereof the supply-pipes are attached to bring the several feeder parts alternately on opposite sides of the supply-pipes and to discharge into the retort in opposite directions, the feeder part of each of such combined coupling and feeders consisting of a water-nozzle discharging into the retort and an oil-nozzle discharging into the water-nozzle adjacent to the discharge-opening thereof, whereby the oil discharged into the retort is surrounded by water as it passes through the water-nozzle of the feeders, and means to intermittently supply pressure to the contents of the oil and water supply pipes; substantially as described.

11. In a gas-making apparatus, the combination with a retort, of supply-pipes therein extending longitudinally thereof, a plurality of combined coupling and feeders in the retort, to the coupling part of each whereof the supply-pipes are attached, to bring the several feeder parts on opposite sides of the supply-pipes and to discharge into the retort in one direction from the feeder parts on one side of the supply-pipes and in the other direction from the feeder parts on the opposite side of such supply-pipes, means to intermittently apply pressure to the contents of the supply-pipes, and filling material in the retort extending from the under side thereof to near the discharge-opening of the feeder part of the combined coupling and feeders and upon which filling material the liquid discharged therefrom is delivered; substantially as described.

12. In a gas-making apparatus, a furnace, retorts, supply-pipes to and within the retorts, respectively, the supply-pipes in the retorts comprising inner supply-pipes inclosed within outer supply-pipes, such supply-pipes re-

spectively provided with passage-ways the passage-ways in the outer supply-pipes communicating with the retorts and the passage-ways in the inner supply-pipes communicating with the outer supply-pipes adjacent to the passage-ways in such outer supply-pipes, and means to intermittently apply pressure to the contents of the inner supply-pipes to obtain an intermittent delivery of such contents into the retorts; substantially as described.

13. In a gas-making apparatus, a combined coupling and feeder, consisting of an outer and an inner coupling, each provided with screw-threads at both ends thereof, and each provided with an outlet midway thereof extending laterally therefrom, and each provided with a nozzle communicating with the laterally-extending passage-ways, the passage-ways in the nozzles extending parallel with the axes of the couplings and the nozzle of the inner coupling contained within the nozzle of the outer coupling; substantially as described.

14. In a gas-making apparatus a furnace, retorts, supply-pipes respectively provided with passage-ways, the supply-pipes in the retorts comprising inner supply-pipes inclosed within the outer supply-pipes and such outer supply-pipes respectively provided with return-pipes from the inner end thereof extending back and out of the retorts, valves to such return-pipes respectively, such supply-pipes respectively provided with passage-ways communicating with the retorts and means to intermittently supply pressure to the contents of the supply-pipes to obtain an intermittent delivery therefrom into the retorts; whereby the proportionate delivery of the contents of the outer supply-pipes into the retorts is controlled by the position of the valves in the return-pipes; substantially as described.

Signed at Chicago this 26th day of June, A. D. 1901.

WILLIAM J. FAULKNER.

In presence of—
CHARLES TURNER BROWN,
C. A. ADAMS.