

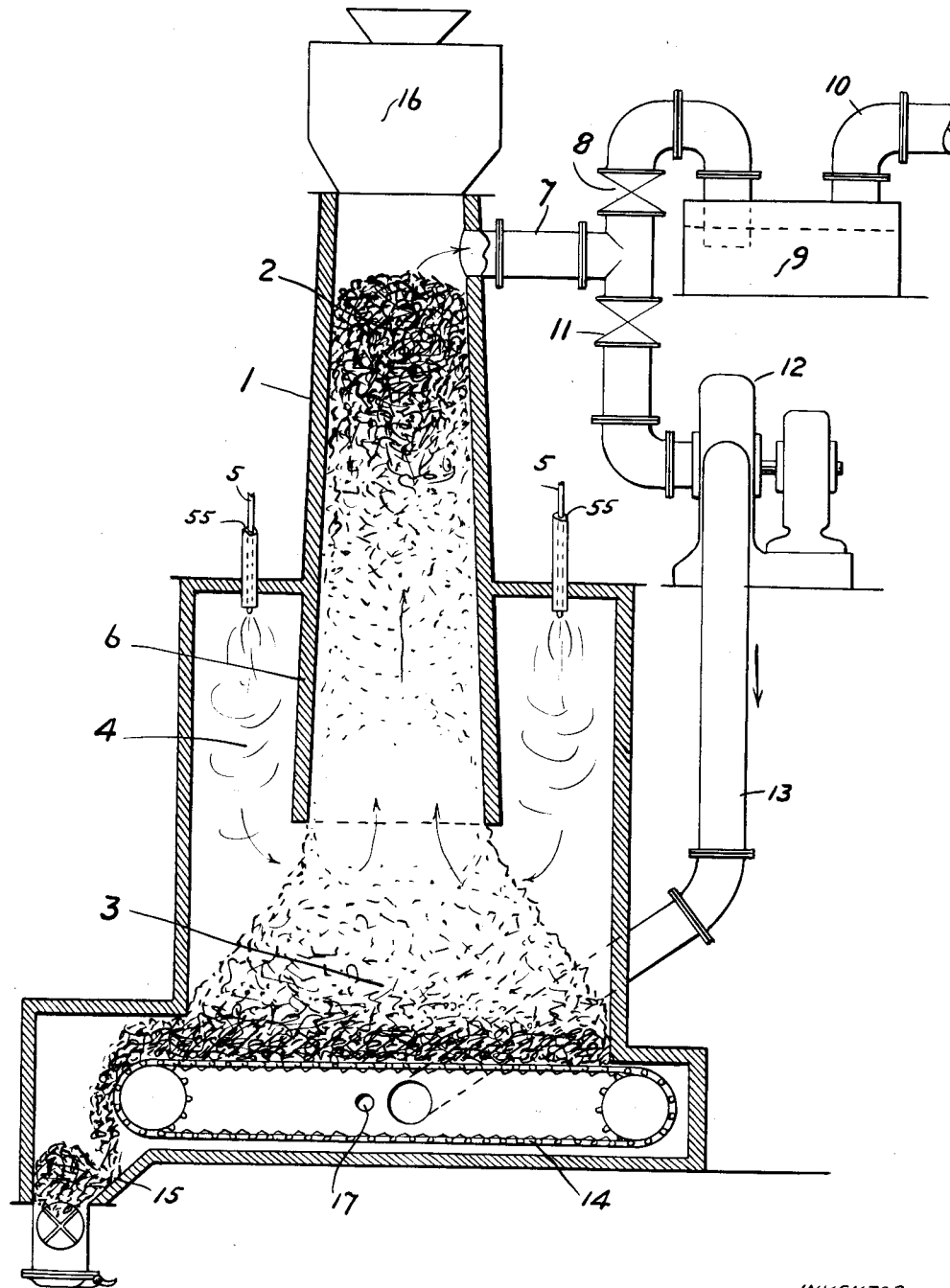
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PROCESS OF CARBONIZING SOLID BITUMINOUS FUEL

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WITNESS:

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PROCESS OF CARBONIZING SOLID BITUMINOUS FUEL

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The present invention relates to the carbonization of solid bituminous fuel by direct contact with hot gases.

More particularly it relates to the carbonization of such fuel by the contact of the hot products of combustion produced by the combustion of fuel with an oxygen-containing medium that contains a greater proportion of free oxygen than does atmospheric air, with the production of coke and a mixed gas consisting of coal gas and products of combustion relatively low in inert nitrogen.

The object of the invention is to provide an improved method for such carbonization.

In general the process includes establishing a continuous or intermittent flow of the bituminous material, one portion of which is comprised of uncarbonized and partially carbonized fuel in process of heating and another portion of which is comprised of coke resulting from the carbonization in process of cooling, establishing a hot zone intermediate of the ends of the flow of fuel by heating an intermediate portion, indirectly, by the combustion of other fuel with an oxygen containing gas that contains a greater proportion of free oxygen than atmospheric air, and directly, by leading into the first mentioned fuel the resultant hot products of combustion, passing them from the hot zone through the fuel in process of carbonizing to heat it and effect carbonization, leading off the resultant mixed coal gas and products of combustion from the fuel, passing a cooling agent through the coke resulting from the carbonization to cool it and from thence through the hot zone and through the fuel undergoing carbonization to assist in the carbonization.

The process will be particularly described in its application to a descending fuel bed and in connection with the attached drawing which forms a part of this specification.

The drawing shows a partial vertical cross section and elevation of apparatus chosen for illustration in which my process may be performed.

Referring to the drawing,

1 generally indicates the carbonizing chamber, containing a fuel bed the upper

portion of which, indicated as 2, is comprised of solid bituminous fuel undergoing carbonization and the lower part of which, indicated as 3, is composed of coke resulting from the carbonization.

4 is a combustion chamber provided with the fuel supply means 55 and oxygen supply means 5 and arranged to heat the intermediate section of the fuel bed through the wall 6. The combustion chamber 4 is in communication with the fuel bed at a zone intermediate of the ends of the fuel bed.

The carbonizing chamber is provided with the gas off-take 7 leading from above the fresh fuel through the valve 8 to the wash-box 9.

10 is the gas off-take from the wash-box to a place of storage, not shown.

The off-take 7 may also be connected through the valve 11 to the input side of the circulating means 12 (a fan, as shown for illustration). The output side of the fan is connected by connection 13 to the base of the fuel bed. Means for the continuous discharge of coke may be provided as for instance the travelling grate 14 which discharges to the hopper 15.

Means for continuous charging of fresh fuel may be provided if desired as the charger indicated at 16.

17 is a steam supply means.

In operation fresh fuel such as bituminous coal, lignite, etc., is fed to the top of the fuel bed by the charger 16 and cooled coke removed from its base by the grate 14.

Fuel and an oxygen-containing medium containing a greater proportion of free oxygen than does atmospheric air are admitted to the combustion chamber 4 and partially burned therein, heating the mid-section of the fuel bed indirectly through the wall 6. The products of combustion pass from the combustion chamber into the mid-section of the fuel bed heating it directly and pass upward through the fuel in the upper portion of the fuel bed effecting its carbonization and distilling off its volatile material. The mixed coal gas and products of combustion give up their heat in contact with the fresh fuel in the upper portion of the fuel bed and

issue from the top of the fuel bed relatively cool. A portion of the mixed gas passes through connection 7 and valve 8 to the wash-box, the remainder is drawn through
 5 valve 11 by the fan 12, passed by connection 13 to the base of the fuel bed and forced upward through the coke, cooling the coke in the passage. The mixed gas then passes through the highly heated zone and is heated
 10 therein and passes upward through the uncarbonized fuel above to assist in its carbonization.

Instead of recirculating the mixed gas to cool the coke, all of the mixed gas may be
 15 led directly to the wash-box and a small amount of steam, sufficient to cool the coke, may be admitted at 17 and passed upward through the fuel bed or steam may be mixed and recirculated with the gas produced

20 The fuel introduced with oxygen, to the combustion chamber may be pulverized coal, oil, tar or gas. Preferably sufficient oxygen is introduced for its partial combustion only, thereby maintaining a low proportion
 25 of incombustible constituents in the resultant combustion gases.

The exact composition of the final mixed gas will depend, among other things, on the fuel introduced to the combustion chamber.
 30 In the case of oil or refinery oil gas, partial combustion with oxygen can be regulated to furnish combustion products containing considerable amounts of hydrocarbons as well as carbon monoxide and hydrogen and
 35 the combustion products may have a relatively high calorific value.

If the fuel supplied to the combustion chamber is pulverized coal, the supply of this fuel and the oxygen supply may be regulated to effect the partial or total carboni-
 40 zation of the pulverized fuel by combustion of a part of it.

As the combustion products are passed through the fuel bed, the fuel bed will retain
 45 the partially carbonized pulverized fuel and its carbonization will be completed therein. If the carbonization is completed in the combustion chamber, the fuel bed will retain the resultant coke which will be cooled and
 50 discharged with the coke produced in the fuel bed.

The operations of carbonizing by the hot products of oxygen combustion and the cooling of the coke may be simultaneous and continuous, or they may be alternated if desired.
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The fuel bed may be in continuous descent as illustrated or the descent may be intermittent, due to periodic charging of fresh fuel and removal of coke.

60 While I may prefer to employ a fuel bed in the practice of my invention, it is also applicable to the carbonization of a stream of pulverized fuel. A descending flow of pulverized fuel may be established in the retort
 5 by feeding pulverized fuel at the top and re-

moving coke at the bottom. The mid-section of this stream of fuel may be heated indirectly by the combustion of other fuel with oxygen in the combustion chamber and directly by passing the resultant hot products
 70 of combustion into the fuel stream and upward against the downward fall of the fuel, heating and carbonizing the fuel in the upper portion of the retort. A cooling agent, as
 75 mixed products of oxygen combustion and coal gas or steam, may be introduced at the base of the retort to cool the coke and to be heated in the mid-section of the retort and assist in the carbonization above.

In any of the above methods all of the
 80 combustion need not all take place in the combustion chamber, a portion may take place in the carbonizing chamber, all of the combustion is not necessarily confined to the fuel supplied to the combustion chamber, a portion
 85 of the fuel fed to the carbonizing chamber may also be burned.

I claim:

1. A continuous process of carbonizing solid bituminous material with the production of coke and combustible gas, which
 90 comprises providing a substantially vertical column of solid bituminous material and feeding it downwardly longitudinally thereof into a closed space, carbonizing the material in said column by burning secondary
 95 fuel other than the material in said column in said space with an oxygen-containing gas having a greater proportion of free oxygen than atmospheric air, transferring heat to an
 100 intermediate portion of said column externally thereof from the products of the combustion but out of contact therewith, passing all the products of the combustion upwardly
 105 through said column in contact with the material therein, discharging the coke from said space, withdrawing the relatively cool mixture of coal gas and products of combustion from the column, and recirculating a portion
 110 of said relatively cool mixture of coal gas and products of combustion through the column to cool the coke and to become heated in the column and to transfer heat to carbonize the on-coming bituminous material.

2. A continuous process of carbonizing
 115 solid bituminous fuel, which comprises establishing a substantially vertical descending column of solid bituminous fuel, burning secondary fuel other than the material in said
 120 column with an oxygen-containing gas having a greater proportion of free oxygen than atmospheric air adjacent the middle portion of said column, admitting all the products of the combustion of the secondary fuel to said
 125 column, carbonizing the material in the intermediate portion of said fuel column by said burning of secondary fuel and by said products of combustion, causing products of combustion to ascend through the descending
 130 fuel column, taking off a portion of the gas

so formed, and recirculating the remainder of the gas so formed from the bottom through the entire fuel column.

3. A continuous process of carbonizing bituminous fuel according to claim 2 in which steam is passed together with the recirculated gas up through the entire fuel column.

4. A continuous process of carbonizing solid bituminous material with the production of coke and combustible gas, which process comprises feeding a substantially vertical column of solid bituminous material downward longitudinally thereof into a closed space, carbonizing the material in said column by continuously burning pulverized coal in said space with an oxygen-containing gas that contains a greater proportion of free oxygen than atmospheric air in such a manner that the solid products of said combustion fall into the lower part of said column, transferring heat to an intermediate portion of said column externally thereof from the products of the combustion but out of contact therewith, passing the fluid products of combustion upwardly through said column in contact with the material therein, discharging the coke from said space, and leading off

mixed coal gas and products of combustion from the upper part of the column.

5. A continuous process of carbonizing solid bituminous material with the production of coke and combustible gas, which comprises feeding a substantially vertical column of solid bituminous material downwardly longitudinally thereof into a closed space, carbonizing the material in said column by continuously burning secondary fuel other than the coke produced by said process in said space with an oxygen-containing gas that contains a greater proportion of free oxygen than atmospheric air, transferring heat to an intermediate portion of said column externally thereof from the products of the combustion but out of contact therewith, passing all the products of the combustion upwardly through said column in contact with the material therein, discharging the coke from said space, leading off mixed coal gas and products of combustion from the upper part of the column, and recirculating a portion of said mixture of coal gas and products of combustion through the entire column of fuel together with steam.

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