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Kemmetmueller

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[54] **INDIRECTLY HEAT EXCHANGING PLURAL GAS STREAMS FOR DRY QUENCHING HOT COKE AND DRYING COAL**

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[52] **U.S. Cl.** **201/39,** 202/150, 202/228

[51] **Int. Cl.** **C10b 39/02**

[58] **Field of Search**.....201/39; 202/227–230, 150

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Assistant Examiner—David Edwards
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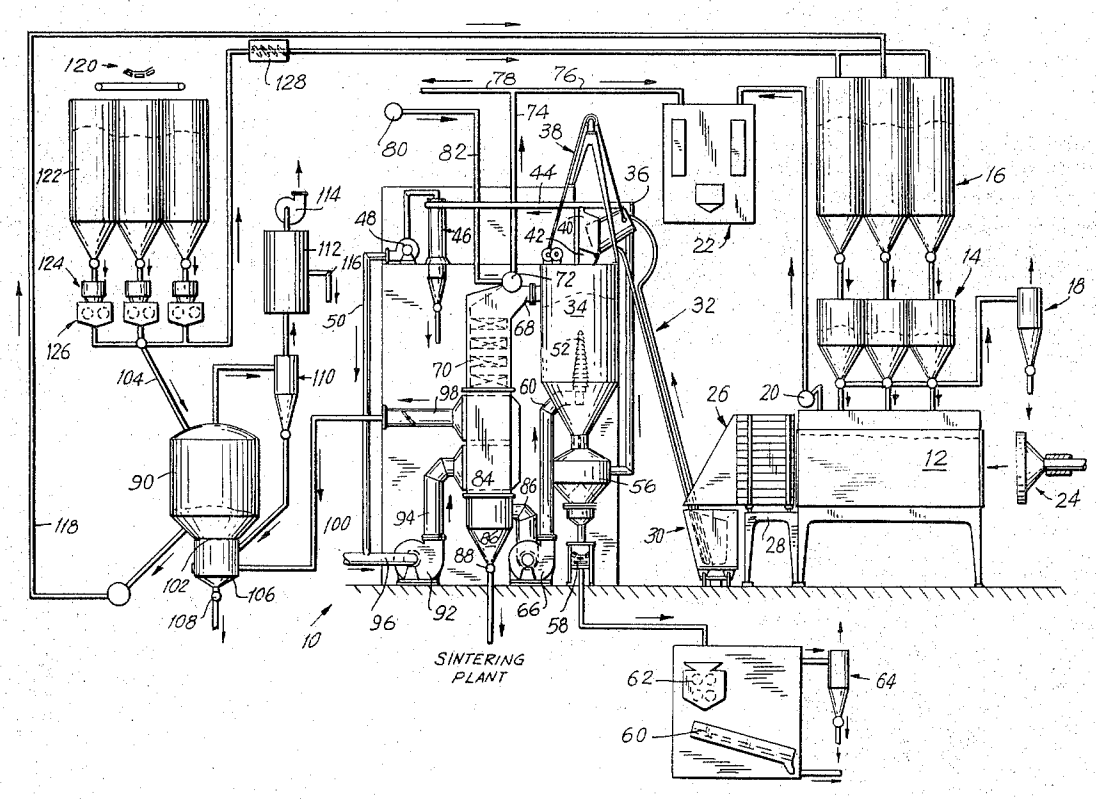
[57] **ABSTRACT**

A coke plant and method for operating the same according to which the coke is cooled by dry-quenching and the coal is dried, prior to being charged in a coke oven, with heat extracted during dry-quenching of the coke. The coke plant and method, in addition to carrying out the latter operations, reduce pollution of the atmosphere by releasing only cleaned and desulfurized gas to the outer atmosphere.

4 Claims, 8 Drawing Figures



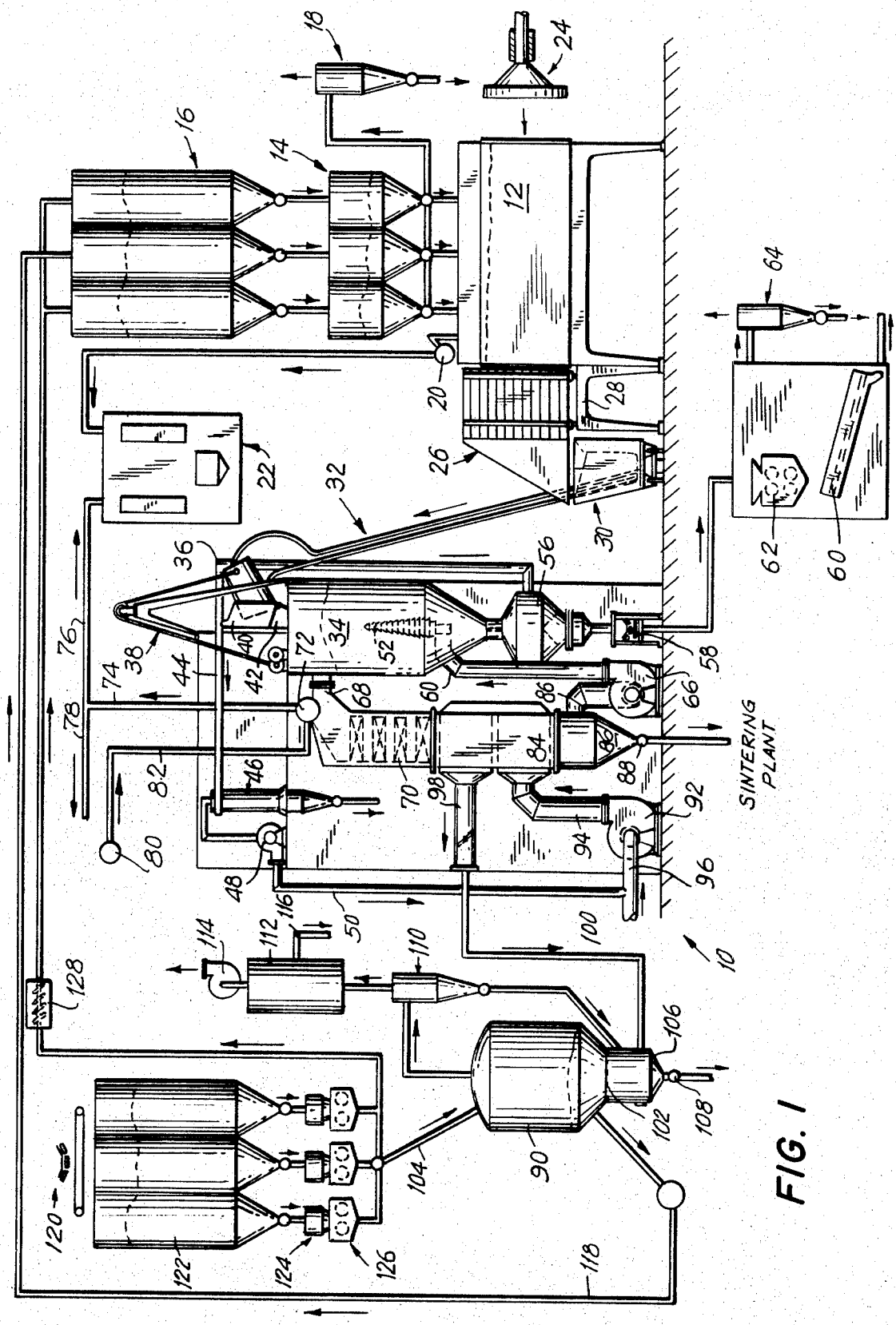


FIG. 1

FIG. 2

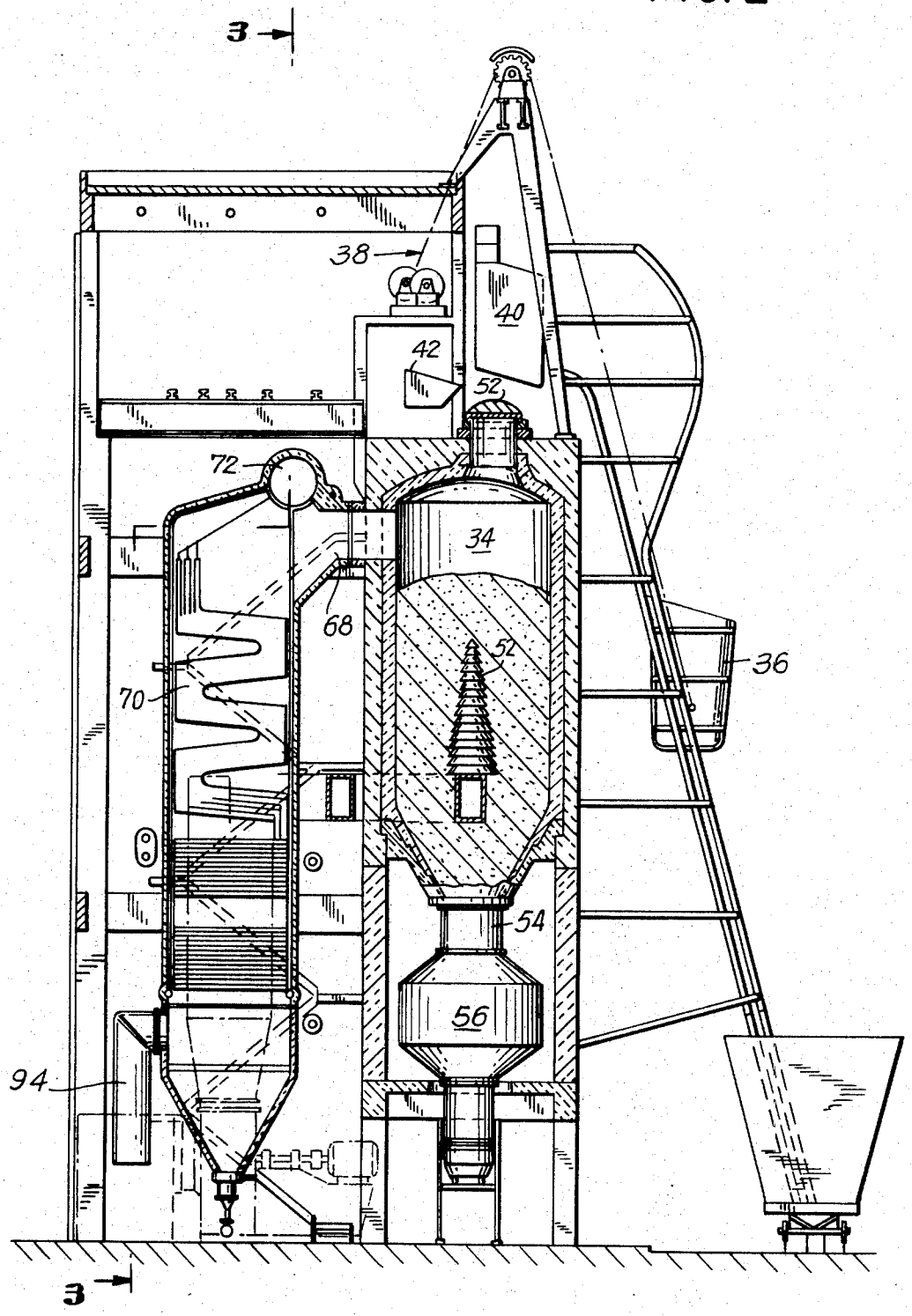
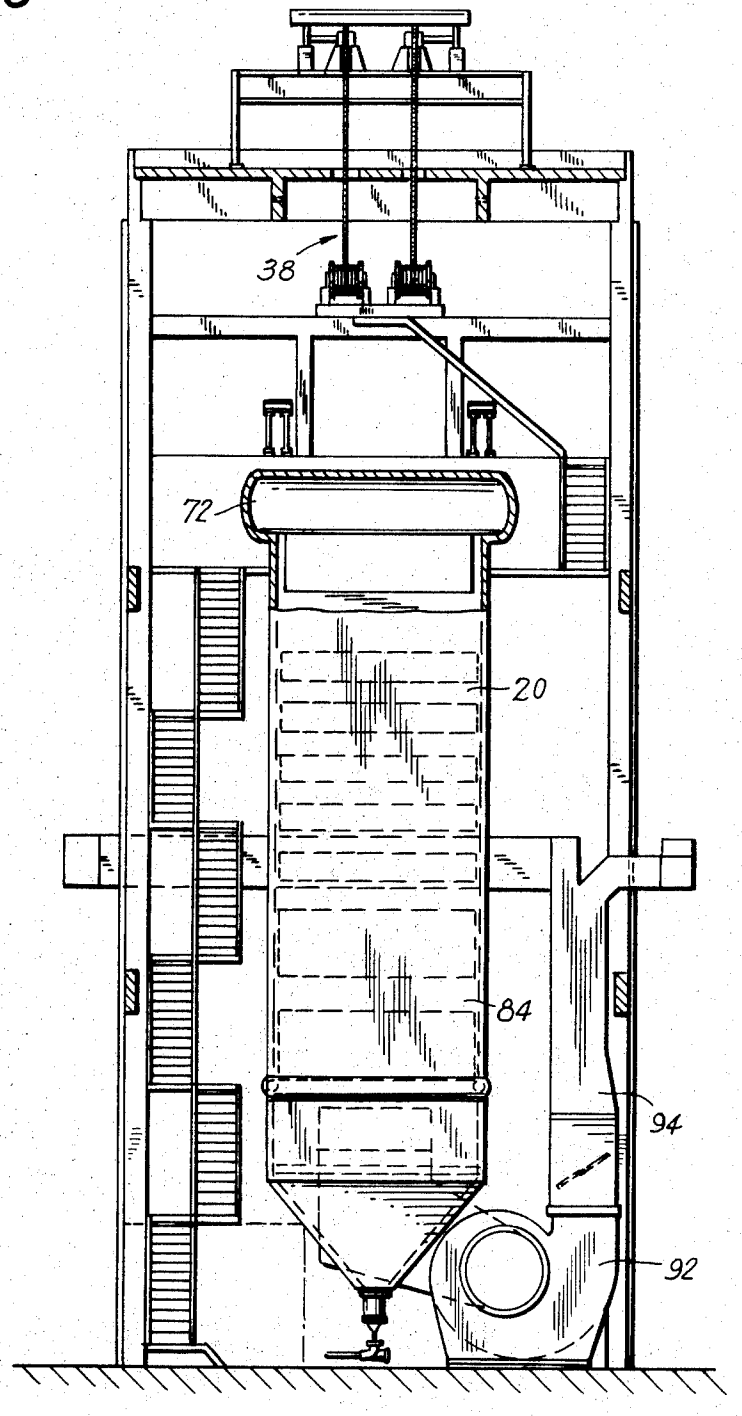


FIG. 3



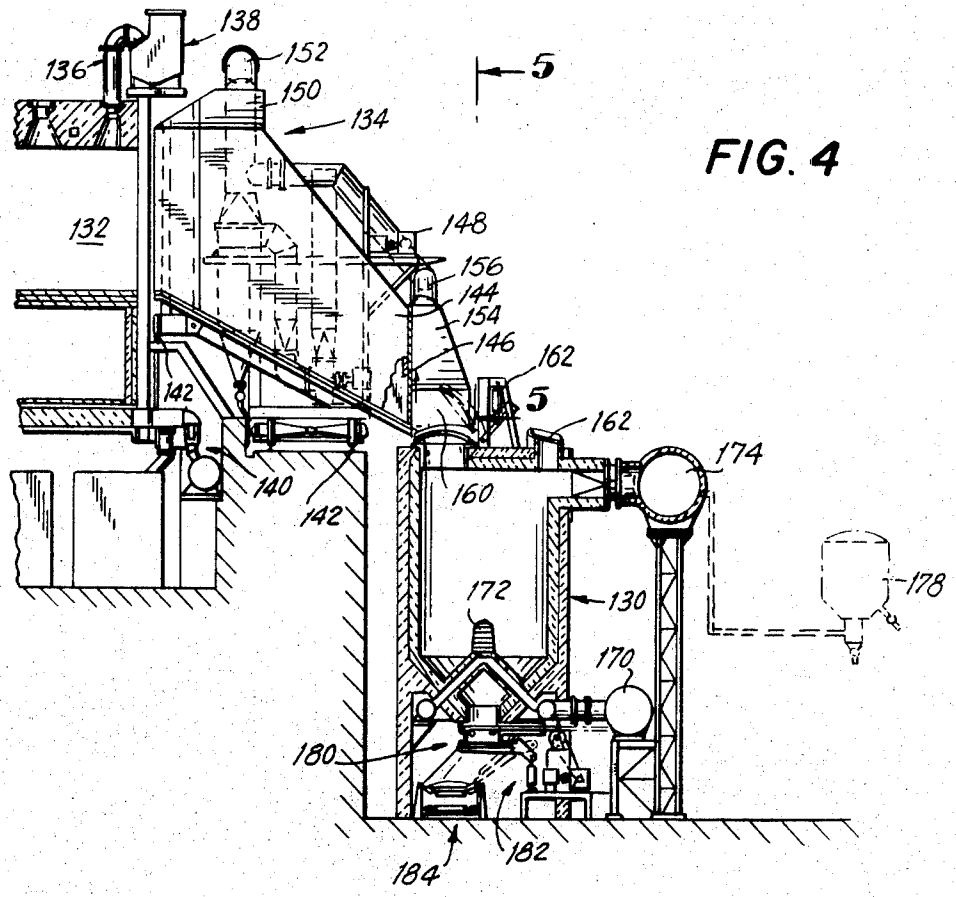

138
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FIG. 4

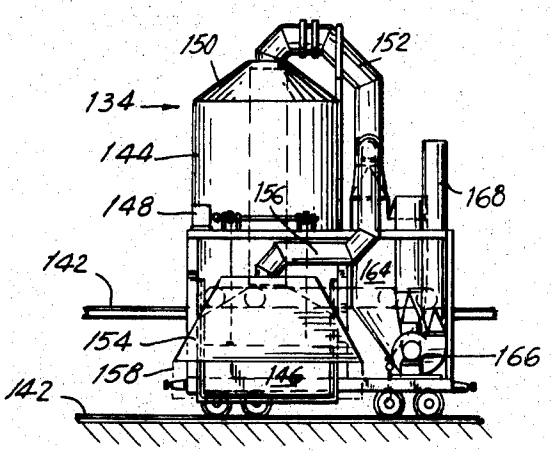
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FIG. 5

FIG. 6

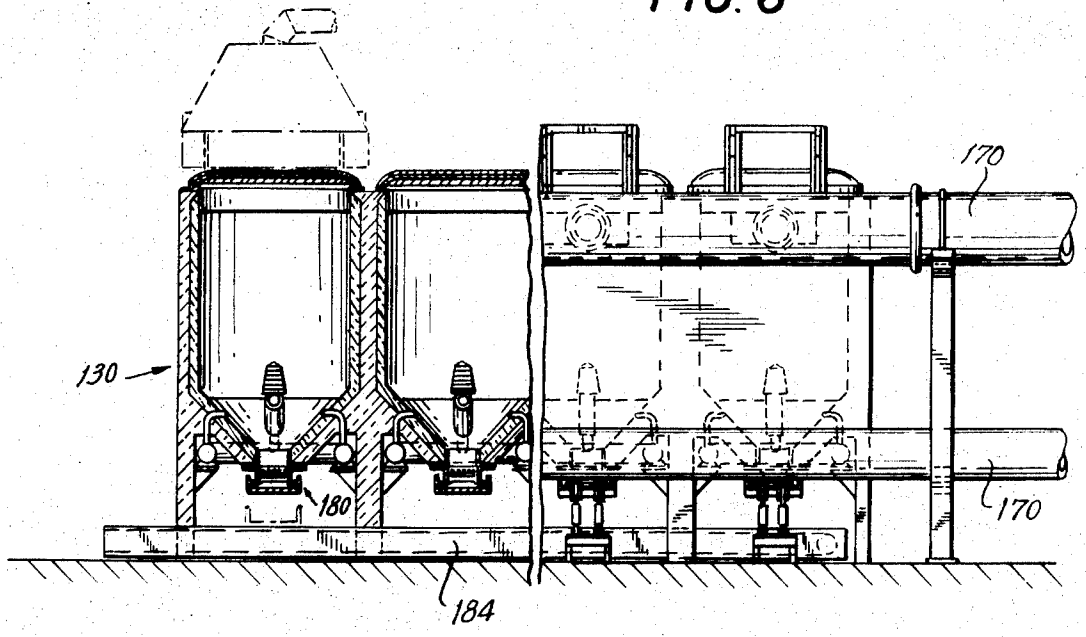
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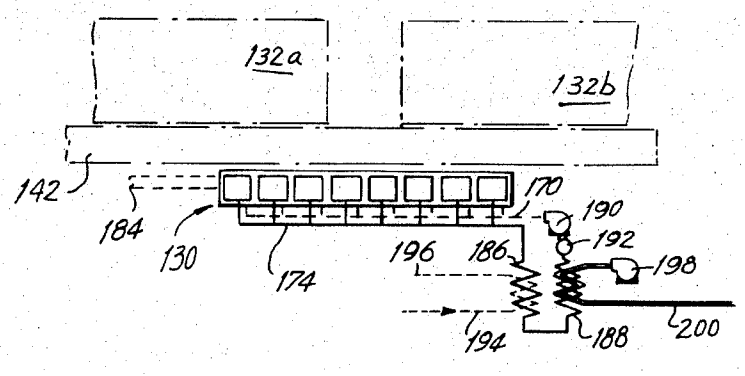
FIG. 7


132a
132b
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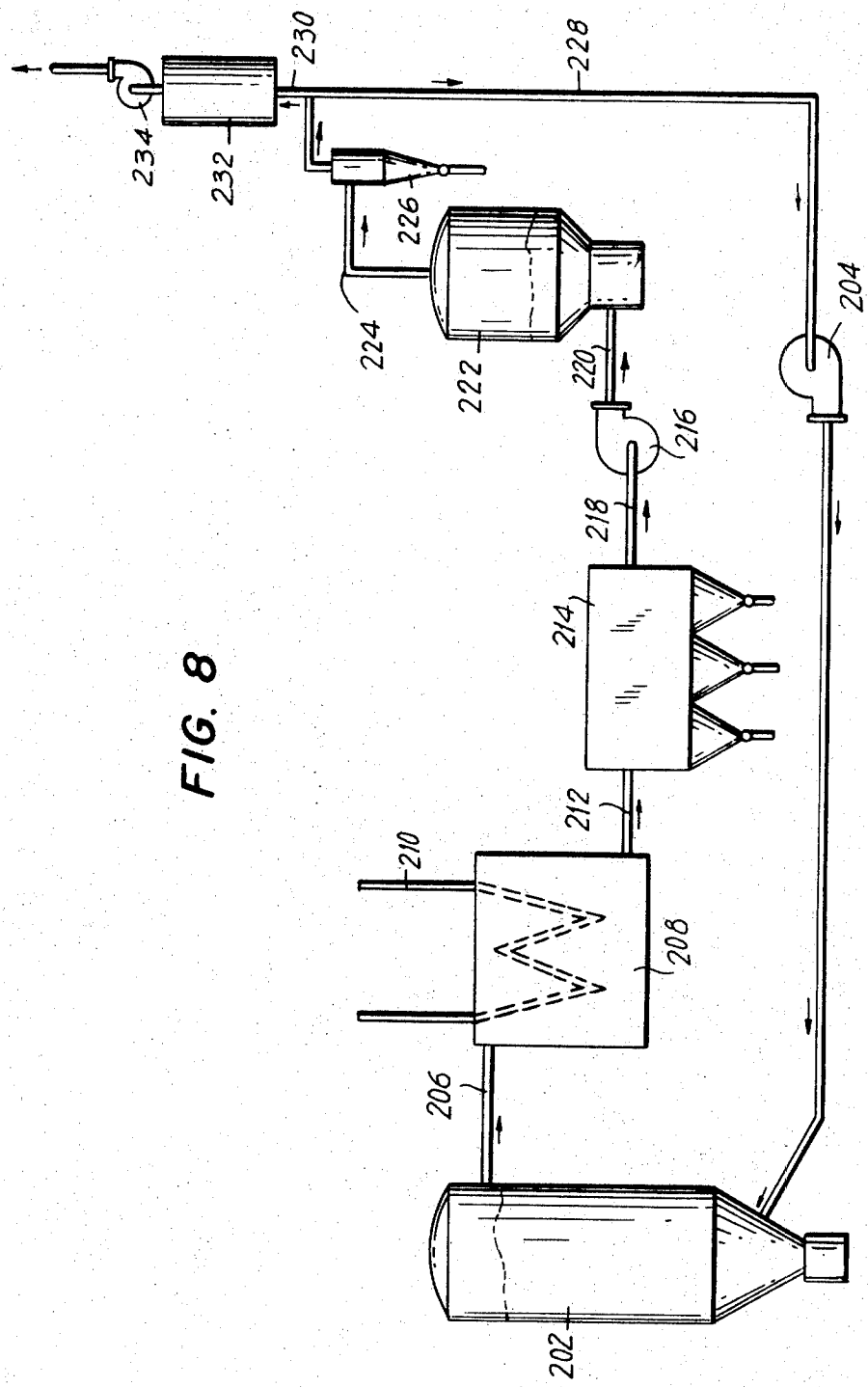
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FIG. 8

INDIRECTLY HEAT EXCHANGING PLURAL GAS STREAMS FOR DRY QUENCHING HOT COKE AND DRYING COAL

BACKGROUND OF THE INVENTION

The present invention relates to coke plants and methods for operating the same.

As is well known, large amounts of coke are required for purposes such as the manufacture of steel. In connection with blast furnace installations, for example, it is conventional to utilize batteries of coke ovens which are periodically charged with coal which is distilled into coke in the coke ovens. During the treatment of the coke in the coke ovens it is possible to derive a considerable amount of energy from the coke ovens, and the coke itself, immediately upon being discharged from the ovens, has a high temperature so that a considerable amount of energy is available from the coke itself immediately upon discharge thereof from the ovens. At the present time much of this energy is wasted. Also, in connection with the operation of conventional coke plants, it is customary to release to the atmosphere undesirable impurities many of which are noxious, with the result that a very substantial pollution problem is encountered. A further factor encountered in connection with conventional coke plants and methods for operating the same is a lack of efficiency resulting from such conditions as charging the batteries of coke ovens with coal which is not in the best condition for treatment in the coke ovens and obtaining from the coke plant coke which is not in the best condition for subsequent use.

SUMMARY OF THE INVENTION

It is accordingly a primary object of the present invention to provide a coke plant and method for operating the same according to which the above drawbacks are reduced and in some cases eliminated.

Thus, it is a primary object of the present invention to provide a coke plant and method for operating the same which makes the greatest possible use of the energy resulting from distillation of the coal into coke.

Also it is an object of the present invention to provide a coke plant and method for operating the same according to which the coal is in the best possible condition for treatment in the coke ovens and the coke derived from the plant and method of the invention is in the best possible condition for subsequent use.

The object of the present invention also include the provision of a coke plant and method of operating the same according to which release of pollutants to the outer atmosphere is reduced to such an extent that if there is any such release it is too small to create any problem.

According to the method of the invention there is a periodic charging of a coke oven with coal and a discharging of hot coke therefrom. The discharge hot coke is subjected to dry-quenching to reduce the temperature of the hot coke while extracting heat therefrom. At least part of the coal which is charged into the coke oven is dried prior to charging with heat extracted from the hot coke during the dry-quenching thereof.

The coke plant of the invention has an oven means for distilling coal into coke as well as a charging means operatively connected with the oven means for charging the latter with coal. A discharging means is operatively connected with the oven means for discharging hot coke therefrom, and a bunker means is provided for receiving the hot coke discharged from the oven means. A transporting means extends between the oven means and the bunker means to transport hot coke from the oven means to the bunker means. A gas-circulating means is provided for circulating a quenching gas along a path part of which is formed by the interior of the bunker means. A coal drying means is provided for gas-drying coal prior to charging of the coal by the charging means into the oven means. A gas-directing means communicates on the one hand with the coal-drying means and on the other hand with the path along which the quenching gas is circulated for heating gas used for coal drying with heat extracted from the coke.

BRIEF DESCRIPTION OF DRAWINGS

The invention is illustrated by way of example in the accompanying drawings which form part of this application and in which:

FIG. 1 is a schematic representation of a coke plant according to the invention, FIG. 1 also illustrating the method of the invention;

FIG. 2 is a schematic partly sectional elevation of that part of the plant of FIG. 1 where the coke-cooling bunker is located, FIG. 2 illustrating components which cooperate with this bunker;

FIG. 3 is a schematic partly sectional elevation taken along line 3—3 of FIG. 2 in the direction of the arrows and illustrating further features of the plant and method of the invention;

FIG. 4 is a schematic partly sectional elevation of a further embodiment of a coke-plant and method of the invention;

FIG. 5 is a schematic elevation taken along line 5—5 of FIG. 4 in the direction of the arrows and illustrating a larry car installation of FIG. 4;

FIG. 6 is a fragmentary partly sectional schematic elevation showing the arrangement of successive coke-cooling bunkers used with the embodiment of FIGS. 4 and 5;

FIG. 7 is a schematic illustration of the circulation of the quenching gas and the manner in which this gas is used with the embodiment of FIGS. 4–6; and

FIG. 8 is a schematic illustration of a further embodiment of a coke plant and method according to the invention.

DESCRIPTION OF PREFERRED EMBODIMENTS

Referring first to FIG. 1 there is illustrated therein, schematically, a coke plant 10 according to the invention for carrying out the method of the invention. The coke plant 10 includes an oven means 12. This oven means 12 in practice takes the form of a battery of many ovens located one next to the other. As is well known during distillation of coal in the oven means 12 gas is directed through the oven means 12 so as to carry out the distillation of the coal with the heated gas being directed to regenerators, for example, after which the gas may be used in blast furnaces.

Each oven of the oven means 12 is periodically charged with coal by way of a charging means 14. This charging means may take the form of a larry car which travels along the top of the battery of ovens from one

oven to the next, periodically charging each oven with a charge of coal to be distilled into coke. The charging means **14** receives its charge of coal from a storage bunker installation **16** where the coal is stored in preparation for being charged into the oven means **12**.

During charging of the oven means **12** hot gases escape out of the oven and are cleaned and desulfurized by the gas cleaning means **18** before being released to the atmosphere. This gas cleaning means **18** may include suitable dust collectors, centrifuges, and the like, with a suitable fan operating for creating the desired flow of gas, and in addition the gas discharging from the oven means during charging thereof may be burned so as to prevent release of noxious fumes to the outer atmosphere while at the same time providing a source of useful heat which may be used for such purposes as generating steam in a boiler or the like.

In addition, through suitable stand pipes the gases discharging from the oven means **12** are received in a conduit **20** from where the gases flow to a by-product plant **22**. In this case also the stand pipes may be cooled to extract heat from the gas discharging from the oven means, and this heat may be used for generating steam or other purposes.

A discharging means **24**, shown at the lower right of FIG. **1**, takes the form of well known pushing structure operatively connected with the oven means **12** for pushing the coke out of the latter in order to discharge the coke as schematically represented in FIG. **1**.

A coke guide and exhaust assembly **26** is capable of travelling along rails supported by a framework **28** into alignment with whichever one of the ovens happens to be discharged at any given time, and the discharge coke is received in the coke guide and exhaust unit **26** which is completely enclosed so that there will be no escape of impurities into the outer atmosphere. An unillustrated exhaust unit is operatively connected with the coke guide and exhaust **26** for preventing release of smoke to the outer atmosphere, the gas which is discharged from the unit **26** being purified before being released to the outer atmosphere, and in this case also the heat in the gases taken from the unit **26** may be used for generating steam of the like.

In this way through the enclosed unit **26** the discharged coke is received in a hot coke car **30** supported for movement along rails which extend along the battery of ovens which form the oven means **12** so that the discharged coke will be received in the coke car **30**. This car **30** together with the unit **26** form part of a transporting means **32** for transporting the hot coke from the oven means **12** to a bunker means **34** in which dry-quenching of the hot coke takes place. Thus, the transporting means **32** is situated between the oven means **12** and the bunker means **34** for delivering hot coke to the latter. This transporting means **32** in the embodiment of FIG. **1** takes the form of a skip hoist provided with buckets **36** capable of being raised and lowered by way of a cable and pulley assembly **38** operated in any suitable manner and situated over the bunker means **34**. The car **30** as well as the buckets **36** form coke containers which are maintained closed off from the outer atmosphere during travel of the coke between the oven means **12** and the bunker means **34**. For the purpose of further preventing escape of undesirable pollutants into the outer atmosphere there is situated over the bunker means **34** an exhaust hood **40** (FIG. **2**) as well as a coke chute **42**. When a bucket **36**, shown in FIG. **2** on its way to the exhaust hood **40** reaches the latter, the bucket **36** is tipped in the manner shown in FIG. **1**, with the top cover removed from the bucket **36**, so that the contents will flow out of the bucket **36** into the bunker **34** while the open end of the bucket **36** is enclosed by the hood **40**. At this time the chute **42** is displaced from the position shown in FIG. **2** in any suitable way to the position shown in FIG. **1** so as to guide the coke from the hood **40** directly into the bunker **34**, and in this way escape of undesirable contaminants to the outer atmosphere is avoided during charging of the bunker means **34** with the hot coke. The exhaust hood **40** communicates with an exhaust pipe **44** through which gases are directed to a gas-cleaning system **46** such as a suitable cyclone separator, dust collector, or the like, so that the gases discharging from the hood **40** are suitably cleaned before reaching a fan **48** of this gas-cleaning system. The fan **48** serves to draw the gas from the hood **40** through the conduit **44** and the gas-cleaning system **46**, and clean gas is then discharged from the fan **48** along the conduit **50** for a purpose referred to below. After the bunker means **34** is charged with hot coke, the chute **42** is retracted to the position shown schematically in FIG. **2** and the filling pipe of the bunker **34** is closed and sealed with a cover **52** shown in FIG. **2**. This cover **52** is removed during charging of the bunker means **34** when the chute **42** extends between the exhaust hood **40** and the supply pipe at the top of the bunker means **34**.

Situated in the interior of the bunker means **34** is a cooling gas distributor **52** through which the relatively cool gas is delivered to the interior of the bunker means **34** in order to carry out dry-quenching of the coke therein. When the charge of the coke in the bunker means **34** has been dry-quenched by the cooling gas to the desired extent, a discharge valve means **54** of known construction is opened so as to release the cooled coke to a coke-discharge hopper **56**. From the hopper **56** the cooled coke is received by a conveyer means **58** which, as schematically shown in FIG. **1**, delivers the coke to a screening station **60**. Before screening the coke passes through a crusher unit **62** at the screening station. In this case also the screening station **60** is completely enclosed and the gases in the latter are drawn into a gas-cleaning system **64** which serves to clean the gas before it is released to the outer atmosphere, this gas-cleaning system including cyclones, dust collectors, or the like, which removed particulate matter from the gas and deliver this particulate matter to a sintering plant. Thus, the coke breeze resulting from these operations is received at the unillustrated coke-sintering plant. The coke from the screening station, assuming that it is of the proper size as determined by the screening operations, is delivered to a coke bin from where the coke is then delivered to a blast furnace installation.

The dry-quenching gas distributed by the unit **52** in the interior of the bunker means **34** may be an inert gas or air, or a combination thereof. This dry-quenching gas is circulated by a circulating means **66** along a closed path part of which is formed by the interior of the bunker means **34**. Thus, the circulating means **66**

takes the form of a cooling gas fan which delivers the quenching gas along a conduit **60** to the distributor **52** from where the gas flows through the coke to extract heat therefrom. This quenching gas which is thus heated, while reducing the temperature of the coke, is received in a discharge pipe **68** which communicates with a boiler or steam generator **70** having a series of convections sections where heat is taken from the quenching gas and delivered to water which is converted into steam, a suitable steam drum **72** being provided at the top of the boiler **70**. From the steam drum **72** the steam travels along a pipe system **74** and is delivered in part through a conduit **76** to the byproduct plant **22** while the remainder of the steam is transported through a conduit system **78** to any desired location where use in made of steam. A feedwater means **80** communicates through a conduit **82** with the steam generating means **70, 72** for delivering to the latter the water which is converted into steam while extracting heat from the quenching gas.

After travelling through the boiler **70** the quenching gas flows through a heat-exchanger means **84** where further heat is extracted from the quenching gas which has already been cooled by the cooling means **70** to a temperature substantially below the temperature which the quenching gas has when it leaves the bunker means **34**.

The quenching gas which is thus further cooled in the heat exchanger means **84**, for a purpose referred to below, is then drawn through the inlet **86** into the circulating means **66** which now again delivers the cooled quenching gas through the conduit **60** to the gas-distributor **52** in the interior of the bunker means **34**. Thus, the circulating means **66** provides for the quenching gas a closed path through the bunker means **34**, the cooling means **70**, the heat-exchanger means **84**, and back to the circulating means **66**.

At the bottom of the boiler and heat-exchanger installation **70, 84** is a dust hopper **86** in which dust in the quenching gas is collected, and through a suitable valve **88** the collected dust is released from time to time to be delivered, as shown schematically in FIG. **1**, to the sintering plant. The dust collected at the gas-quenching system **46** may be delivered in the same way to the sintering plant.

The coal which is delivered to the storage bunkers **16** to be received therefrom by the charging means **14** is first dried by a coal-drying means **90**. In accordance with one of the important features of the present invention the coal which is charged into the oven means **12** is first dried with heat extracted from the coke delivered to the bunker means **34**. For this purpose a gas-directing means **92** is provided in the form of a suitable fan. This gas directing means **92** communicates on the one hand with the path along which the quenching gas is circulated by the circulating means **66** and on the other hand with the coal-drying means **90**. Thus, the discharge of the fan **92** communicates through a pipe **94** with the heat exchanger **84** so as to direct into the latter a gas which is preferably inert gas. This gas is heated in the heat exchanger with heat extracted from the quenching gas after the latter flows through the boiler **70**. The inert gas, preferably nitrogen of which a large supply is readily available, is delivered to the gas-directing means **92** through an inlet conduit **96**. However, some of the cleaned gas from the gas-cleaning system **46** may be combined with the inert gas through the conduit **50**, as shown in FIG. **1**. The heated coal-drying gas is delivered from the heat exchanger **84** through a conduit **98** to a pipe **100** which delivers the gas into the lower end of the coal-drying means **90**. The conduits **94** and **98** may be provided with suitable valves for controlling the flow of gas therethrough, as shown in FIGS. **1** and **3**.

The coal which is dried in the coal-drying means **90** rests on a suitable screen **102**. This coal-drying means **90** is in the form of a suitable enclosure into which the coal to be dried is delivered through an inlet **104**, as schematically shown in FIG. **1**. The drying gas under pressure which is delivered through the conduit **100** into the lower end of the coal-drying means **90** flows up through the screen **102** so as to form the coal into a fluidized bed in the coal-drying means **90**.

Dust in the coal drying means is collected in a hopper **106** and delivered from time to time through a valve **108** to the sintering plant.

Also, part of the gas within the coal-drying means is continuously circulated by a gas-cleaning system **110** from which part of the gas is delivered to the gas-cleaning system **112** from which gas has been cleaned and desulfurized is delivered to the outer atmosphere through a fan **114**. In this case also any dust which is collected from the gas is delivered through a conduit **116** or the like to the sintering plant.

The dried coal is conveyed by a conveyer means **118** from the drying means **90** to the storage bins **16**, as schematically shown in FIG. **1**.

The wet coal is initially delivered by a conveyer means **120** to blending bins **122** from which the coal is delivered through feed weigher units **124** to coal crushers **126** from which the coal is delivered through the inlet **104** into the coal dryer **90**. However, part of the coal may be conveyed without drying to a mixer unit **128** to be delivered to the bins **16** from the unit **128**, so that if desired part of the coal in the bins **16** will not be dried, and thus it is possible to control very precisely the condition of the coal which is charged into the oven means **12**.

FIGS. **4–7** illustrate another embodiment of the invention. According to this embodiment the bunker means **130** (FIG. **4**) is situated at an elevation lower than the oven means **132**, and the transporting means **134** serves to direct the discharged coke from the oven means to the bunker means **130** gravitationally. The oven means **132** may be the same as the oven means **12**, and a suitable discharge means, such as the means **24**, coacts with the oven means **132** for periodically discharging the hot coke therefrom. The coal is charged into the oven means **132** in the manner described above in connection with the oven means **12**. FIG. **4** illustrates a standpipe arrangement **136** through which gas discharges from the oven means **132** into a unit **138** which serves to purify the gas and utilize heat therein before the gas is discharged to the outer atmosphere. FIG. **4** also illustrates schematically the structure **140** which directs the gas through the coke oven for treating the coal therein and for then flowing to a regenerator, as referred to above.

The transporting means **134** includes a car movable along rails **142** into alignment with the particular oven

which is to be discharged. The transporting means **134** is in the form of an enclosure which is mounted on the car. This enclosure **144** has a lower inclined wall and a pair of side walls forming a guide through which the hot coke flows down into the bunker means **130**. The left end of the enclosure **144** is open for receiving the coke when it is discharged from the oven. The right end of the enclosure **144**, as viewed in FIG. **4**, is provided with a suitable gate **146** capable of being raised and lowered through a suitable winch and cable drive driven by a suitable gate drive **148**. The side walls of the enclosure **144** are interconnected by a roof which includes a smoke-exhaust hood **150** which in turn communicates with an exhaust pipe **152**. This structure is also illustrated in FIG. **5**. To the right of the gate **146**, as viewed in FIG. **4**, is a second smoke exhaust hood **154** which communicates with an exhaust pipe **156**. A flexible curtain **158** extends down from the periphery of the hood **154**.

Each bunker of the bunker means **130** is provided with a closing cover **160** capable of being swung to the open dot-dash line position shown in FIG. **4** by the drive **162**. The hood **154** is aligned with the cover **160** of that bunker which is to receive the charge of hot coke, and then the cover **160** is raised. Upon discharge of the coke from the oven the gate **146** is raised, and thus the coke will flow down into the bunker **130** in order to charge the latter. The bunker is provided with an explosion damper **162**. The pipes **152** and **156** deliver the smoke to a scrubber **164** through which the gas from the enclosure **144** is drawn by a fan **166** before being delivered by the latter to the stack **168**. In this way only purified gas is released to the outer atmosphere from the transporting means **134**. The same gas-cleaning arrangement may be provided for the guide **26** of FIG. **1**.

After a bunker of the bunker means **130** has been charged, the cover **160** is returned to its closed position and the car together with the remainder of the transporting means **134** is moved to the next oven which is to be discharged.

The hot coke within the bunker means **130** is dry-quenched in the manner described above. Thus, cooling gas from a heat exchanger is delivered through a pipe **170** (FIG. **4**) into each bunker to flow through a gas distributor **172** so as to reach and flow through the hot coke in order to extract heat therefrom. The dry-quenching gas is then received in a pipe **174** which delivers the hot gas to the boiler where steam is generated, and then this gas which has thus been cooled is returned to the pipe **170** as described above. In this way the dry-quenching gas is circulated along a closed path in the manner described above, a suitable circulating fan being provided for this purpose. The gas delivered to the pipe **174**, after being cooled as by flowing through a steam generator such as a boiler may then be used for drying coal in a coal-drying means **178**, as schematically shown in FIG. **4**.

The cooled coke is released from each bunker of the bunker means **130** by way of a suitable bunker-discharge unit **180** provided for each bunker and actuated by a suitable drive **182**. The cooled coke is received on a conveyer **184** which delivers the coke to the screening station.

FIG. **6** shows part of the series of bunkers of the bunker means **130** arranged beside each other and all communicating with the pipe **174** which in turn delivers the dry-quenching gas to the steam generator. Also FIG. **6** shows the cooling gas supply pipe **170** as well as the bunker-discharge units **180** and the conveyer **184**.

As is schematically shown in FIG. **7**, the oven means **132** may take the form of a pair of coke oven batteries **132***a* and **132***b* arranged beside the rails **142** for the transporting means **134**. Beside these rails **142** are located the series of bunkers of the bunker means **130**. The conveyer means **184** for conveying the coke to the screening station is also shown schematically in FIG. **7**. FIG. **7** shows schematically the communication between the top ends of the several bunkers of the bunker means **130** with the hot gas pipe **174** which delivers the hot gas to the boiler **186** from where the hot gas flows to the heat exchanger **188** before being returned to the circulating fan **190** after first passing through a cyclone type gas cleaner **192**. The fan **190** then delivers the cool gas to the supply pipe **170** shown in dotted lines in FIG. **7** communicating with the several bunkers of the bunker means. In this way the quenching gas is circulated by the circulating means **190** along a closed path. Feedwater is supplied to the steam generator **186** through the feedwater supply system **194**, and after passing through the boiler **186** the steam is delivered to any suitable plant where use may be made of the steam, by way of the pipes **196**. The inert gas for drying coal is directed through the heat exchanger **188** by a fan **198** which thus forms the gas-directing means for directing the coal-drying gas through the heat exchanger **188** so that this gas can then be delivered through the conduit **200** to the coal dryer such as the coal-drying means of FIG. **1** or the coal-drying means **178** schematically shown in FIG. **4**.

According to the embodiment of the invention which is illustrated in FIG. **8**, there is a single path of gas flow through the bunker for dry-quenching the coke and through the coal-dryer for drying the coal. Thus, referring to FIG. **8**, there is schematically shown therein, at the left, a bunker means **202** into which the hot coke is delivered from the coke oven means through a transporting means such as that of FIG. **1** or that of FIG. **4**. The dry-quenching gas is delivered to the interior of the bunker means **202** by a gas-circulating means **204**, and this gas may be distributed through the coke after passing through a suitable gas distributor such as the distributor **52** of FIG. **1** or the distributor **172** of FIG. **4**. The quenching gas which has thus extracted heat from the coke discharges from the bunker means **202** through a conduit **206**. The gas is delivered to the interior of the bunker means **202** through a conduit connected to the discharge end of the circulating fan **204**. The cooled coke is discharged from the bottom end of the bunker means **202** in the manner described above.

The hot dry-quenching gas is delivered from the conduit **206** into a boiler **208** which forms a cooling means for cooling the dry-quenching gas. This boiler has the feedwater pipe system **210** through which feedwater is delivered to be heated and converted into steam to be used wherever desired as described above.

From the boiler **208** the cooled dry-quenching gas is delivered through a conduit **212** into a filter **214** which

can be combined with a simple cyclone dust collector so that the quenching gas after being cooled is also cleaned. A gas-directing means **216** in the form of a suitable fan draws the cleaned gas from the filter **214** through a conduit **218** into the gas-directing means **216** which now delivers the gas through a conduit **220** into the lower end of the coal-drying means **222** to which wet coal is delivered in a manner described above in connection with FIG. **1** and in which the coal, while it is dried, is maintained in the form of a fluidized bed.

From the coal-drying means **222** the drying gas is delivered through a conduit **224** into a cyclone **226** so as to be cleaned before being returned through a conduit **228** to the inlet of the gas-circulating means formed by the fan **204**.

Thus, with the embodiment of FIG. **8** the gas-directing means **216** also communicates on the one hand with the path of flow of gas through the bunker means **202** in order to utilize the heat extracted from the coke, this gas-directing means **216** also communicating with the coal-drying means **222**, but in the embodiment of FIG. **8** the path of flow of the drying gas is part of the path of flow of the quenching gas, and this latter path is a closed path along which an inert gas stream is continuously circulated by the circulating means **204**.

Part of the water vapor in the gas used both for quenching and coal-drying is bled from the conduit **228**, through a suitable conduit **230** to be delivered by the latter to a wet or dry dust collector **232** which communicates with a fan **234** from which air is delivered to the outer atmosphere so that in this way an undesirable increase in water vapor content in the quenching and drying gas is avoided.

It is apparent that with all of the above-described embodiments of a coke plant and method for operating the same according to the invention, a highly efficient use is made of the energy available in the system, pollution of the outer atmosphere is avoided, the coal is delivered to the coke ovens in a highly favorable condition as the result of the preliminary drying of the coal, and the coke is itself in the best possible condition for further use because of the dry-quenching thereof. In particular, the use of the heat extracted from the coke during the dry quenching thereof for the purpose of drying the coal represents a considerable economy because of the use which is made of heat energy which otherwise would be wasted, and at the same time condition of the coal is improved prior to charging of the coal into the coke oven means while at the same time all of the advantages of dry-quenching of the coke are maintained.

What is claimed is:

1. In a method for operating a coke plant, the steps of periodically charging a coke oven with coal and discharging hot coke therefrom, dry-quenching the discharged hot coke to cool the latter while extracting heat therefrom, drying at least part of the coal charged to the oven with the heat extracted from the hot coke during dry-quenching, and utilizing for dry-quenching the hot coke and drying the coal a pair of completely distinct gas streams which are respectively directed along entirely separate paths so that the gas streams do not intermingle with each other, and transferring by indirect heat exchange heat from the dry-quenching gas to the coal-drying gas, the gas used for coal drying being subsequently discharged in part to the outer atmosphere, and cleaning and desulfurizing said part of said coal-drying gas before it is discharged to the outer atmosphere.

2. In a method for operating a coke plant, the steps of periodically charging a coke oven with coal and discharging hot coke therefrom, a dry-quenching the discharged hot coke to cool the latter while extracting heat therefrom, drying at least part of the coal charged to the oven with the heat extracted from the hot coke during dry-quenching, and utilizing for dry-quenching the hot coke and drying the coal a pair of completely distinct gas streams which are respectively directed along entirely separate paths so that the gas streams do not intermingle with each other, and transferring by indirect heat exchange heat from the dry-quenching gas to the coal-drying gas, and including the step of generating steam from the gas used for dry-quenching prior to transfer of heat from the latter gas to the coal-drying gas so that the gas used for dry-quenching has its temperature reduced after the steam is generated thereby, thus delivering to the coke for dry-quenching thereof a relatively cool gas which extracts from the coke a relatively large amount of heat in a relatively short time.

3. In a coke plant, oven means for distilling coal into coke, charging means operatively connected with said oven means for charging the latter with coal to be distilled into coke, discharging means operatively connected with said oven means for discharging hot coke therefrom, bunker means for receiving the hot coke discharged from said oven means, transporting means between said oven means and bunker means for transporting hot coke from said oven means to said bunker means, gas-circulating means for circulating a quenching gas along a closed path part of which is formed by the interior of said bunker means, coal-drying means for gas-drying coal prior to charging of the coal by said charging means into said oven means, and gas-directing means communicating with said coal-drying means for directing a coal-drying gas therethrough and along a path separate from but in part in close proximity with said path along which the quenching gas is circulated for heating gas used for coal drying with heat extracted from the coke, indirect heat-exchanger means situated along said paths where they are in close proximity for extracting heat from the quenching gas and delivering the extracted heat to the coal-drying gas, and means located along the closed path of said quenching gas upstream of said heat-exchanger means for generating steam from the gas used for dry-quenching prior to transfer of the heat from the latter gas to the coal-drying gas so that the gas used for dry-quenching has its temperature reduced after the steam is generated thereby, thus delivering to the coke for dry-quenching thereof a relatively cool gas which extracts from the coke a relatively large amount of heat in a relatively short time.

4. In a coke plant, oven means for distilling coal into coke, charging means operatively connected with said oven means for charging the latter with coal to be distilled into coke, discharging means operatively connected with said oven means for discharging hot coke therefrom, bunker means for receiving the hot coke discharged from said oven means, transporting means

between said oven means and bunker means for transporting hot coke from said oven means to said bunker means, gas-circulating means for circulating a quenching gas along a closed path part of which is formed by the interior of said bunker means, coal-drying means for gas-drying coal prior to charging of the coal by said charging means into said oven means, gas-directing means communicating with said coal-drying means for directing a coal-drying gas therethrough and along a path separate from but in part in close proximity with said path along which the quenching gas is circulated for heating gas used for coal drying with heat extracted from the coke, indirect heat-exchanger means situated along said paths where they are in close proximity for extracting heat from the quenching gas and delivering the extracted heat to the coal-drying gas, and means communicating with said coal-drying means for discharging part of the coal-drying gas to the outer atmosphere and for cleaning and desulfurizing said part of said coal-drying gas before it is discharged to the outer atmosphere.

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