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W. H. ADAMS & F. POWELL.

APPARATUS FOR MANUFACTURING PRODUCER GAS.

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Fig. 1

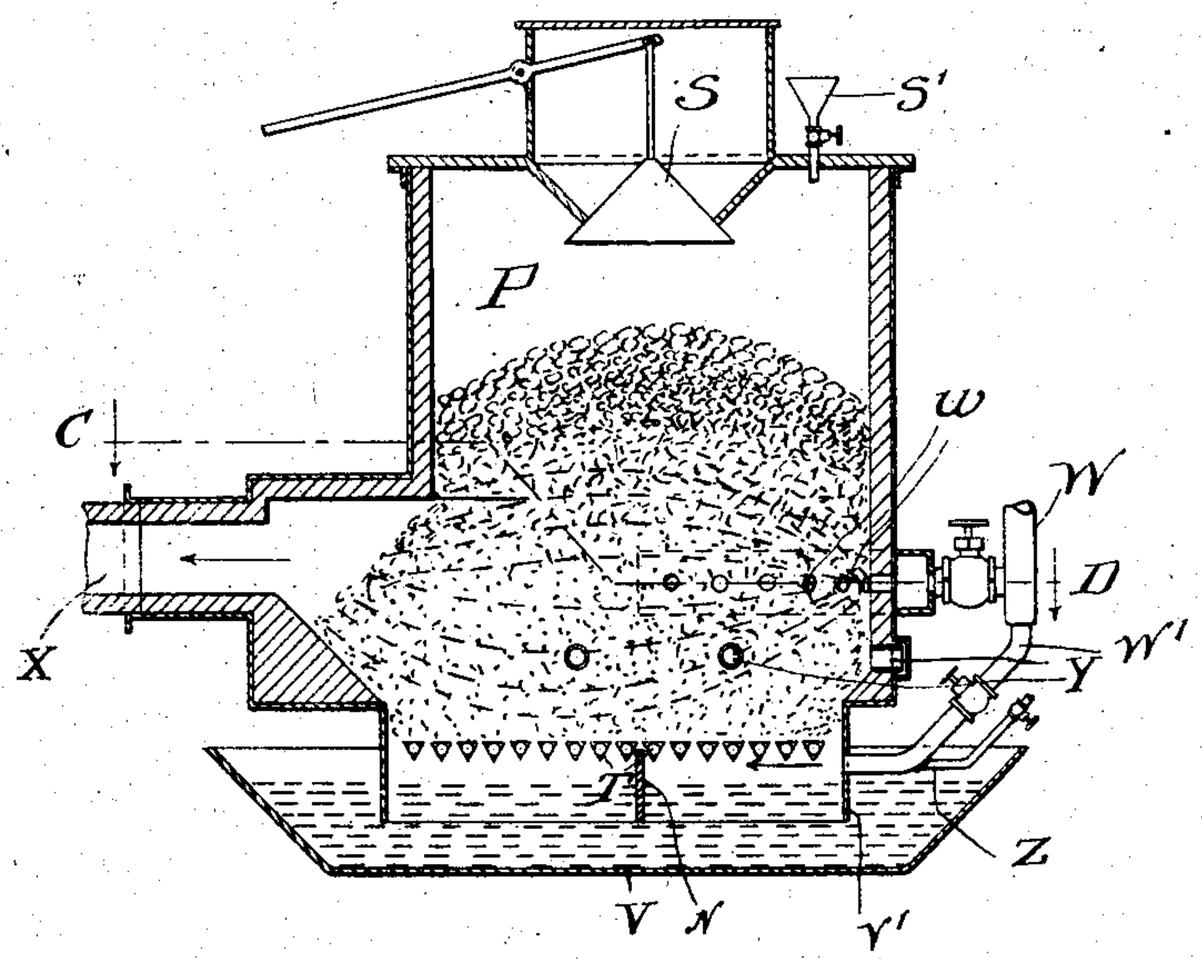
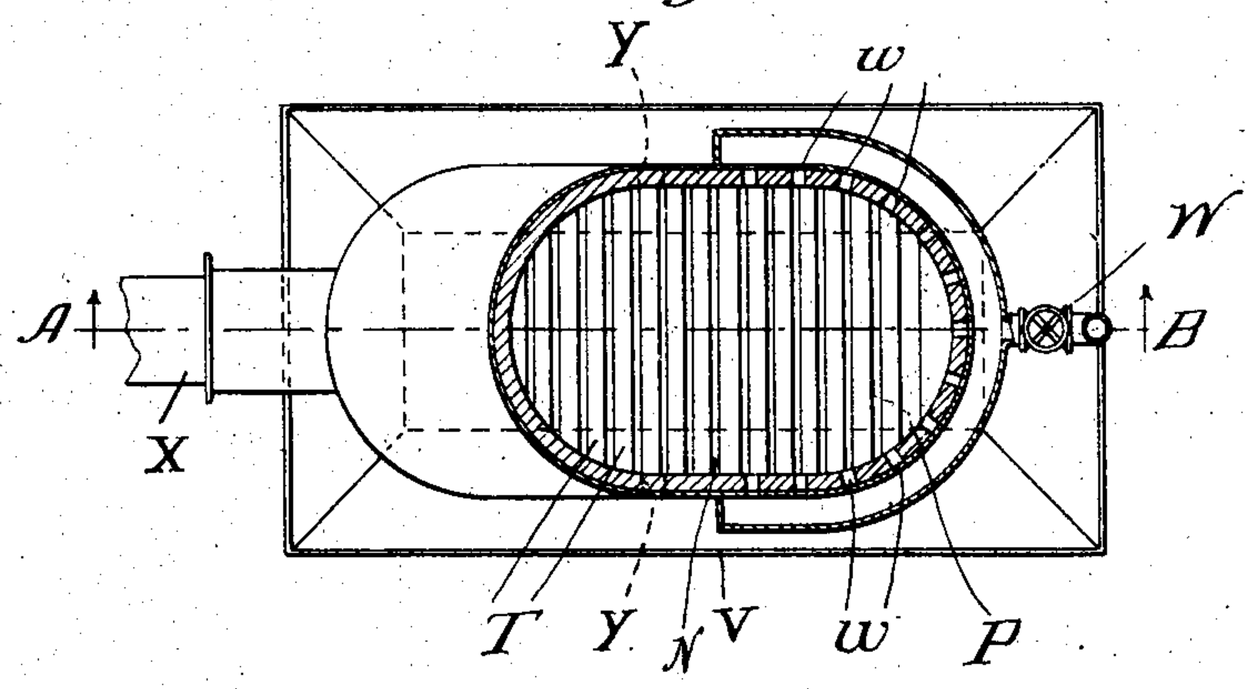


Fig. 2



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APPARATUS FOR MANUFACTURING PRODUCER-GAS.

No. 834,238. Specification of Letters Patent. Patented Oct. 30, 1906.

Application filed June 30, 1904. Serial No. 214,717.

To all whom it may concern:

Be it known that we, WILLIAM H. ADAMS and FREDERICK POWELL, citizens of the United States, residing in Portland, in the county of Multnomah and State of Oregon, have invented a new and useful Improvement in Apparatus for Manufacturing Producer-Gas, of which the following is a specification.

Our invention relates to the new apparatus for the continuous manufacture from any substance containing sufficient carbon for the purpose—such as peat, sawdust, wood, coal, or coke or from any of these substances mixed with petroleum, tars, asphaltum, &c., in proper proportions—of what is generally known as "producer-gas."

Our invention is intended to supply a less expensive and self-contained and a generally more useful type of gas-producer than has heretofore been built and one which is adapted to be continuous and positive in its operations and capable of making gas of uniform composition.

The construction of our new form of generator will be understood from the accompanying drawings, in which—

Figure 1 is a vertical section on the line A B of Fig. 2, and Fig. 2 is a horizontal section on the line C D of Fig. 1.

The chamber P of the generator is preferably elliptical in form and is elongated at the base just above the grate T, so as to form an increased area at the zone of incandescence. In this manner we insure an additional mass of fuel in this zone, which we find desirable to thoroughly decompose and fix the products of combustion and the volatile constituents of the fuel. The fuel is admitted to the chamber of the generator by the feed device S, the operation of which will be understood. S′ represents a valved feeder through which liquid hydrocarbons may be admitted to the generator for enriching the gas.

A water-seal ash-pan is shown at V, and W is an air-inlet having ports *w*, through which the air passes to the fuel.

X is the outlet for the gas, and, as will be seen, it is in the same horizontal plane practically as the air-inlet.

W′ is an additional air-inlet for supplying air through that portion of the grate immediately below the ports *w*. N is a vertical diaphragm placed transversely across the bottom of the generator below the grate and extending downward into the water in the ash-pan. This diaphragm limits the area of the grate through which air and steam are applied by the inlet W′ and forms a close junction at its ends with the depending skirt V′, which surrounds the grate-space and extends down into the water of the ash-pan. This skirt effects the water seal with the ash-pan and prevents the entrance of the air to the bottom of the grate except such as is admitted by the air-inlet above described. The air and steam admitted through the portion of the grate described pass at first upward and then horizontally toward the gas-outlet X in the same manner as the air from the side inlets W.

Z represents a steam-inlet entering the air-pipe W′ at a point close to the body of the generator, and Y represents poke-holes.

The effect of the diaphragm, which limits the under grate blast or draft to a portion only of the grate area, and the locating of the air-inlets *w* in advance of the plane of the diaphragm is to divide the zone of incandescence into two substantially distinct and separate portions. That portion of the fuel in front of the plane of the diaphragm, if extended vertically, is subject to the direct blast or draft and undergoes complete combustion at once. That portion of the fuel behind the plane of the diaphragm and nearest the gas-outlet receives no direct blast or draft, but is subject to the action of the hot products of combustion from the front portion. The fuel in this second or posterior portion of the zone of incandescence is thus heated and brought into a state of incandescence in which it acts as a regenerator, decomposing the carbonic-acid gas from the first or anterior portion into carbonic oxid.

Our practice in making producer-gas with this type of generator is substantially as follows: The generator is first filled to a sufficient height above the grate with wood to act as kindling. On top of this is added sufficient fuel of any desired character to bring the level somewhat above the gas-out-

let. The fire is then lighted through the poke-holes and increased by natural draft or the application of a gentle blast through the pipe W. All openings in the top of the generator are then closed substantially air-tight. The fuel in the anterior portion of the generator ignites quickly up to the level of the gas-outlet, and the fuel in the posterior portion is rapidly thereafter brought into a state of incandescence, so that the production of producer-gas is begun. As soon as this is accomplished (ten or fifteen minutes being usually sufficient) the blast is increased and a regular feed of fuel is begun, care being taken to prevent the escape of gas at the top of the generator. The entire body of the fuel between the grate and the plane of the top of the gas-outlet is brought to a state of incandescence and afterward maintained in that state, so that a steady output of the gas can be obtained through the same and the quality of the gas be always within control of the operator by choice in the kind and in the quantity of fuel, the volume of air applied, and the amount of moisture in the fuel or applied in the form of steam at Z.

In this operation the reactions take place as in other producers—namely, the union of the oxygen of the air with the carbon or hydrogen of the fuel, producing carbonic acid and water-vapor, these being decomposed in their passage horizontally across the bottom of the generator through the bed of incandescent fuel and escaping through the gas-outlet X in the form of carbonic oxid and hydrogen with the usual percentage of nitrogen and a small amount of the other elements always found in producer-gas. In addition to this the volatile constituents of of the fuel set free in the zone immediately above the zone of incandescence pass at once downward into the latter in their pure state undiluted with air, as in the case of down-draft producers, and not driven forward in a crude state with the other gases, as in the up-draft producers, but, on the contrary, by their immediate entrance into the bed of incandescent fuel are at once converted into fixed gases, the moisture being converted into water-gas and the tars split up into permanent gaseous hydrocarbons and carbonic oxid.

The bed of fresh fuel above the zone of incandescence, which is a very important feature of our invention, is renewed, of course, as fast as it settles into the zone of incandescence, and the form of the apparatus is such as to make it easy to maintain a constant renewal of the fuel and the withdrawal of the ash as fast as required, so as to maintain a uniform continuation of the process. It also enables us to maintain a zone of incandescence of uniform depth and extent, and by the exact regulation of the volume of air and the amount of fuel we are enabled to insure a constant high temperature, and therefore a constant percentage of gas from a known quantity of fuel.

It is also practicable in our invention to add to the bed of fresh fuel additional fuel rich in volatile hydrocarbons—such as crude petroleum, asphalt, &c.—which by their rapid volatilization enrich the gas to any desired extent. These may be added with the solid fuel or separately, as desired, through the feeder S′ under proper control, or they may be supplied with an absorbent fuel, such as sawdust, and fed therewith. These volatile hydrocarbons become fixed gases in their passage through the zone of incandescence. Where the gas is lean in combustibles, we may in this manner enrich it to any desired extent during its manufacture, and this procedure is not feasible or practicable in other processes of manufacturing producer-gas.

It is evident that the posterior portion of the chamber P of the generator performs a different function from the anterior portion and that we have, in effect, combined in one chamber the primary gas-generator and a secondary regenerator, with manifest economy and simplicity in the apparatus and increased efficiency in the method of operation. This secondary regenerator requires no periodical blowing up to maintain the fuel in a state of incandescence sufficiently hot to accomplish the required reaction, such as is necessary with a second chamber for regenerating and fixing the products from the first chamber, nor is it necessary that the draft be reversed at intervals, as is the common practice where two generators are employed and are so connected that each generator may in its turn act as a primary producer and as a regenerator.

The operation can be carried on continuously or intermittently at will and can be practiced in a single producer, and we obtain with one generator all that is accomplished by the more expensive producer plants heretofore used with their duplication of parts. The gas produced, which of course may vary somewhat in its constituents, is, however, substantially free from objectionable constituents—such as tars, volatile substances, and water-vapor—and can be at once utilized for heating boilers or for metallurgical work, or it can be cleansed in the usual manner at less expense and with no appreciable loss of valuable constituents.

While our apparatus has been devised with more special reference to the manufacture of producer-gas, we do not wish to be limited to such use by our claims, as the apparatus is also adapted to be used in the manufacture of illuminating-gas.

We claim—

1. The gas-generator having a fuel-chamber receiving the fuel at its center and having a forward horizontal extension and also having its air-inlet at the anterior end and its

outlet at the posterior end, and both the inlet and the outlet being located in a plane below the top fuel-level in the chamber, whereby a horizontal zone of incandescence is established through the chamber, the anterior portion of which acts as a generator and posterior portion as a regenerator.

2. The gas-generator having a fuel-chamber which is long in the direction of the draft, and has all its air-inlets at the front end and its outlet at the opposite end and said inlets and outlet being all located at a level below the top plane of the fuel, whereby a horizontal zone of incandescence is established through the chamber, the anterior portion whereof acts as a generator and the posterior portion as a regenerator.

3. The gas-generator for manufacturing gas, having a horizontally-elongated fuel-chamber adapted to receive a long, horizontal body of fuel, and its air-inlets all opening into the anterior portion and the outlet opening from the posterior portion of the chamber, the direct access of air being wholly cut off from the posterior portion of the chamber, and said inlets and the outlet being all located below the top of the fuel and at the same level, whereby the anterior portion of the chamber acts as a primary generator, and the posterior portion as a regenerator, acting on the products of combustion from the anterior portion.

4. In a gas-producing generator, the combination of a grate, an ash-pan, a depending skirt surrounding the grate-space and extending into the water in the pan, and a vertical diaphragm dividing the space inclosed by the skirt.

5. The gas-producing generator, having in combination a grate, a water-seal ash-pan, an inlet admitting air through the seal, and a diaphragm for shutting off the air so admitted from a portion of the grate.

6. The gas-producing generator having in combination a grate, a water-seal ash-pan, an inlet admitting either air or steam through the seal, and a diaphragm for shutting off the air or steam so admitted from a portion of the grate.

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