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Calderon

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[54] METHOD IN BYPRODUCT COKE OVEN OPERATION AND APPARATUS FOR SAME

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[58] **Field of Search** .....202/227–230, 262, 202/263, 95, 253, 268; 201/39, 40, 36–38; 110/171; 266/32, 5 C, 4 S; 239/1, 187, 566, 184–186

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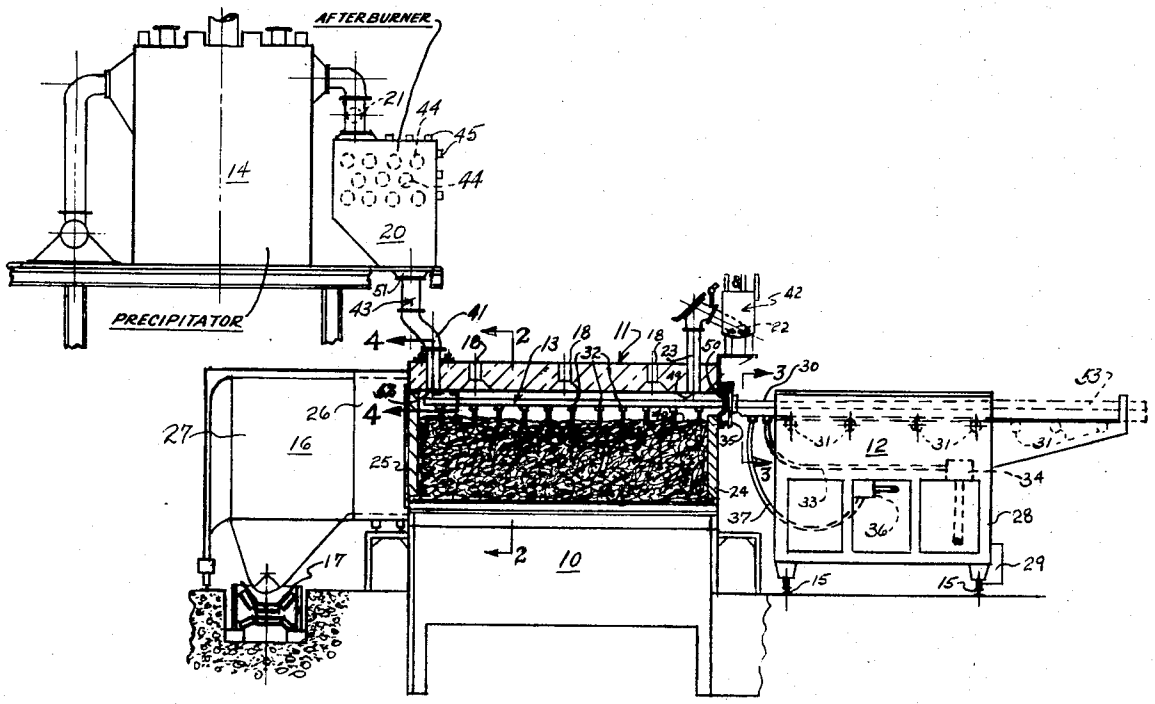
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[57] **ABSTRACT**

An improved method for byproduct coke oven operation wherein the problems of pollution caused by charging, oxidation of green coke, pushing and quenching are eliminated by the quenching operation taking place within the oven prior to the removal of the doors and pushing of the coke; the combustion gases created by the charging, and the steam and water gases generated by the quenching are extracted and completely burned in an afterburner prior to the gases being dust-cleaned in a precipitator. The coke being quenched in the sealed oven to a temperature lower than the ignition point of the coke eliminates the oxidation thereof after it is pushed from the oven thereby increasing the efficiency of the oven from the standpoint of yield.

13 Claims, 4 Drawing Figures



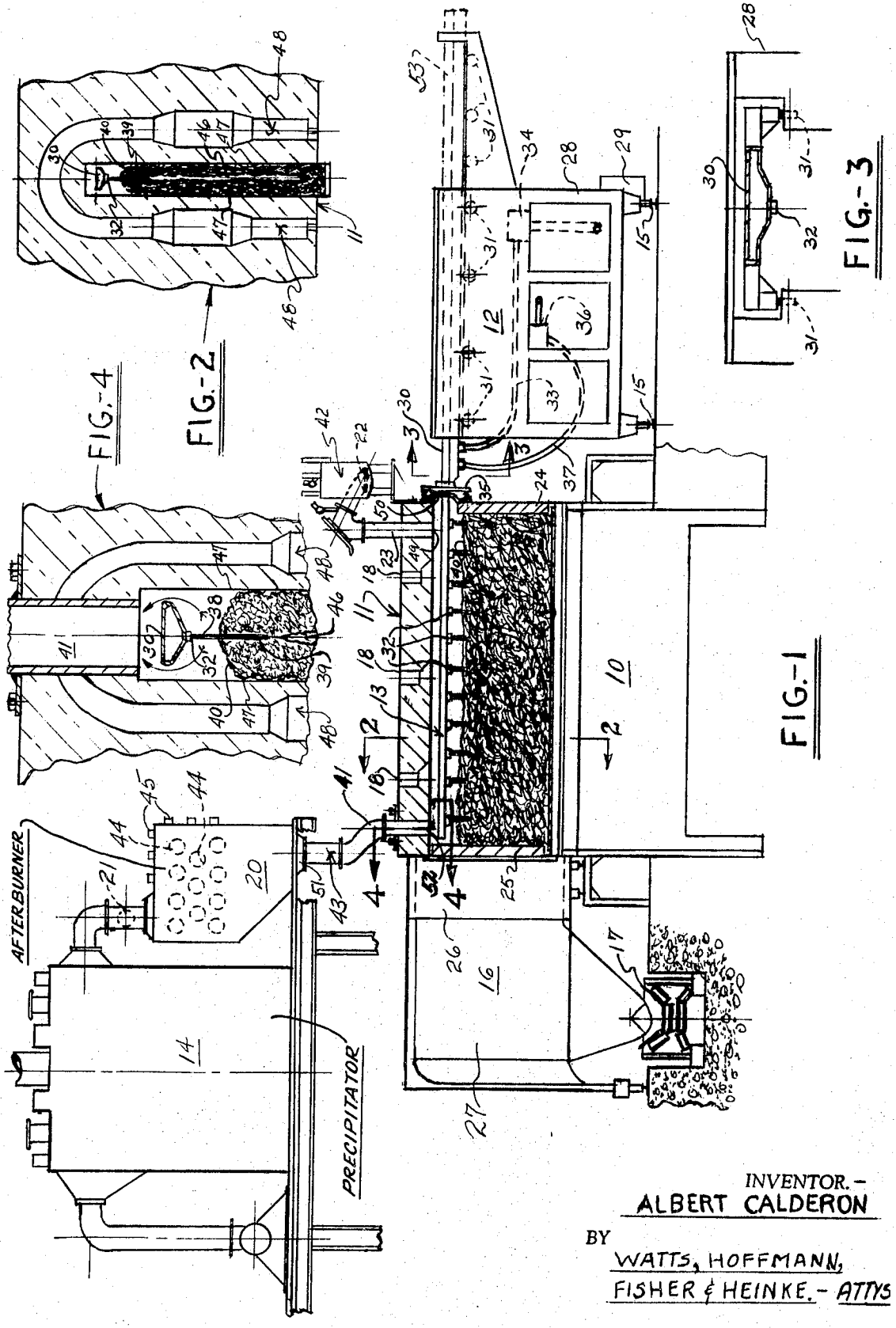


FIG.-1

FIG.-2

FIG.-3

FIG.-4

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METHOD IN BYPRODUCT COKE OVEN OPERATION AND APPARATUS FOR SAME

The present invention relates to an improved byproduct coke oven of the type commonly used for the commercial production of coke. This application is a continuation in part of the copending application of Albert Calderon, Ser. No. 1,598 filed in the United States Patent Office on Jan. 9, 1970.

In the art of making coke in a byproduct oven, which oven is one of many ovens situated side by side in battery form, the coal is charged through apertures of the roof and the coal is heated indirectly by means of heated refractory walls which in turn are heated by the burning of fuel. During the baking of the coal or the "coking," byproduct gases evolving from the coal leave the oven by means of an ascension pipe which delivers these gases into a main which connects the battery of ovens to the byproduct coke plant where these gases, which are rich in chemicals are processed. After the coking operation, which lasts about 17 hours, the doors are removed and the coke is pushed through a guide into a quench car which in turn is driven to a tower where the incandescent coke is quenched; thence the coke is transported to a wharf where the quench car discharges it for inspection and delivery to the screening and storage area of the blast furnace. During the charging of the coal, the removal of the doors, the pushing of the coke and the quenching thereof, a very serious problem of pollution is created. The present technology is such that there are several disadvantages both operationally and economically in addition to the serious pollution problem:

i. Some of the coal next to the doors is not fully coked and normally called green coke.

ii. oxidation of the coke takes place after the doors are opened and the coke is pushed into the quench car thereby causing loss in coke yield.

iii. great quantities of steam are dissipated.

iv. excessive manpower and equipment is employed.

The present invention proposes a new and novel method of and apparatus for the improvement of the now commercial byproduct coke oven operation to eliminate the above-mentioned disadvantages. It is therefore, the main object of this invention to provide an improved byproduct cokeoven which collects and cleans the gases of combustion of the coal dust during charging, which collects the byproduct gases during coking, which quenches the coke prior to the removal of the doors, which collects the steam and gases during the quenching, which fully burns the combustible gases collected during the quenching, which cleans the steam and burnt gases before ejection, which pushes the coke after the temperature of the coke has been dropped lower than its ignition point and which makes use of the sensible heat of the steam and gases for waste heat recovery.

Another important object of this invention is the provision of means to spray water within the oven in order to quench the coke in the sealed chamber of the oven to thereby drop the temperature of the coke below its ignition point before the doors of the oven are removed and before the coke is pushed out, said means to spray comprising a travelling apparatus equipped with retractable means adapted to enter the oven in order to perform the quenching operation.

Further, another object of this invention is to quench the coke in a deliberate and controlled pattern and at the same time refrain from dousing the oven refractories with water in order not to subject said refractories to thermoshock.

Yet, it is an object of this invention to direct jets of air or oxygen under pressure on the crust of the coke body in order to pierce the coke to minimize water splashing and thereby direct said sprays into the cleavage of the body of the coke for efficient quenching and at the same time providing a protection for the refractory walls from excessive amounts of water, the directing of said jets of air or oxygen taking place prior to the actuation of the water sprays.

Still another object of this invention is to provide an afterburner which would connect to the exhaust from the oven to burn combustible gases emanating with the steam during the quenching.

It is still another object of this invention to provide a dust collection system such as a wet scrubber which would receive the steam and the gases from the afterburner for dust collection and recovery of certain valuable chemical solutions.

Further still, another object of this invention is to employ a waste-heat recovery means in connection with the afterburner for useful purposes within the plant.

Further yet, another object of the invention is to provide a travelling sealed distribution bin operating in conjunction with the coke-guides to receive the quenched coke from the oven.

It is further yet another object of the invention to eliminate the quenching car, quenching tower and wharf by replacing them with a conveyor system and said distribution bin, which bin is preferably attached to the conventional coke-guides.

Other objects of this invention will appear from the following description and appended claims, reference being made to the accompanying drawing forming a part of this specification wherein like reference characters designate corresponding parts in the views.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a section taken through the coke oven illustrating the present invention; and,

FIG. 2 is a section taken along 2—2 of FIG. 1.

FIG. 3 is a sectional view taken along 3—3 of FIG. 1.

FIG. 4 is an enlarged sectional view taken at 4—4 of FIG. 1.

Before explaining the present invention in detail, it is to be understood that the invention is not limited to its application to the details of construction and arranging of parts illustrated in the accompanying drawing since the invention is capable of other embodiments. Also, it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not limitation.

In FIG. 1, reference numeral 10 indicates generally an apparatus of the present invention capable of carrying out the method of the present invention and comprising several component assemblies including a byproduct coke oven indicated generally at 11; a quenching machine generally indicated at 12; a spray distribution system for quenching indicated generally at 13; a steam and dust evacuation system including a precipitator for dust-collecting generally indicated at 14; a running track made up of rails generally indicated at 15; a coke guide with a distribution hopper generally indicated at 16 and a conveyor system generally indicated at 17.

Generally, it will be observed from FIG. 1 that during the charging operation of the coal through apertures 18, the gases generated from the combustion of the coal dust will be sucked by the fans of precipitator 14, from oven 13 into afterburner 20 where these gases are fully burnt before being cleaned in 14. It is to be noted that the negative draft induced by the fans will prevent any combustion gases escaping from charging holes 18. Before the coking operation begins damper valve 21 is closed and valve-seal 22 is opened.

During the coking operation byproduct gases leave the oven through ascension pipe 23 and at the conclusion of the coking, quenching machine 12 positions itself in front of the oven for the quench which is described in detail hereinafter. After the quenching operation, doors 24 and 25 are removed and the coke charge is pushed out of door 25 with guides 26 ensuring the discharge of the quenched coke into sealed bin 27 which in turn discharges onto conveyor 17, thus transporting the quenched coke directly to the screening and coke-storage area. Bin 27 moves on track wheels and preferably is an integral, structural part of traveling coke-guide 26.

Quenching machine 12 preferably comprises a super structure 28 mounted on wheels and powered by drive 29. Embodied in the uppermost part of said structure there is a retractable and telescoping member 30 which rides on rollers 31. Member 30 is equipped with a plurality of nozzles 32 to effect the spraying action for the quenching operation. The supply of water into member 30 is preferably accomplished by flexible hose 33, the flow and pressure of the water being con-

trolled by valve means 34. It is preferred to introduce member 30 into the oven through the conventional leveling door-opening 50 which is situated above door 24. Door seal 35 is provided on member 30 in order to seal the opening through which member 30 enters the oven. Quenching machine 12 also possesses delivery means 36 for air or oxygen under pressure to burn and pierce holes in crust 40 of the body of the coke in order to confine the spraying action from nozzles 32 and thus prevent water impingement of the refractory walls. Flexible hose 37 carries the air or oxygen to member 30 which in turn distributes the flow to nozzles 32. Delivery means 36 controls the air or oxygen flow which is directed through flexible hose 37 and member 30 and out of nozzles 32. The coke being incandescent, is oxidized locally by powerful and piercing jets 38, shot out of nozzles 32 at high velocity to cause the burning or boring of a plurality of holes such as hole 39 through crust 40 and into the body of the coke proper.

It is conceivable that all exhaust gases can be withdrawn from conventional ascension pipe 23, but it is preferred to withdraw all gases from the oven, except byproduct gases from the coking operation, through secondary standpipe 41 which ties to afterburner 20 with expansion joint 51, in order to provide two separate exhaust systems: The byproduct coking gases through ascension pipe 23 to system 42 and all other gases through standpipe 41 to system 43. Afterburner 20 which is made with ample capacity to withstand explosions, possesses waste heat recovery means 44 and auxiliary burners 45 to ensure ignition of the combustible gases, generated during charging, piercing and quenching.

Inherently the body of the coke has a parting line or cleavage 46 in the center of it, which cleavage is a characteristic result of the coking action. It is therefore preferred to direct the water sprays through nozzles 32 with pressure into holes 39 and thus reach cleavage 46 in order to quench the incandescent coke in a predetermined, deliberate and controlled pattern from the center and outwardly towards walls 47. Further, in order to prevent damage to the walls by the water sprays, high firing rates are maintained in the flues 48 in order to take advantage of the Liedenfrost effect which in actuality forms a protective film of high temperature steam against oven walls 47.

In operation, the coal is charged into the oven through its apertures 18. A negative draft is maintained by precipitator 14 in order to prevent flames from shooting out of charging apertures 18 when the cold coal falls inside the hot oven. Damper 21 between afterburner 20 and precipitator 14 is opened for inducing this draft.

When the oven is charged, damper 21 is closed and seal valve 22 in ascension pipe 23 opens. The coking process proceeds as conventionally performed. During the coking process the gases enter ascension pipe 23 at point 49. After the lapse of coking time, seal valve 22 in ascension pipe 18 closes and damper 21 in afterburner 20 opens and the quenching operation is about to begin.

Quenching machine 12 moves in front of oven to be quenched and the cover of opening 50 is lifted to permit the insertion of telescoping member 30 into the oven so that the complete top of the body of the coke is under spray system 13 and opening 50 is seated by means of 35. Delivery means 36 is actuated and high velocity air or oxygen at high-pressure shoots out of nozzles 32 to pierce and bore crust 40 of the coke in order to reach cleavage 46. After the lapse of a certain preset period of time, delivery means 36 is deactivated and valve means 34 is actuated to cause powerful water jets to flow out of nozzles 32 and into bored holes 39 and thusly reach cleavage 46.

The quenching procedure is carried in a controlled and predetermined pattern from the center outwardly and from the top of the body downwardly: This quenching operation continues until the temperature of the coke drops below its ignition point. The combustible gases, which are mainly made up of carbon monoxide and hydrogen, the steam so generated from the quenching water are pulled from the oven through opening 52 of standpipe 41 and into afterburner 20 where they are fully burned, taking advantage of the energy release for waste heat recovery into system 44. The gases are then cooled and cleaned by dust collector 14 before ejection. At this point recovery of chemicals in solution such as sulphuric acid, can be made possible.

Once the quenching of the coke is concluded spray system 13 is retracted from oven 11 to position 53 which is shown with broken lines in FIG. 1, and quenching machine 12 moves away from oven 11 to make room for the pusher (not shown) and also to register with another oven for the quenching cycle to be repeated. Doors 24 and 25 are then removed, the coke is pushed out of oven 11 into bin 27 while it is confined by guides 26 until all the coke is in bin 27. The coke, with its temperature lower than its ignition point, does not oxidize and therefore does not emit pollutants. Having quenched the coke in a sealed oven, whatever pollutants are generated are carried by the steam to precipitator 14.

The four areas of pollution in a conventional byproduct oven of the commercial-type stem from the following:

1. the cold coal being charged in a hot oven.
2. the oxidation of the green coke when the doors are removed prior to pushing.
3. the discharge of the hot coke into the atmosphere and oxidizing the exposed surface thereof until the quenching operation in the tower stops the oxidation.
4. the quenching of the oxidized coke creates an enormous quantity of dust carried by the steam and thusly into the atmosphere.

In conclusion, by providing a suitable negative draft at the precipitator during the charging, by quenching in a sealed oven and by pushing coke with a temperature below its ignition point, the four causes of pollution are eliminated forthwith.

Numerous other advantages are obtained as aforementioned. For example: The yield of the coke is increased, the steam and gases so generated are available waste heat recovery and automation is made possible by eliminating the quenching car, the quenching tower and the wharf.

All in all it is submitted that the present invention provides an improved method in byproduct coke oven operation and apparatus for accomplishing same.

I claim:

1. In the method of making coke in a byproduct oven of the commercial type having the shape of a vertical-rectangular slot the improved method of:

a. heating material to be coked in the oven to produce a body of coke having an internal cleavage volume;
b. removing byproduct gases during coking;
c. forming at least an opening in said coke body extending from an exterior surface to said cleavage volume;
d. directing at least a stream of water into said cleavage volume through said at least one opening to progressively quench said coke body from the cleavage volume outwardly toward the exterior surfaces thereof without impinging water on the oven walls and to drop the temperature of the coke below its ignition point;
e. maintaining a high firing rate in the flues of said oven in order to prevent the chilling of the walls of said oven;
f. removing the steam and gases generated by said quenching from said oven and burning the combustible gases in an afterburner;
g. cooling and cleaning the removed steam and gases in a dust-collecting system before ejection; and,
h. pushing the coke body out of the oven.

2. The method as set forth in claim 1 further including recovery heat from said afterburner in order to make use of waste heat from the steam gas generation.

3. The method as set forth in claim 1 further including introducing a spraying system into said oven and wherein forming said opening comprises introducing high-pressure air through said spraying system to impinge on the surface of the coke and thereby pierce and bore at least a hole in the coke

through which a water spray is directed to the center of the coke to thereby quench the coke from the center of the coke body outwardly towards the oven walls.

4. The method as set forth in claim 1 further including introducing a spraying system into said oven and wherein forming said opening comprises introducing high-pressure oxygen through said spraying system to impinge on the surface of the coke and thereby pierce and bore at least a hole in the coke through which a water spray is directed to the center of the coke to thereby quench the coke from the center of the coke body outwardly towards the oven walls.

5. The method as set forth in claim 1 wherein the quenched coke is confined in a sealed distribution bin after the coke leaves the oven.

6. The method as set forth in claim 1 wherein the coking byproduct gases are collected in a first processing system and all other gases and steam are collected in a second processing system.

7. A method of making coke in a byproduct type coke oven comprising:

a. charging a byproduct coke oven with material to be coked;

b. heating the material in the oven to produce a body of coke having a central cleavage volume;

c. removing byproduct gases during heating;

d. quenching said coke while in said oven, said quenching comprising:

1. forming at least one opening in said body of coke extending from an exterior surface into said cleavage volume;

2. directing a quenching medium into said cleavage volume through said opening; and,

3. quenching said coke body by cooling the body commencing from the inside of the body to the exterior surfaces and thereby avoiding impinging quenching medium on walls of the oven;

e. collecting and processing steam and gases produced in said oven during quenching; and,

f. removing the quenched body of coke from the oven.

8. A method as claimed in claim 7 wherein forming said at least one opening comprises directing a stream of oxidizing medium onto a limited area of said coke body to thereby pierce said body.

9. A method as claimed in claim 8 wherein directing the stream of oxidizing medium comprises directing air onto the coke body.

10. A method as claimed in claim 8 wherein said oxidizing medium is oxygen.

11. A method as claimed in claim 7 wherein quenching said coke body further comprises inserting a flow directing member into said oven and introducing said oxidizing medium into said oven through said flow directing member to pierce said coke body.

12. A method as claimed in claim 7 wherein quenching said coke body comprises inserting a flow directing member into said oven and introducing said quenching medium into said coke body through said flow directing member.

13. A method as claimed in claim 11 further including directing said quenching medium into said coke body through said flow directing member.

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