METHOD OF OPERATING GAS-PRODUCERS.

To all whom it may concern:

Be it known, that I, HENRY L. DOHERTY, a citizen of the United States, and a resident of New York city, in the county of New York, and State of New York, have invented certain new and useful Improvements in Methods of Operating Gas-Producers, of which the following is a specification.

This invention relates to methods of operating gas producers whereby the fuel bed of a producer may be maintained comparatively free from ashes, and open and easily permeable by the blast.

In the accompanying drawings I have shown a form of apparatus suitable for applying my invention.

Figure 1 is a diametral section through the gas producer and the screening and elevating mechanism, while Fig. 2 is a section at right angles to that of Fig. 1 through the fuel-feeding means.

The construction and method of operating the apparatus, shown, to carry out my invention is as follows: The columns 27 support a mantel, 26, upon which is built the refractory walls 29 of chamber 1. A metal shell, 28, envelops the lining walls 29. Poke-holes, 32, arranged around the periphery of chamber 1 provide means of access to the interior. Poke-hole 31, in the dome of the chamber, permits of the insertion of tools for the purpose of working the fuel bed and breaking up any arches that may form.

A bed of cinder free from fine ashes is first charged into chamber 1 to a level above the gas off-takes 3. This cinder may either be charged through the opening 30 at the top of chamber 1 or, preferably, through the fuel charging means 4. By this latter method, the cinder is charged into the hopper 29 of 3 by opening the cover 40. The slide 41 is next opened and the screw 42 set in operation. This moves the cinder through the passage 15 to the chute 14, over which it falls to the buckets 11 of the elevator 3. This latter is simply an elevator of any practicable type and, as shown, consists simply of two endless chains, carrying buckets 11, working over the drums or sprocket wheels 37 and 38. The elevator shaft 17 may either be built within the same shell as the gas producer or separately. Near the top of the shaft 17 a trip (not shown) is arranged which tips the buckets 11 so that their contents discharge through the chute 18 into the chamber 1. The bottom of chamber 1 terminates in the hopper 9. This has a discharge opening 10, through which the cinder passes into the screen 2. This, at first, is permitted to stand at rest. The cinder therefore builds up in 2 within its angle of repose and thus stops the opening 10. After the cinder has been built up to or above the gas off-takes 3, kindling is introduced into 1 through the opening 30 and ignited, air being admitted to 1 either by opening the clinker ing passages 33 and 34 or by having an atmospheric connection on the conduit 7, and admitting air through it, the valve 35, flue 6, and off-takes 5. The combustion gases escape through the opening 30. Fuel is now charged into the chamber 1 in the same manner as the cinder was previously charged, until a bed of ignited fuel several feet thick has been built up, and the producer is ready for gas making.

The openings 33 and 34 to the hopper 9 are closed and also any atmospheric connection on 7. The opening 30 is likewise closed and valve 35 opened. An exhaustor or other draft inducing means in connection with the conduit 7 is now started; or the blast may, instead, be supplied through 25 under pressure. The direction of the draft through 1 is thereby reversed—the flow now being from the top to the bottom of the chamber. The air, in passing through the deep mass of incandescent fuel, is converted into producer gas by the well known reactions, the gas produced passing through 90 the off-takes 5, flue 6, and passage 7 to a scrubber or direct to the place of consumption as desired.

The cinder is now withdrawn through the clinker passage 34 until the live coals appear in the passage 10. 34 is now sealed and the screen 2 started. This has bearing collars, 43, which work on flanged rolls, 16. The screen is driven by a pinion (not shown) meshing with the circular rack 8.

As the screen revolves, the ash and ignited fuel resting in the large end of the screen are given a motion of progression through the screen cones, the fine ash falling through the perforations 12 into the ash hopper 13, while the over-screen portion discharges through the chute 15 into the boot of the elevator 3. By 3, the over-screen portion, which is principally made up of the ignited fuel, is raised to the top of chamber 1 and discharged through the chute 18 onto the top of the fuel bed therein.
The ash falling into the ash hopper 13, is removed therefrom by the screw conveyer 20 working in the passage 19. The conveyer 20 discharges the ash through the opening 21 into the hopper 22. 22 is closed at the bottom by the gate 23 and at the top by the gate 24. When 22 is full the ash is discharged by closing the gate 24 and opening the gate 23, the conveyer 20 first being stopped. The introduction of the gate 24 is for the purpose of cutting off communication between the atmosphere and the chamber 1 through 13 and 10, while the gate 23 is open.

15 The screen 2 and elevator 3 are operated continuously. There is thus established a continuous movement of the fuel through the chamber 1. The rate of this movement is, of course, regulated by the speed of rotation of the screen 2. The elevator 3 is preferably run at a much higher relative speed than the screen, so that the buckets of 3 are only partially filled by the hot fuel from 1. I aim to circulate the fuel at such a rate that the proportion of ash in the fuel entering the screen at any time is comparatively small. The result is that I am able to keep the whole depth of the fuel bed in chamber 1 in a condition suitable for the development of the highest efficiency in gas making.

19 The ordinary method of operating gas producers allows the fuel to be burned wholly to ash by the time that it reaches the bottom of the fuel bed. The result is that about one-third of the fuel bed is practically useless for gas generation while the intermediate third has a low efficiency. It is of course a matter of importance that the fuel entering the screen at any time be in such a condition that the fuel bed which is in a condition to develop its maximum efficiency in generating gas. To secure a reasonable make of gas therefore, it is necessary to carry the maximum depth of fuel bed that can be used with the blast pressure available. The limit of depth permitted is of course that which will result in a sufficient rate of flow at the working pressure. Since the fine ash residue from the fuel offers far more resistance to the passage of the blast than does the unconsumed fuel itself, it is obvious that, by the ordinary method of working, the resistance offered to the passage of the blast for a given depth of live fuel must be nearly double what it is in my method. Thus for the same depth of live fuel and the same blast pressure I am enabled to pass about twice the volume of air and therefore secure about double the make of gas. Owing to the fact, however, that by eliminating the fine ash and maintaining the fuel in a uniform condition of porosity I am enabled to work with a much lower retardation of the blast than in the usual method, I am able to carry a much greater depth of active fuel bed.

This makes it possible to use a much higher velocity of blast than can be used with the customary depth of fuel bed, since by increasing the depth of fuel the time of contact between the draft current and fuel for any given velocity of draft is proportionally increased. The make of gas per sq. ft. of grate surface by my method of operating can as a consequence be nearly more than doubled.

An important feature of the invention is the charging of the raw coal onto the surface of the hot coals in the buckets 11. This insures the heating and distillation of the coal before it is charged onto the fuel bed in 1. There is thus never at any time, a layer of cold inert fuel on top of the fuel bed. The gases and vapors driven off from the coal in 17 ascend through the latter and pass through the fuel chute 18 into chamber 1, where they burn. This still further promotes the complete distillation of the coal.

Having described my invention, what I claim is:

1. The method of operating a gas producer which comprises the step of continuously withdrawing ignited fuel from the bottom of the fuel bed of said gas producer and recharging the said fuel onto the surface of said fuel bed.

2. The method of operating a gas producer which comprises withdrawing ignited fuel from the bottom of the fuel bed of said gas producer, separating ashes from said ignited fuel and recharging the said ignited fuel onto the surface of said fuel bed.

3. The method of operating a gas producer which comprises continuously withdrawing ignited fuel from the bottom of the fuel bed of said gas producer, separating 105 ashes from said ignited fuel and recharging the said ignited fuel onto the surface of said fuel bed.

4. The method of operating a gas producer which comprises withdrawing the partially burned fuel from the bottom of the fuel bed of said gas producer, separating ashes from said ignited fuel, charging a portion of fresh fuel onto the surface of the said partially burned fuel, said fresh fuel being separated from the same, whereby the volatile constituents of said fresh fuel are distilled therefrom by
the heat of said ignited fuel, and continuously recharging the said ignited fuel and the coke from the said fresh fuel onto the surface of the fuel bed in said gas producer. 5

6. The method of operating a gas producer which consists in continuously withdrawing the partially-burned but ignited fuel from the bottom of the fuel bed of said gas producer, separating ashes from said fuel, charging a portion of fresh fuel onto the surface of the said ignited fuel after ashes have been separated from the same, whereby the volatile constituents of said fresh fuel are distilled therefrom by the heat of said ignited fuel, continuously recharging the said ignited fuel and coke from the said fresh fuel onto the surface of the fuel bed in said gas producer, conducting the distilled volatile constituents of said fresh fuel into the fuel chamber of said gas producer and burning the said volatile constituents, introducing a current of air into the upper part of said fuel chamber, passing the commingled products of combustion of said volatile constituents and the said air through the fuel bed and withdrawing the resulting producer gas from the lower part of said fuel bed.

8. The process of operating apparatus for the combustion of solid fuel, which comprises, moving said fuel in an ignited condition through the combustion chamber of said apparatus at a rate sufficient to prevent accumulation of relatively fine ash therein, withdrawing ignited fuel from the lower part of said combustion chamber, rejecting accompanying fine material, and returning said ignited fuel to the upper part of said combustion chamber.

Signed at New York city in the county of New York and State of New York this 12th day of April A.D. 1911.

HENRY L. DOHERTY.

Witnesses:

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