

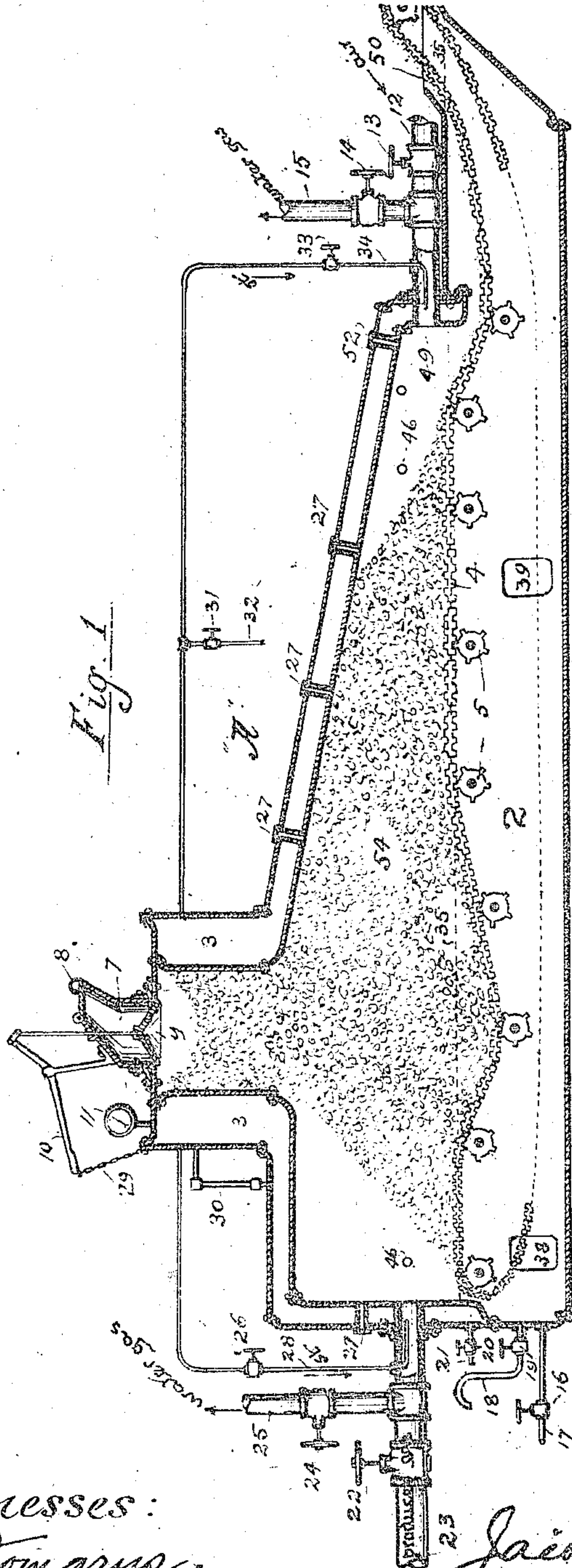
No. 859,989.

PATENTED JULY 16, 1907.

J. S. SMITH.
APPARATUS FOR PRODUCING GAS.

APPLICATION FILED APR. 24, 1905.

2 SHEETS—SHEET 1.



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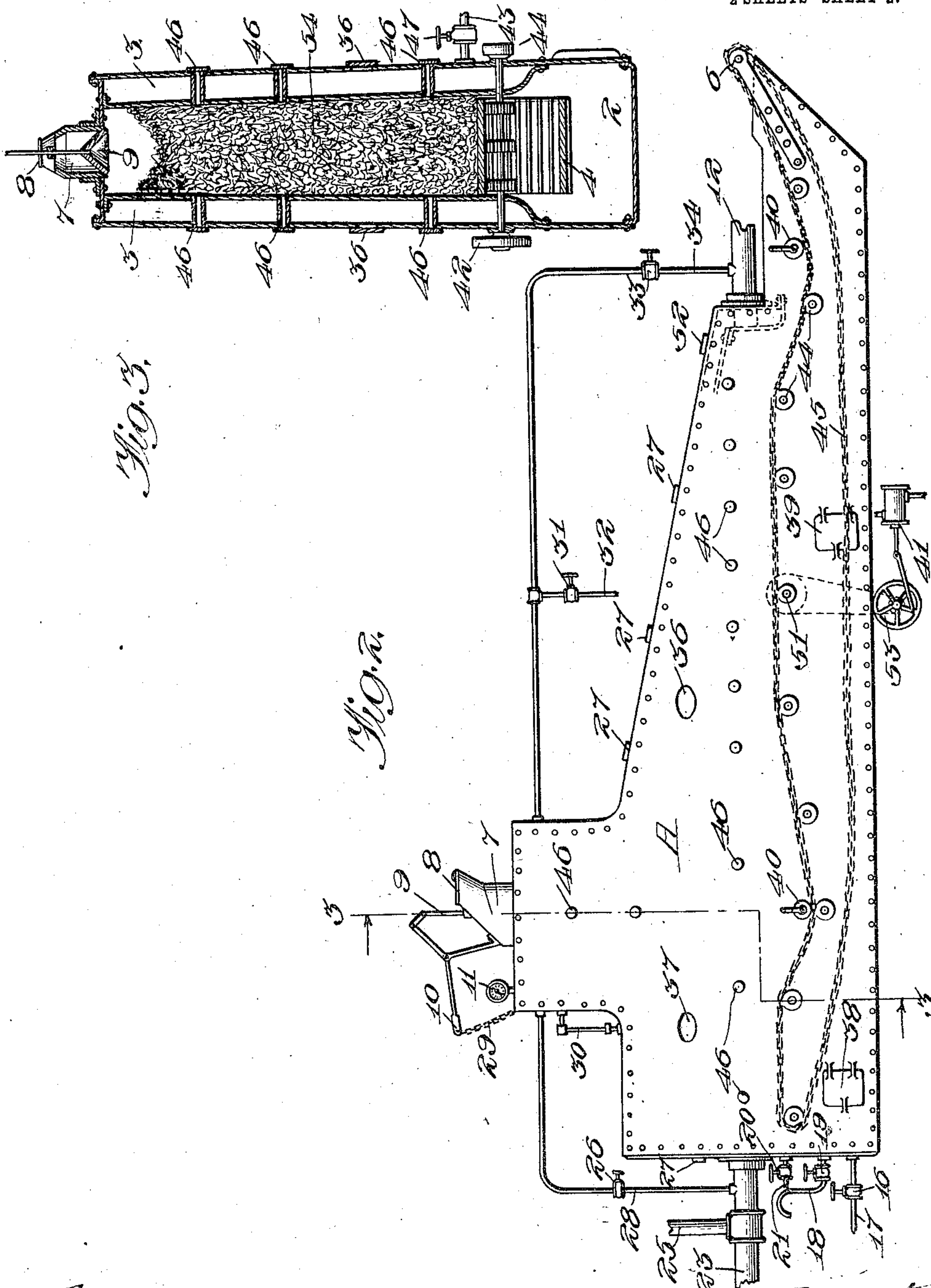
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UNITED STATES PATENT OFFICE.

JACOB S. SMITH, OF CHICAGO, ILLINOIS.

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No. 859,989.

Specification of Letters Patent.

Patented July 16, 1907.

Application filed April 24, 1906. Serial No. 257,121.

To all whom it may concern:

Be it known that I, JACOB S. SMITH, a citizen of the United States, residing in the city of Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Apparatus for Producing Gas, of which the following is a specification.

This invention relates to improvements in apparatus for producing gas for heating purposes from coal, coke, wood, peat or other hydro-carbons, with the employment of air and steam, and particularly from coal.

One of the objects of my invention is to manufacture water and producer gas, alternately, in the same generator.

Another object of my invention is to generate gas from coal, coke air and steam, commonly known as producer gas, and concurrently therewith continuously supply the coal to the generator and remove the ashes, clinkers and other refractory materials therefrom, without interfering with the continuous operation of producing gas.

With these ends in view, my invention consists of certain features of novelty in the construction, combination and arrangements of parts, by which said objects and certain other objects hereinafter appearing, are attained, all as fully described with reference to the accompanying drawings, and more particularly pointed out in the claims.

In the said drawings: Figure 1 represents a vertical longitudinal section of a gas generating apparatus for carrying out my invention, with certain pipes hereinafter described, shown in full lines. Fig. 2, a side elevation of the said apparatus illustrating the means for driving the endless bottom, supporting the coal or other hydro-carbon in the generating chamber, and Fig. 3, a vertical cross-section on the line 3-3 of Fig. 2.

Similar characters of reference indicate the same parts in the several figures of the drawings.

A indicates a water cooled generator, the upper half of which may be in the form of a water jacket 3, and at the same time constituting a steam generator for steam to be supplied to the generating chamber for gas and for a motor for actuating the various conveyers, pumps etc. employed in connection with the generator. The lower half of the generator is substantially in the form of a vat or tank 2, filled with water to a level indicated by the dotted line 35 and in which is partly submerged the endless bottom 4 of which a portion is submerged in the contents of the vat 2.

The endless bottom may consist of a number of linked grate bars but is preferably composed of a series of corrugated hinged plates 4, provided with downward projections or cogs, and supported and actuated by means of a number of cog wheels 5. Some of these cog wheels are in different planes from others, preferably lower immediately under the feeding device 7 and

the firing nozzle 49, so that the movable bottom is submerged some distance below the surface of the water in its passage over the cog wheels 5, 5 and then gradually rises after passing under a point vertically from device 7 and to such a plane with reference to the water level in the tank, that the plates of which the movable bottom is composed, are partly submerged, but their supporting surfaces are out of the water until nearing the firing nozzle 49, when the bottom again descends beneath the surface line 35, and after being submerged in the vat 2 in its endless movement, passes thence out through the opening 50 over wheel 6.

The walls of the tank are provided with suitable stuffing boxes not shown, through which the shafts of the several cog wheels project, all of which shafts preferably have on their outer ends, sprockets 44 for a drive chain 45. While I have shown external sprockets 44 on every one of the shafts, for the internal cog wheels and an endless chain 45 connection therefor, some of these sprockets may be omitted, although they are preferably used in order to insure a uniform movement of the movable bottom when the load therein hereinafter described, seemingly requires them.

The driving shaft 51 is propelled by the steam engine 41, or by any suitable power and the steam therefor may be taken from the pipe 32 now shown as connected. The water line 35 is maintained in vat 2 by the water inlet 17 and the gooseneck 18 and the water for the steam generator 3 is introduced through 21 with the blow-off 43 and hand holes 36 and 37 for controlling and cleaning purposes, and the steam generator 3 also has a water gage 30, steam pipes 28, 32 and 34 with gates 26, 31 and 33 and steam gage 11. Surmounting the generator is the feeding chamber 7 which has a lever 10 held by the chain 29 controlling the valve 9 and a lid or trap 8. Entering the front end of generator A is pipe 12 discharging at point 49 attached to which are gates 13 and 14 and pipe 15, and connected at the opposite end is a pipe 23 controlled by gate 22 connected to which is pipe 25 with a gate 24 and on the top and end are bar holes 27, 27, 27, 27 and hole 52 for igniting purposes near the firing point 49. The peep-holes 46 may also be used as bar holes or for the introduction of steam or air by suitable connections at such points as desired and are closed or opened by ordinary plugs for such purposes. The power to drive shaft 51 is applied to the larger sprocket wheel 42 by means of a chain and gear 53 from engine 41 which may receive its steam from pipe 32.

40, 40 are pulleys to prevent the chain 45 from leaving the sprockets and 38 and 39 are openings for entrance to the vat for repairs or adjustment.

54 represents the coal in place in the generator ready for igniting.

In the operation of this apparatus coal is introduced by raising the trap 8 and lowering the valve 9 by un-

hooking the chain 29, when the generator 1 has been filled as far as is possible through the feeding chamber 7, the gear is started and the endless bottom moved toward the firing point 49 while at the same time adding coal through chamber 7 until the generating chamber has been filled as shown by 54, the gear is then stopped, valve 9 closed and the coal is ignited through 52, when the portion nearest to the point 49 has been consumed the gear is again started and regulated to carry out the ashes and cinders formed by the combustion within, and coal is introduced by means of 7, by manipulating the lever 10 and the trap 8. A blower (not shown) attached to the pipe, 12, is then operated to create draft, the gates 13 and 22 being open and gates 14, 26 and 24 are closed and steam introduced as required through 34 by the gate 33. The resulting gases pass out through the pipe 23. The same results may be obtained by attaching an exhauster to the pipe 23 to assist the circulation of the generating gases and in that case the blower beyond on pipe 12 may be omitted or used as desired, but I prefer the use of both blower and exhauster.

The product so made is the producer gas hereinbefore mentioned and may be directed immediately into a furnace for heating purposes, or scrubbed, filtered and treated to extract the tarry or other objectionable matter for use in gas engines or other purposes to which it may be adapted.

In the production of water gas intermittently with producer gas, the running of producer gas is interrupted by closing gates 13, 31 and 22 and opening gate 24; gate 33 is operated to admit steam and the gas so made is conducted away through the pipe 25 which may be provided with an exhauster or pump beyond. When the temperature of the coal has been reduced below that required for generating water gas, the gates are again manipulated and the production of producer gas again resumed and so on. The water gas so made will necessarily carry with it some hydro-carbons, but if gas comparatively free from tarry matter is desirable, then the change from the making of producer gas is as follows: Gates 13, 22, 33, 24 and 31 are closed and gate 14 opened and steam is admitted through gate 26, the resultant gas passes out through pipe 15 which circulation may be assisted by a pump or exhauster beyond attached to the pipe 15. When the heats within have subsided below the point necessary to generate gas in this manner, the gates are again manipulated and the generating of producer gas is resumed. During the runs of water gas the movement of the gears and movable bottom are stopped, and started when producer gas is resumed.

As this invention pertains only to the generating of gas, the ordinary exhausters, pumps, blowers, scrubbers, filters and connections beyond are not shown.

Water cooled gates and fire brick lining are intended where such are necessary and not shown, and fire brick may be substituted for the water cooled sides and top of the generator A, but I prefer the water cooled construction especially in the manufacture of producer gas because of the lower heat that may be so maintained admits of the greater gasification of coal within the necessary temperature.

The object of the elongated box shaped generator is to secure a large quantity of gas making materials, as for example, coal so distributed and in such position as

will insure varying stages of gasification throughout the mass, whereby the gasifying elements may be made to permeate and pass through an extended body of dissociating materials.

The endless bottom carries out the ashes and refractory matter continuously, by such movement the coal is agitated within to maintain the necessary degree of porosity and the wedge shape of the top inclining in the direction of the movement forces the coal against the top and sides until near the point of combustion where it is reduced to ashes and is carried out by the endless bottom. In this manner the generator is kept closely filled until nearing the nozzle and the air, steam and gases are forced to pass through the coal and the dip or depression of the endless bottom beneath the surface of the water in the vat below, which dip preferably is under the filling point for coal forces any gas that may pass through or on the bottom into the coal above. It is obvious that this extended circulation of the gaseous elements throughout the body of coal in its various stages of gasification insures contact and mixing under the essential heats and conditions necessary for the very best results.

The entire machine is easy of control in that the ashes and cinders are deposited as fast as made in the plain view of the attendant by which he may govern the consumption of coal by manipulating the air, steam or movement of the endless bottom. The peep-holes and bar-holes also disclose and provide means for the control of conditions within the generator.

The watery vapors arising from the vat by reason of the heat above and contact with the endless bottom, which is necessarily loosely jointed, pass upward and are dissociated in the coals above, but any excess of such evaporation may be easily controlled by the larger flow of cold water in and out of the vat to reduce the temperature of the water, or may be suspended by so maintaining the water in the vat below the evaporating point.

The steam generated within the water cooled sides and top of the generator may be used to furnish the power to drive the gears by means of an ordinary steam engine 41 and the exhaust steam of the engine may be utilized for the steam of gas generation by simply connecting the exhaust pipe of the engine with steam pipe 34 and the usual gates and openings for its control.

The movable bottom in its passage reversely to the consuming current of gasification, forces the coal continuously into a wedge shaped form closely filling the generating chamber as fast as the coal is consumed, at the same time by such movement promoting the porosity of the contents, whereby the air and steam are passed through an extended and decomposing mass, and the bottom moving with the lower part of its plates in the water line is kept substantially cool with practically no interference with the combustion and gasification above.

Having described my invention, what I claim and desire secured by Letters Patent is,

1. A gas producing apparatus comprising in combination a gas generating chamber, a water vat below the same, an endless bottom for said generator the fuel supporting surface of which bottom is provided with a depression submerged in the liquid contents of said vat, and means for supplying steam to said chamber in a direction

opposite to the rearward movement of the fuel supporting surface of the endless bottom, substantially as described.

2. A gas producing apparatus, comprising in combination, a gas generating chamber, a water vat below the same, an endless bottom for said generator, partly submerged in the contents of said vat, a water jacket surrounding said chamber and means for supplying steam therefrom to both extremities of said chamber, substantially as described.
3. A gas producing apparatus comprising in combination an elongated box shaped generator converging from its forward towards its rear end, and a movable bottom therefor, means for supplying coal to said bottom, and means for actuating said bottom whereby said coal during its forward movement through the generator chamber is forced to wedge and fill the space between the top and bottom of said generator, substantially as described.

4. A gas producing apparatus comprising in combination an elongated converging box shaped generator, a movable bottom therefor, means by which coal supplied to the generator is forced in wedge shape toward a firing nozzle, of a water filled vat and means whereby said bottom is moved on the surface of the water and ashes are discharged through the water chamber and entirely outside of the apparatus, substantially as described.

5. A gas producing apparatus, comprising in combination a generating chamber, a water filled vat, an endless bottom, the fuel supporting surface of which has a de-

pression submerged in the contents of said vat at a point opposite the supply of fuel thereto, substantially as described.

6. A gas producing apparatus comprising in combination a generating chamber, a water filled vat, an endless bottom for said generator, the rearward end supporting surface of which is submerged in the contents of said vat whereby the ashes and the other waste materials are submerged in the watery contents of the vat before they discharge from said chamber, substantially as described.

7. A gas producing apparatus comprising in combination a generating chamber, a water filled vat, an endless bottom for said generator, the rearward supporting surface of which is submerged in the contents of the vat and projects to a point externally of the structure of the apparatus, substantially as described.

8. A gas producing apparatus comprising in combination a generating chamber, a water filled vat, an endless bottom, the fuel supporting surface of which has a depression submerged in the contents of said vat and means for injecting steam and air into said chamber in a direction opposing the movement of the endless bottom therein, substantially as described.

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