B. LOOMIS.

APPARATUS FOR MANUFACTURING GAS.

APPLICATION FILED FEB. 2, 1906.

939,282. Patented Nov. 9, 1909.

3 SHEETS—SHEET 1.

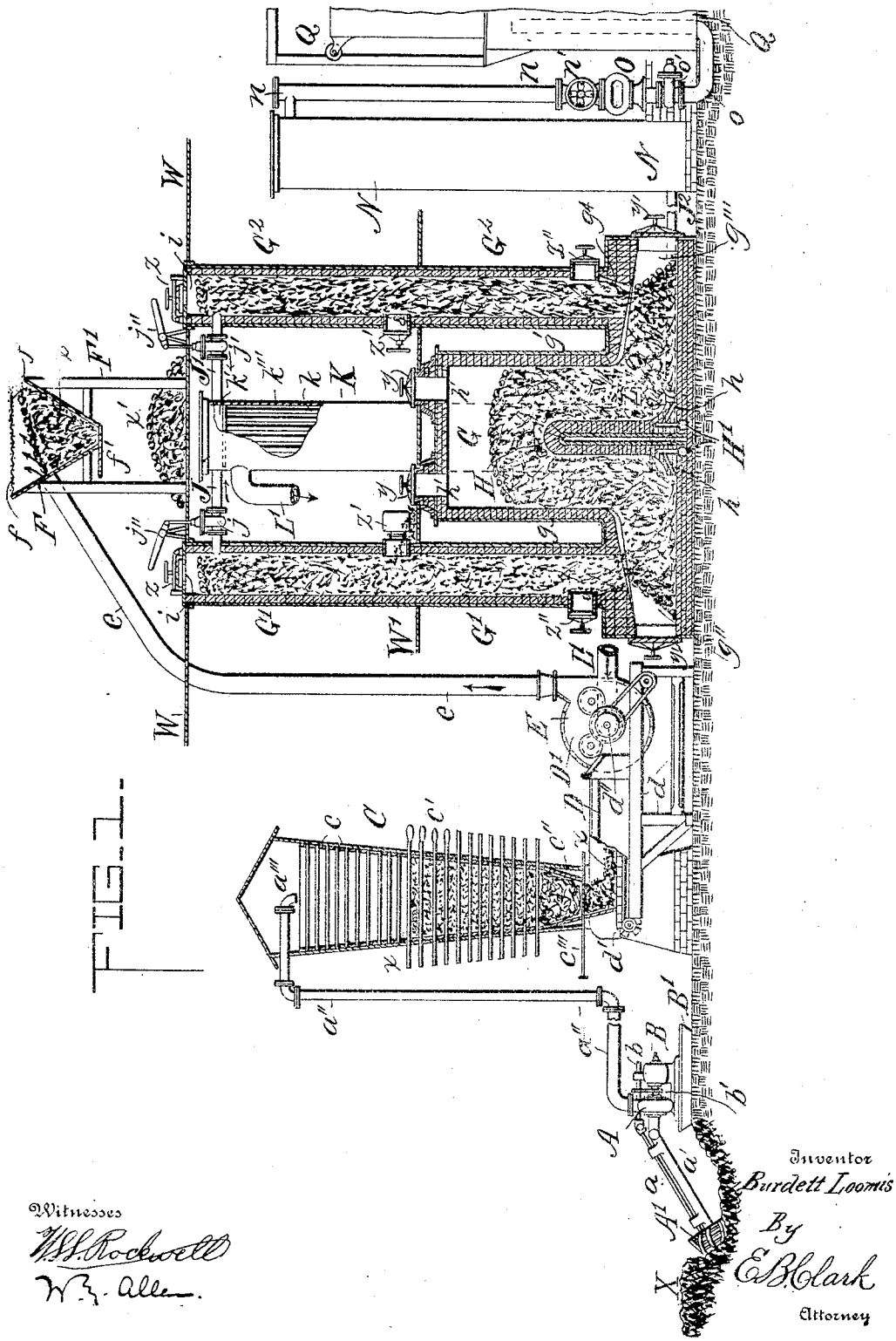

FIG. 1.

Witnesses

W. S. Rockwell

W. J. Allen.

Inventor

Burdett Loomis

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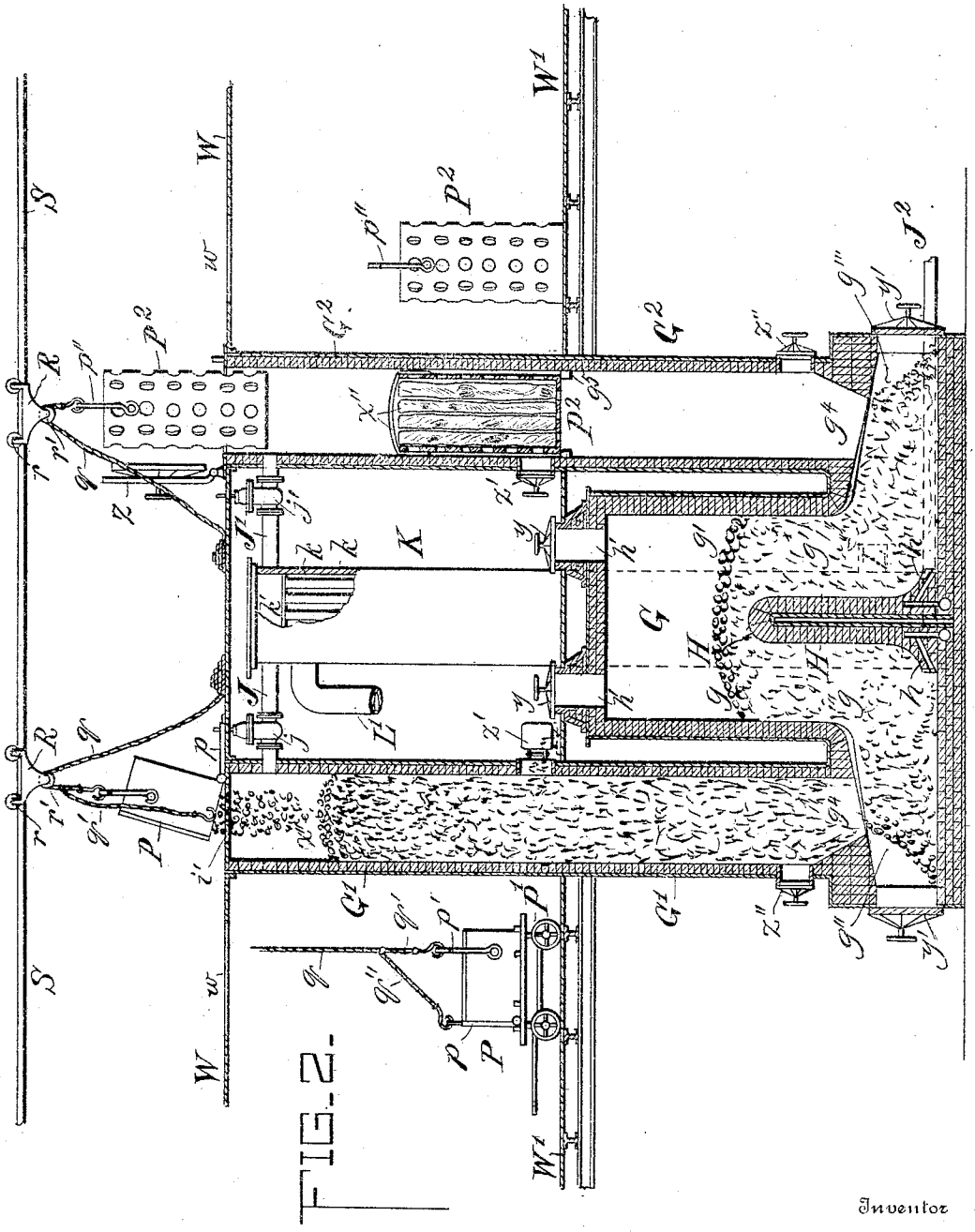

FIG. 2.

Witnesses

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3 SHEETS—SHEET 3.

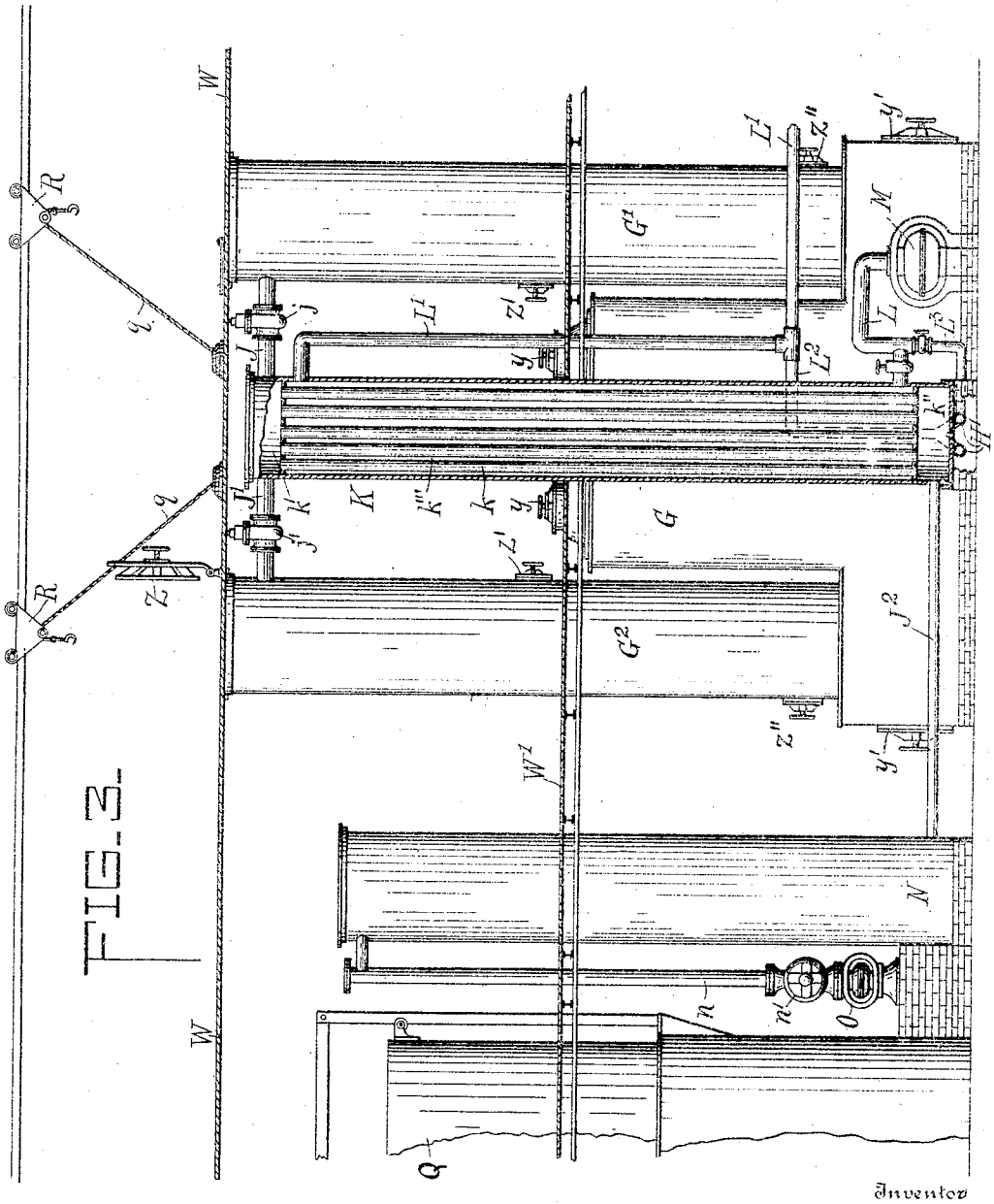

FIG. 2.

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UNITED STATES PATENT OFFICE.

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APPARATUS FOR MANUFACTURING GAS.

939,282. Specification of Letters Patent. Patented Nov. 9, 1909.

Application filed February 2, 1906. Serial No. 299,126.

To all whom it may concern:

Be it known that I, BURDETT LOOMIS, a citizen of the United States, residing at Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Apparatus for Manufacturing Gas, of which the following is a specification.

This invention relates to apparatus for manufacturing gas from cheap, waste material.

The object of my invention is, more particularly, to provide a gas generator which is adapted for making gas from peat, garbage, bagasse, spent beet-pulp, sawdust and other waste material containing a large per cent. of water, and in which the excess of moisture is vaporized and carried off by the outgoing hot gas before such material is fed down to the gas making zone and gasified.

One of the special objects of my invention is to provide for economically and effectively driving off the excess of moisture in gas making material by hot gas which is passed off from the generating chamber.

Another object of my invention is to provide for economically drying and feeding the dried material to the top and bases of the generating chambers, in a two chambered generator, and to periodically reverse the draft, so that the body of dried material in one feeding and drying chamber may be gasified while another body of fresh, moist material in the other feeding and drying chamber is being dried by the outgoing hot gas.

Another object of my invention is to provide for heating air which is separately used in the drying and gasifying operation; also to produce, incidentally, charred material by means of the out-going hot gases.

The apparatus may be operated in a variety of ways for making the particular kind, or quality of gas desired.

The matter constituting my invention will be defined in the claims.

The construction and operation of my apparatus will be understood by reference to the accompanying drawings, in which—

Figure 1, represents a longitudinal vertical section with parts in elevation. Fig. 2 represents a vertical section of the generator and connected drying and distilling chambers, on enlarged scale, with parts in elevation. Fig. 3 represents a rear elevation of the apparatus, showing part of the generator, a condenser, air blower, scrubber and holder.

Peat, as taken from the bog, contains from 7 to 85 per cent. of water and cannot be successfully gasified in that condition in the ordinary gas-producer, or generator by reason of the excess of moisture. I wish, however, to avoid the long and expensive preliminary drying operation in a special apparatus which involves much loss of time and much expense for handling, and to rapidly and economically make gas, which is adapted for motive power and heating purposes, from crude, raw material, such as peat, garbage, sawdust, bagasse and spent beet-pulp. I have therefore devised an apparatus in which the raw, moist material is gradually fed down to the gasifying zone in the generating chamber while it is being dried and distilled by contact therewith of the outgoing hot gas from the generating chamber.

I will first describe apparatus adapted for rapidly taking peat from a bog, storing it in drying bins or cribs, cutting it and delivering it by a hot air blast and blower-elevator into a separating hopper, whereby much of the water is preliminarily removed.

I preferably employ a centrifugal pump A and a rotary cutter or excavator A^1 having a jointed driving shaft *a* and a jointed exhaust pipe *a'*, the cutter head being located in the peat box X, and the pump on a barge B^1 or any suitable supporting base which can be moved along. An electric motor B may be connected directly with the shaft of the pump and be provided with a gear *b'* meshing with a similar gear on the driving shaft *b* which is flexibly connected to the shaft *a*. A delivery pipe *a''* leads from the pump A to the top of a storing and drying crib C where it is provided with a discharge spout *a'''* arranged centrally at the top of the crib. The crib C is constructed with a vertical frame work and with cross slats or bars *c*, providing ventilating openings as shown in Fig. 1. In the ventilating openings may be placed a series of removable sustaining bars *c'* to keep the moist peat from packing into a close mass. These bars may be removed near the bottom as material is fed downward. Any desired number of cribs may be provided and they may be moved into place on wheels or trucks. Each

crib is provided at the lower end with a discharge chute c'' and with a sliding damper or valve c'''. Evidently a number of cribs C may be filled with peat and allowed to stand and dry out any desired length of time before the material is used. A crib being in proper position a feeding and conveyer trough D, supported on a frame d, may be arranged under the chute c'' for conveying the peat to the revolving cutter D^1 which is also supported on the frame d. In the trough D is placed a conveyer belt d' passing over rollers and adapted for conveying peat to the cutter D^1. This cutter is provided with suitable driving gearing d'' and has connected with it a blower-elevator E by means of which the material, as cut, will be blown by an air blast up through the delivery pipe e into the elevated hopper F. A hot air pipe L^1, leading from a condenser, connects with the blower E to assist in drying the material. The hopper F is supported on a frame F^1 and is provided at the top with a wire cloth screen f and at its lower end with a sliding damper or valve f'. The screen f will permit the escape of air and vapor but will retain the peat x. The material may be discharged from the hopper in a partly dried condition into a pile x' on the working floor W, convenient to the upper ends of the drying and distilling chambers as shown in Fig. 1.

My generator, proper, comprises the two chambered cupola generator G and the two connecting fuel-drying and distilling chambers G^1, G^2, and the necessary connections, supply and outlet pipes. The generator G is made oblong in cross section toward the top and below is divided by a transverse vertical partition H into the two fuel chambers g and g' and each of these is provided, at the base, with a horizontal extension or neck, g'', g'''. The generator G and side chambers G^1 and G^2 are constructed with iron shells and brick linings, and the partition H is made with a double iron jacket, having an intervening air space, and interior brick linings. In the brick-work at the base of the partition are placed the air inlet pipes H^1, having ports or twyers h, h, The top of the generator is, preferably, provided with two fuel supply openings h', h' having tight closing lids y, y. The outer openings of the necks g'', g''' are closed by tight fitting doors y' y'. The necks g'', g''' are made strong and suitably arched to support the drying and distilling chambers G^1, G^2, which connect therewith by the contracted openings g^4. The chambers G^1, G^2 are constructed with iron shells and brick linings and are, preferably, made tall,—about twice the height of the generator,—to better utilize the heat of the outgoing gas. They are made with upper openings i and tight fitting covers z, with side openings and doors z' at the floor level W^1, and with lower openings and doors z'' for removal of dried material and charcoal. The openings z' and z'' will be of any desired size and height for removing large pieces of charred material. Near the tops of chambers G^1, G^2 are connected the gas outlet pipes J, J^1, provided with valves j, j', and connecting with the condenser and air heater K. To the stems of the valves are connected the operating levers j'' mounted on stands on the floor W.

The condenser K is constructed of a cylindrical shell, with upper and lower tube sheets connected by tubes k, and providing upper and lower gas chambers k' and k'' and a tube chamber k'''. An air supply pipe L, leading from a blower M, connects with the lower end of chamber k''', and an outlet pipe L^1 connects with the upper end thereof and leads to the blower elevator E. A branch pipe L^2 may take part of the hot air to the air inlet pipe H^1 connecting with the base of the generator. A branch pipe L^3 may take air directly from the blower to pipe H^1. A pipe J^2 takes gas from the base of condenser K, to the base of the wet scrubber N. A pipe n, having a valve n', leads from the top of the scrubber to the exhauster O, from which a discharge pipe o, having a valve o', leads into the holder Q.

In using garbage and other refuse it is placed in a detachable tight receptacle, or tank P, having a hinged door p, and a pivoted bail p', and adapted to be mounted on a truck or wagon P^1 for transportation to the gas plant, as shown in Fig. 2. A hoisting rope q, having ends q', q'', provided with hooks, is engaged with the bail and an eye on the door for elevating tank P to the top of either chamber G^1 or G^2 and discharging the contents therein. The rope q passes over a pulley r' on a trolley R which is provided with wheels r resting on the elevated rail S. The chamber G^1 will be filled or charged with fresh moist material when valve j is closed and gas is being drawn off through chamber G^2 and valve j', into the top of condenser K. In a similar manner the chamber G^2 will be charged when chamber G^1 is closed and gas is being drawn off through it and valve j into the condenser.

When it is desired to dry and partially char rail road ties and other large pieces of timber I, preferably, provide perforated cylinders P^2, having perforated bottoms and, near the top, laterally projecting studs or bolts with which are connected the eyes or loops of a swinging bail p'' as clearly shown in Fig. 2. Since the ties or other sticks of timber are to be charred only on the outer surface they are preferably placed only in the upper half of one or both of the chambers G^1, G^2 as shown. Inwardly projecting

lugs g^3 may be provided for sustaining a lower cylinder and then another cylinder set on top of the same. In this arrangement the lower half of the chamber may be charged with slabs and irregular pieces of wood to be distilled and converted into charcoal by a sufficiently long exposure to the hot gas to produce that result. Of course, sticks of wood in the cylinders P^2 may be exposed to the hot gases long enough to reduce the same to charcoal. The cylinders containing charred material may, on removal from the chamber G^2, be placed in an air tight pit or other receptacle out of contact with the air. The charcoal made in the chambers G^1, G^2 may at any time be withdrawn through the doors z'' and stored in tight chambers for separate use or sale as desired.

I may use two or more condensers like that shown at K, or of any other approved style which is adapted for condensing the volatile material in the out-going gas so as to make and save the largest possible amount of tar-water. This tar-water will be separately treated for obtaining wood alcohol and other products. The air blower M is connected by pipe L with the lower end of the tube chamber k''' and the air will circulate around the tubes k while hot gas will pass down through the tubes, thereby heating the air, which is passed off through the upper pipe L^1 and used as above described.

In practice suitable means will be provided for drawing off tar-water from the condenser and storing it in closed tanks.

In operating the apparatus fires are kindled, in both chambers g and g' supplied with fuel and burned with natural draft till well ignited, the products escaping through the fuel openings h', after which the doors and lids are closed and the air-blower M started, forcing air through pipes H^1 and twyers h, h into both beds of fuel. The exhauster O may now be started and gas drawn off through the distilling and drying chamber G^1, pipe J, the condenser K and scrubber N. At any suitable time the chamber G^1 will be charged with moist waste material so that the hot gas will be drawn through it. While gas is being drawn through chamber G^1, the chamber G^2 may be charged with fresh material. In continuing the operation the air blast may be admitted only to the chamber g' of the generator and passed up through the fuel therein, thence down through the fuel in chamber g where any contained carbon dioxid will be converted into carbon monoxid, and hydrocarbon or other vapors will be converted into fixed gas. This gas is then passed up through chamber G^1 where it acts on the moist material to dry and distil the same and carries the volatile distillates off through pipe J, thence through the condenser and scrubber. The volatile matter will be condensed into crude tar-water in the condenser K. At any suitable time after the material in chamber G^1 has been partially distilled and charred the valve j is closed and the valve j' is opened, and air will be admitted into chamber g of the generator. The gaseous products will now pass up through chamber g and down through chamber g' where the reactions above mentioned will take place, and the hot gas will then pass up through the material in chamber G^2 thereby distilling and charring the same. At any desired time one of the doors z' may be opened and dried material drawn out and fed through the fuel openings h', one or both, into the top of the generator G so as to maintain the fuel at a level above the top of the partition H and, preferably, at a height about midway between the top of the partition H and the top of the generator. The material fed into the generator G may contain about 20 to 30% of water; this will be sufficient to yield the desired proportion of hydrogen to the whole volume of gas produced. While gas is being drawn off through chamber G^2 some of the vapors which are being evolved in chamber G^1 will be drawn through the beds of fuel in the chambers g and g' and converted into fixed gas. In a like manner vapors may be drawn from the chambers G^2 through both beds of fuel when gas is being passed off through the chamber G^1. The direction of the draft and flow of gas through the chambers will be reversed at such intervals or periods as are found to give the best results, according to the condition of the fuel in chamber G and the material in chambers G^1 and G^2.

In large cities and other places much dry waste material such as paper, paste-board, excelsior, sticks of wood, etc., will be fed directly through the top openings h' into the generator.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. A cupola gas-generator having at the top a fuel supply opening, and at the base, a horizontal extension chamber provided with a door, a charring, or drying and distilling chamber mounted on, and opening into said extension chamber and having an upper outlet pipe for gas and vapor and means for supplying air to the generator, substantially as described.

2. The combination with a gas generator and a charring and distilling chamber connecting with the base thereof and having a gas outlet pipe, of means for heating air, a blower elevator having a moist fuel supply, a pipe connecting the air heater with said elevator, and a delivery pipe therefrom, for elevating and drying the moist material, substantially as described.

3. The combination with a gas generator and a connecting charring and distilling

chamber, having a gas outlet pipe, of a connecting gas condenser and air heater, means for supplying air thereto, a blower elevator having a moist fuel supply, and a pipe connecting the air heater with said elevator for elevating and drying the moist material in transit, substantially as described.

4. The combination with a gas generator and a charring and distilling chamber connecting with the base thereof and having a gas outlet pipe, of a hopper above said charring chamber, a blower elevator having a moist fuel supply and air inlet pipe, and a delivery pipe connecting the blower elevator with said hopper, substantially as described.

5. The combination with a gas generator and a connecting charring and distilling chamber, having a gas outlet pipe, of a connecting gas-condenser and air heater, means for supplying air thereto, a cutter for moist material, a connected blower-elevator and a pipe connecting the air heater with said elevator for elevating and drying the moist material, substantially as described.

6. The combination with a gas generator and a connecting charring and distilling chamber, having a gas outlet pipe, of a connecting gas-condenser and air heater, means for supplying air thereto, a cutter and blower-elevator, a separate hopper having a perforated screen and mounted above the distilling chamber, a pipe for hot air connecting the condenser with the blower-elevator and a pipe leading from the latter to said hopper, substantially as described.

7. A two-chambered cupola gas-generator having a transverse partition rising from the bottom and each chamber having a horizontal extension or neck provided with an outer door, a distilling and charring chamber connecting with each neck and having at the top a valved gas outlet pipe, a tubular condenser and air heater having an upper gas chamber with which said outlet pipes connect, said distilling chambers having feed openings and lids at the top, substantially as described.

8. The combination with a two-chambered gas-generator having a fuel opening at the top and each chamber having an air supply pipe at the bottom and also a horizontal extension or neck having an outer opening and door, of two vertical distilling and charring chambers connecting with said necks, a tubular gas condenser and air heater, gas outlet pipes, each having a valve, connecting the tops of said distilling chambers with the gas chamber of the condenser and an exhauster connecting with the lower end of the condenser, substantially as described.

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

BURDETT LOOMIS.

Witnesses:
HARRISON B. FREEMAN, Jr.,
G. L. LOOMIS.