No. 816,123. PATENTED MAR. 27, 1906.

J. RADCLIFFE.

GAS GENERATOR.

APPLICATION FILED MAR. 28, 1905.

2 SHEETS—SHEET 1.

FIG. 2.

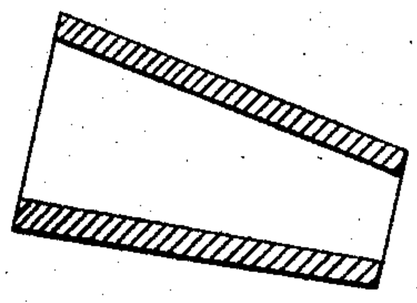

FIG. 3.

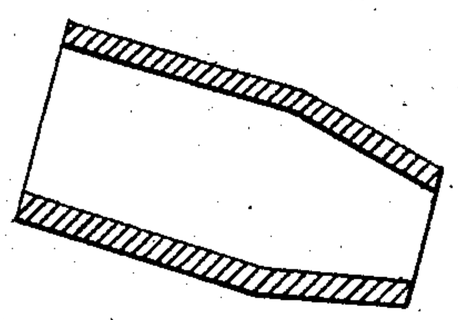

FIG. 4.

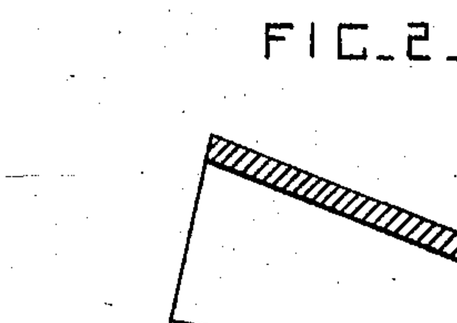

Fig. 1.

Witnesses:
J. Spragg Poole
Robt. A. Cassel

Inventor
John Radcliffe
by Herbert W. Jenner
Attorney

No. 816,123. PATENTED MAR. 27, 1906.

J. RADCLIFFE.

GAS GENERATOR.

APPLICATION FILED MAR. 28, 1905.

2 SHEETS—SHEET 2.

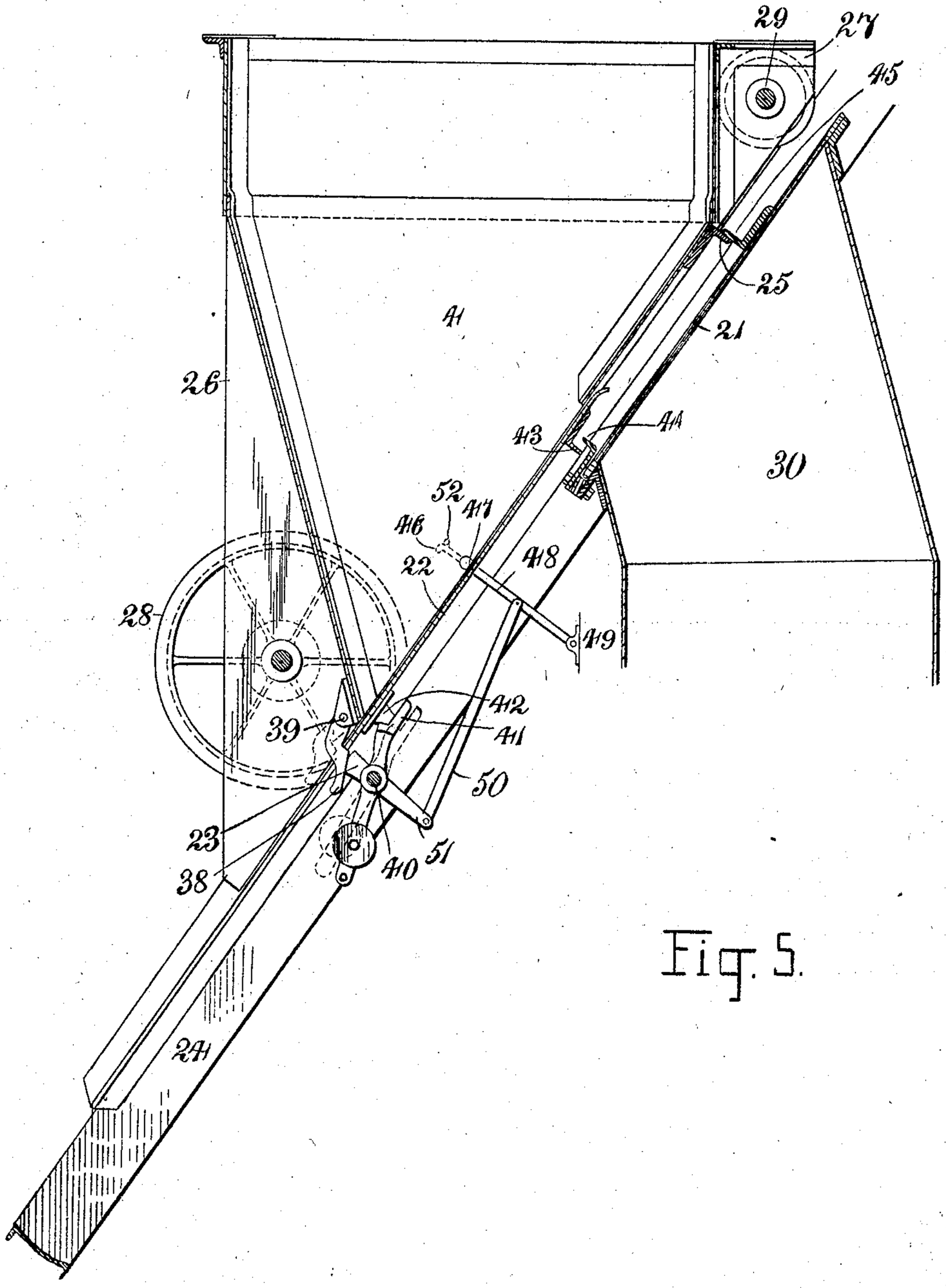

Fig. 5.

Witnesses.
J. Spragg Poole
Robt A Cassel

Inventor.
John Radcliffe
by Herbert W. Jennet.
Attorney

UNITED STATES PATENT OFFICE.

JOHN RADCLIFFE, OF ELLAND, ENGLAND.

GAS-GENERATOR.

No. 816,123. Specification of Letters Patent. Patented March 27, 1906.

Application filed March 28, 1905. Serial No. 252,441.

To all whom it may concern:

Be it known that I, JOHN RADCLIFFE, gas-engineer, residing at Roma, Victoria Road, Elland, in the county of York, England, have invented certain new and useful Improvements in or Relating to Gas-Generators and the Manufacture of 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.

This invention relates to gas-generators and the manufacture of gas; and the object thereof is to provide an improved means for producing gas from combustible materials. According to former inventions the combustible material has been fed into the upper end of an inclined revolving chamber through which it descended slowly as the chamber was turned, exposing fresh surfaces for combustion, and combustible material has been purposely supplied to the revolving chamber. Now according to my present invention I find it advantageous in some instances that the combustion should take place in a fixed chamber and that a revolving chamber or chambers be employed chiefly as receptacles for the hot ash and as a means for heating the blast as it passes over the ash and for conveying the ashes away from the chamber in which the combustion takes place.

A generator constructed in accordance with my invention comprises a generating-chamber having a gas-outlet, an aperture through which the fuel is fed into the said chamber, means for feeding the fuel into the generating-chamber, and an inclined revolving chamber or chambers at the lower end of the generating-chamber for the purpose of removing the ashes and holding them while they are still hot, so that fresh surfaces of hot ash may be exposed to that portion of the blast which passes through the rotary chamber. The air or air and steam blast is delivered directly or indirectly into the upper chamber with or without another delivery at the lower end of the rotary chamber or in some cases entirely through the rotary chamber. By introducing a preponderating proportion of air or air and steam to the upper chamber directly and a small supply at the lower end of the revolving chamber I insure that the generation of gas is effected in the upper chamber, which is the object of my invention. The inclined chamber may be cylindrical throughout or it may be cylindrical at its upper end and frusto-conical at its lower end. In the latter case the inclination of the upper part is greater than that of the operative surface at any given moment of the lower part, and the ash therein is banked up at the upper end where it is hot, leaving a thin layer at the lower end, where it discharges, at the same time facilitating the discharge of ash from the lower end of the generating-chamber. Instead of being partly cylindrical and partly frusto-conical the inclined chamber may be entirely frusto-conical or may be gradually curved toward the lower end; but the point of discharge should always be the lowest point of the rotary chamber in order that it may be possible to completely empty the said chamber. The said rotary chamber is supported on suitable bearings and adapted to be rotated by worm-gearing or other suitable means.

Although the operations described can be carried on with only one rotary chamber, it will generally be advantageous to use two or more, as this reduces the area of the fixed bottom of the generating-chamber and renders the descent of the material more regular with one rotary chamber, there being a tendency for the fuel to fall down the side of the generator at which the rotary chamber is located. Moreover, where two rotary chambers are employed, for instance, if one tube becomes choked or otherwise disabled the plant can still be worked with the other.

Such being the nature and object of the said invention I will now describe the same more fully with reference to the accompanying drawings, which illustrate means for putting the same into practice.

Figure 1 is a general view of an apparatus having two rotary chambers. Fig. 2 is a diagram of a rotary chamber of frusto-conical form. Fig. 3 is a diagram of a rotary chamber, partly cylindrical and partly frusto-conical. Fig. 4 is a diagram of a rotary chamber of curved form. Fig. 5 is a detail in central vertical section of the feeding-hopper.

Referring, first, to Fig. 1, number 1 indicates the fixed generating-chamber, which is provided with a suitable gas-outlet 2. This chamber may be of any convenient shape, but must be of such a capacity as to contain sufficient depth of fuel to convert the greater part of the oxygen admitted thereto into car-

bon monoxid. Fuel may be supplied to the chamber 1 at the upper end by any suitable feeding apparatus—such, for instance, as the well-known bell and hopper—but preferably by means of the feeding-hopper illustrated in the drawings, in which I have shown a tube or fuel-reservoir 3 open at the lower end and provided at the upper end with a hopper 4. The said hopper and the mode of operating the same will be described hereinafter.

Each of the rotating tubes or chambers 5 communicates at its lower end with an ash-bin 6, the passage of the ashes from the rotary chamber 5 into the bin 6 being retarded by the baffle-plate or ash-bridge 7. This baffle-plate, however, would not be required where the lower portion of the chamber 5 was curved, frusto-conical, or of greatly-extended length, as will be hereinafter described. The engine, motor, or other source of power 8 actuates either directly or through pulley 9 the eccentric 10 and by pawls 11 and ratchet-wheels 12 the worms which engage the worm-wheels 13, mounted upon the cylinders 5. Antifriction bowls or wheels 14 engage rings 15, which support the cylinders while rotating. The pulley 9 also drives the blower 16, which by the pipe 17 delivers air or air and steam at the top of each ash-bin 6, whence it passes over the hot ashes in the cylinders 5 to the fuel in the fixed chamber 1. If desired, a small amount of air and steam may be delivered by the pipe 17 and a larger amount directly to the generating-chamber through inlets 18. Water-jets 19 may be employed to cool the ashes in the bins 6.

It will be observed that the ashes in the chambers 5 when at rest must be inclined at an angle of not more than forty-two degrees, which is about the "natural slope" of the material being dealt with, as otherwise they would be discharged into the ash-bin 6 with such rapidity that the whole of the fuel in the upper chamber 1 would follow and it would be impossible to fill the said upper chamber or for any fuel to be retained therein. At the same time it is advisable that the axis of the chamber 5 should be inclined as much as possible in order to facilitate the passage of the materials through the apparatus, and therefore when the chamber 5 is of cylindrical form the ash-bridge 7 is necessary for maintaining the slope of the ashes within the cylinder 5 unless the said cylinder 5 be made of an unnecessarily-extended length. It is, however, sometimes preferable to dispense with the ash-bridge in order to allow the discharge of ashes in a thin layer at the lower end of the chamber 5, and this I am enabled to accomplish by the adoption of a curved or frusto-conical shape of the lower end of the said chamber, whereby the inclination of the working portion of the upper part of the chamber at any moment is greater than that of the working portion of the outlet end thereof. The said chamber 5 may, however, be entirely frusto-conical in shape, as shown diagrammatically in Fig. 2.

The generating-chamber 1 is provided with a suitable number of poke-holes 20.

In operation when starting to use the generator the rotary chambers may be charged with non-combustible material, so as to prevent the raw fuel from entering the said rotary chambers. The generating-chamber is then charged after a fire has been made and the blast started. In due course the fuel becomes incandescent, resulting in the production of combustible gas as the air and steam pass through it. The rotary chambers are then revolved, permitting the hot ash to pass down and be discharged at the lower end, and the blast becomes heated as it passes over the hot ashes.

To permit of the free discharge of the contents of the hopper 4 into the tube 3, the feeding-aperture of which is normally closed by a sliding lid or cover 21, as shown in Fig. 5, I provide the said hopper with a sliding bottom or base plate 22, which on arrival at the feeding-aperture is engaged by a fixed catch or projection 23 on the rail or hoist 24, up which the hopper 4 travels, or on the furnace in such manner that the body of the hopper passes on and allows its contents to be discharged. The hopper is also provided with a catch or projection 25, adapted to engage with the lid or cover 21, so as to carry such lid upward in front of the hopper, thereby leaving the tube 3 open to receive the contents of the hopper. On the hopper commencing its return journey the lid 21, being released, slides back by gravity or otherwise into its former position, closing the tube 3, and at the same time the backward movement of the hopper 4 reinstates the sliding bottom or base plate 22 thereof into its normal position, and the hopper returns ready for another load.

The hopper 4 is provided with webs 26 27 for carrying the axles of wheels 28 29, on which the hopper travels upon the rails 24, extending upward from the position where the said hopper receives its charge to a point above the chute 30 at the top of the tube 3. The raising of the hopper may be effected by a cord or chain 31, (see Fig. 1,) passing over pulley 32 and winch or winding-drum 33, which drum may be rotated by the pulley 9 through the medium of pulley 34, carrying a worm 35, driving worm-wheel 36 on the shaft 37 of the drum 33. The drum 33 is released or its motion reversed to permit of the return or downward journey of the hopper 4 by means of any suitable clutch. (Not shown.) The sliding bottom 22 of the hopper is normally retained in its closed position by means of the step on the trigger 38, Fig. 5, which trigger is pivoted to the hopper at 39. The fixed catch or projection 23, which is

shown as being carried upon a stud or shaft 40, suitably supported on the rail 24 or otherwise, is adapted to engage the trigger 38 upon the hopper reaching a certain height and lift the said trigger into the position shown in dotted lines, thereby releasing the slide 22 from the hopper. Working on the same shaft 40 is a weighted catch or detent 41, and on the slide 22 is a boss or projection 42, which after passing over the detent 41 falls or rests thereupon when the slide 22 is released from the trigger 38, as previously mentioned, the function of this detent 41 being to prevent the slide 22 from slipping down to the bottom of the rails 24 before the return of the hopper. At the front or upper end of the slide 22 is a projection 43, which by engaging with the projection 44 on the furnace would stay the upward progress of the slide in case the said slide failed to become detached from the hopper at the proper time.

On the front of the hopper 4 the projection 25 is adapted to engage with the projection 45 upon the lid or cover 21, and thus to push the said lid open as the open bottom of the hopper arrives above the chute 30, so as to permit of the discharge of the contents of the hopper. On the return or downward journey of the hopper the cover 21 returns by its own weight (or it can be assisted by a counterweight) to reclose the chute 33, and the trigger 38 slides over the loose bottom 32 until it falls into operative position at the lower end thereof; but it is obviously necessary to provide means for disengaging the detent 41, so as to permit the said loose bottom 22 to travel down the incline along with the hopper. This may be accomplished by any suitable arrangement of linked and pivoted levers; but I have shown one such arrangement, by way of example. This consists of a weighted bell-crank lever 46, hinged at 47, so as to be movable upon its hinge in one direction only upon the lever 48, pivoted at 49 to a convenient part of the furnace or framework thereof, the lever 48 being linked by bars 50 51 to the boss of the detent 41. A pin or stud 52 upon the hopper presses the bell-crank lever 46 upward on the advance of the hopper; but on the return of the hopper the pin 52 finds the lever 46 rigid and presses it down until the said pin slides over the end of the said lever, and the downward movement of the levers 46 and 48, through links 50 51, forces the detent 41 into the position shown in dotted lines.

The various catches and other mechanism described for operating the two slides 21 and 22 or any part of such mechanism may be duplicated—that is, each side of the hopper may have a separate set of engaging and disengaging apparatus, both sets of course working in unison.

Suitable joints may be made, if considered desirable, at 53, (see Fig. 1,) where the fixed portions of the apparatus are adjacent to the ends of the rotary chambers 5, by recessing the cast-iron rings 54 and placing in the recess an asbestos cable provided with a hollow center formed by a coil of wire, which cable can be held in position by arms attached to either the fixed or moving portions.

In a generator made in accordance with my invention the ash is automatically and continuously taken away, and low-grade fuels or other materials containing a large proportion of incombustible matter—such, for instance, as towns' refuse and the like—can be used for the generation of gas.

When I use the term "ash," it is to be taken to include any combustible particles which might have escaped complete combustion in the generating-chamber.

I claim as my invention—

1. The combination, with a stationary combustion-chamber for generating gas, of means for feeding fuel into the upper part of the said chamber, two inclined ash-receivers arranged below the said chamber and projecting on opposite sides of it, said ash-receivers being provided with outlets for ashes at their lower ends, a blast-pipe connected direct to the said stationary chamber whereby the generation of the gas is completed in the said stationary chamber and before its contents pass into the said ash-receivers, and means for revolving the said ash-receivers.

2. The combination, with a single stationary combustion-chamber for generating gas, of means for feeding fuel into the upper part of the said chamber, inclined ash-receivers arranged below the said chamber and projecting radially from it, said ash-receivers being provided with outlets for ashes at their lower ends, means for revolving the said receivers, a blast-pipe connected direct to the said stationary chamber whereby the generation of the gas is completed in the said stationary chamber and before its contents pass into the said ash-receivers, and means for revolving the said ash-receivers.

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

JOHN RADCLIFFE.

Witnesses:
LEONARD H. CROWLEY,
WILLIAM HENRY SAYERS.