

[54] **PROCESS FOR QUENCHING HOT COKE FROM COKE OVENS**

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[22] Filed: **Mar. 4, 1974**

[21] Appl. No.: **447,976**

[30] **Foreign Application Priority Data**

Mar. 15, 1973 Germany..... 2312907

[52] U.S. Cl. **239/11; 239/66; 239/209;**
202/227; 202/230; 201/39

[51] Int. Cl. **B05b 17/04; C10b 39/08; C10b 39/12**

[58] Field of Search 239/185-187,
239/209, 1, 11, 66; 202/227, 263, 230;
55/385; 201/39

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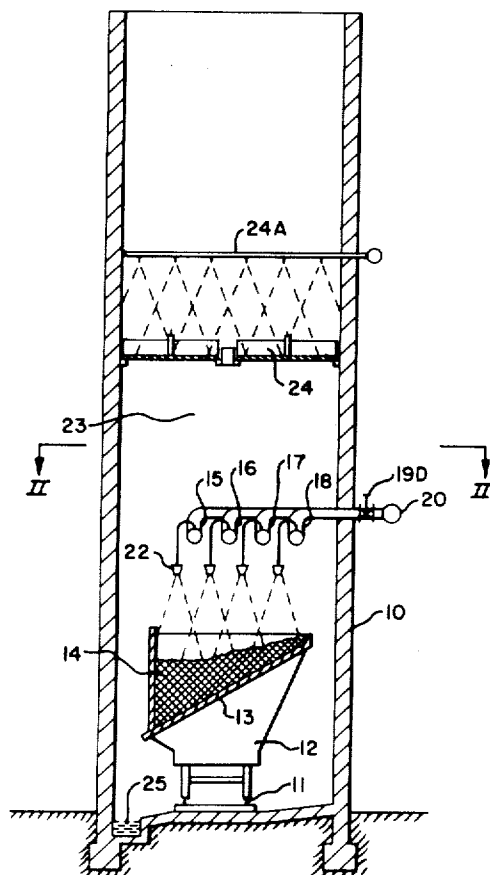
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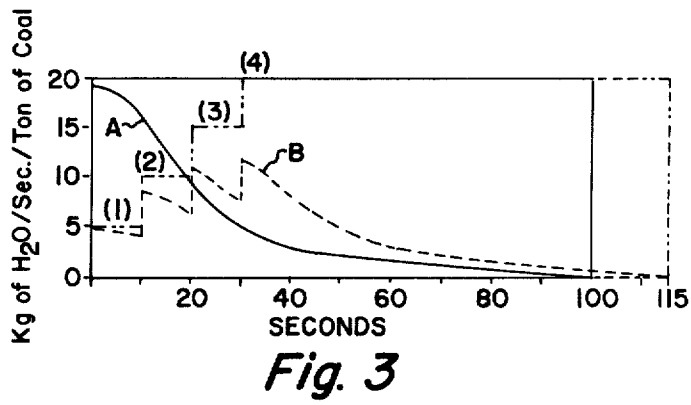
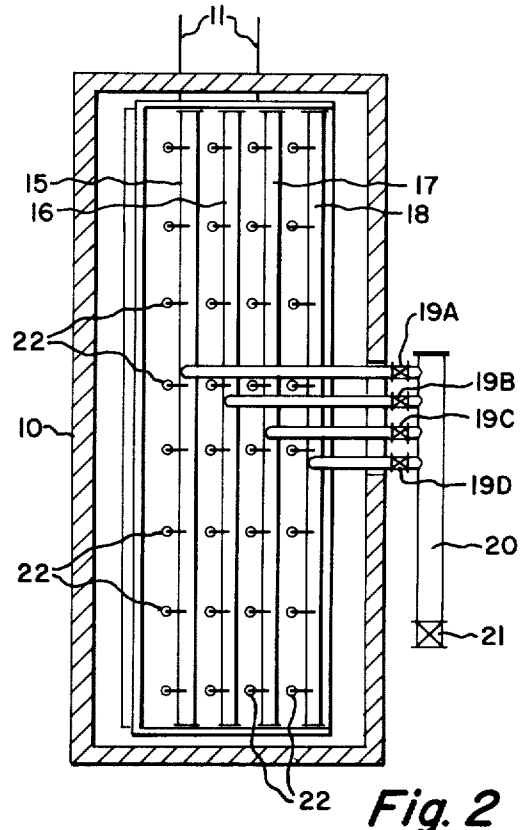
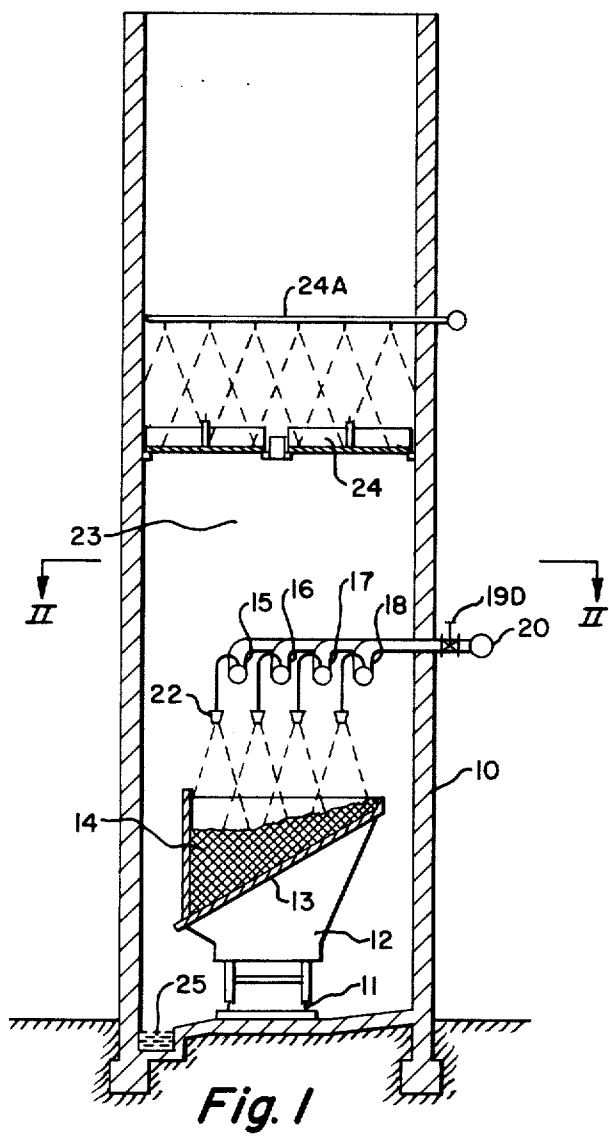
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[57] **ABSTRACT**

A process for quenching coke from coke ovens by independent spray pipes arranged parallel to each other to extend along the length of a coke transfer car while located beneath the chimney of a quenching tower. The coke transfer car has an inclined support floor to provide a progressively decreasing depth of coke transverse to the car. The water discharged by each pipe is controlled to start after successive intervals of time, for example, after 10-second intervals within a 100-second or greater quenching period. The water discharge control is such that the maximum depth of coke is sprinkled with water throughout the entire quenching process while successively lesser depths of coke are quenched for progressively decreasing periods of time.

8 Claims, 3 Drawing Figures





PROCESS FOR QUENCHING HOT COKE FROM COKE OVENS

BACKGROUND OF THE INVENTION

This invention relates to a process for quenching hot coke that has been spread out on a quenching car after discharge from a coke oven. More particularly, the present invention relates to quenching the hot coke through the controlled use of a water sprinkler system installed beneath the chimney of a quenching tower.

The steam produced during quenching of coke has an extremely powerful draft or uplift which is magnified further by the chimney effect of a quenching tower. As the quenching steam emerges from the upper end of the quenching tower, it takes the form of a large white cloud which then becomes identifiable and associated with the coke quenching process. The cloud of quenching steam is visible from great distances and it is symbolic of the presence of a battery of coke ovens. Despite the fact that the quenching steam manifests itself as a white steam cloud, it does nevertheless, contain a great number of solid particles which have been carried in the cloud upwardly from the coke. In addition to the solid particles, the cloud includes poisonous components which, among other origins, stem from the sulfur content of the coke. These solid particles and poisonous components in the steam constitute a severe burden in terms of the surrounding area at a coke oven, especially when that area is inhabited by humans. In view of this, there has been many attempts undertaken to minimize or lessen the nuisance and burdens brought about by the quenching steam. In this connection, in the upper portion of a quenching tower, water has been introduced in a fan-shaped form and mechanical devices have also been installed to catch the water sprayed in this manner in the lower portion of the tower so that the drain water in the tower would not again find its way onto the hot coke. Quenching towers have also been provided with different forms of special structures to decrease the diameter of the quenching tower or channel the quenching steam off to one side in the quenching tower. In the final analysis, these measures brought about a partial sealing-off of the quenching tower which caused the quenching steam to escape from the bottom of the tower, a result that was even less desirable.

An essential factor contributing to the failure of many past attempts and devices used in quenching towers is the strength of the draft causing the quenching steam to rise in the tower.

SUMMARY OF THE INVENTION

It is an overall object of the present invention to provide a process for quenching hot coke located beneath a quenching tower in such a manner that the quenching steam generated during the quenching process is essentially and substantially reduced so as to reduce the quantity of steam passing through the quenching tower for more effective and complete removal of particles and substances causing pollution should they be discharged into the atmosphere.

It is a goal of the present invention to considerably lower the burdens occurring during the quenching of coke by an essentially lessening of the upward draft of the quenching steam in a quenching tower. By lowering or decreasing the amount of quenching steam rising through the vertical opening in the quenching tower

within a period of time, the invention achieves a lowering of the draft inherently associated with the quenching steam and, therefore, it is easier to bind or restrain the solid materials contained in the quenching steam to prevent their discharge into the atmosphere. This binding or restraining of the solid material in the quenching steam is carried out by way of the use of a water sprinkling system and, if appropriate, by way of installations used to cause the sudden expansion of the steam.

According to the present invention, there is provided a process for quenching hot coke from coke ovens by a water sprinkling system arranged above a container bearing hot coke while located beneath the chimney of a quenching tower. The process includes the steps of sprinkling the hot coke at a first preselected water discharge rate throughout an initial time segment which is a fractional part of the time duration of a quenching process, and thereafter sprinkling the hot coke throughout the remaining time for the quenching process at a final water discharge rate which is essentially and materially greater than the first preselected water discharge rate.

The invention is based upon the following considerations and assumptions. About 25 percent of the total amount of water introduced in connection with the quenching of coke will vaporize whereas the remaining 75 percent of this water will run off. The run-off portion of water is conducted to a settling or clearing tank. The quenching process takes place over an extended period of time. During the first few seconds of time, almost all of the quenching water will vaporize. The vaporization of water then diminishes rapidly and during the last phases of the quenching process, the water serves only as a coolant for the partially cooled coke. The present invention takes advantage of the foregoing considerations and phenomena by providing that the amount of water added per unit of time consists of only a fraction of the amount of water that is customarily added at the start of the quenching process. The invention provides that thereafter an additional amount of water per unit of time is gradually increased up to the usual water discharge rate which remains unchanged until the end of the quenching process. By following the teachings of the present invention, the amount of quenching water that vaporizes is considerably lessened during the initial portion of the quenching process. Thus, during the initial quenching, only jets or impulses of steam occur at greatly decreased velocity and it is thereby possible to control the steam by way of sprinkling and deflector members mounted in the quenching tower, thus rendering it essentially easier and more effective to remove the harmful materials entrained in the quenching steam. This will practically eliminate burdens inflicted by the quenching steam upon the areas surrounding a quenching tower.

In order to bring about sprinkling of coke in a controlled manner to quench it according to the process of the present invention, the coke is spread out on an inclined surface which may typically take the form of an inclined floor of a quenching car. The invention contemplates the use of a suitable water system in which the discharge of coolant water is effected by way of a plurality of pipes arranged in a parallel, spaced-apart location so as to extend along the length of the quenching car. In this form of the process, the water discharge pipe below which the greatest depth of coal is located is open first to discharge water onto the underlying

coke and then successively one pipe after another is controlled to discharge water onto the hot coke underlying these pipes so that the successive application of water occurs in the direction of a decreasing coke bed height.

These features and advantages of the present invention as well as others will be more fully understood when the following description is read in light of the accompanying drawings, in which:

FIG. 1 illustrates a vertical section through a quenching installation and includes the lower portion of a quenching tower;

FIG. 2 is a sectional view taken along line II—II of FIG. 1 and illustrates in greater detail one form of water distribution system to carry out the process of the present invention; and

FIG. 3 is a composite graph illustrating the features and advantages of the present invention.

In FIG. 1, there is illustrated a quenching tower having vertical walls 10. Rails 11 carry a wheeled-support frame 12 of a quenching car for movement into and out of the quenching tower. The quenching car has an inclined floor 13 for supporting hot coke 14 at a non-uniform depth transversely of the car. Thus, along one longitudinal side of the car, the coke has a maximum depth while at its opposite longitudinal side, the coke has a minimum depth. Elongated water pipes 15, 16, 17 and 18 are arranged in a parallel, spaced-apart relation at a location above the quenching car and extend along the length of the car. These horizontal pipes are connected by way of shut-off valves 19a, 19b, 19c, and 19d, respectively, to a main water distribution line 20 that, in turn, receives water passing through an intake control valve 21 from a suitable water system, not shown. Sprinkling nozzles 22 are provided along the length of each horizontal pipe 15, 16, 17 and 18. Reference numeral 23 identifies the space above the pipes forming the water sprinkling system as just described. Components 24 are located within the upper portion of the quenching tower and may take the form of closure or deflector plates arranged in such a manner to deflect and partially obstruct the rising currents of air and steam in the tower. The components 24 may be made adjustable to control the passage of the rising currents of steam and air. Above the components 24, there is located a spray pipe 24a for directing a plurality of water sprays onto the components 24. Gutters 25 collect the water that drains off in the tower after sprinkling.

After the quenching car containing the hot coke has been positioned within the tower walls 10, the quenching process proceeds by opening the main control valve 21 and then subsequently valve 19a is opened, thus feeding water to pipe 15 for spraying the coke lying thereunder. Approximately ten seconds after valve 19a is opened, valve 19b is opened, thus feeding water to pipe 16 to spray the coke thereunder. Ten seconds after 19b is opened, valve 19c is opened to feed water to pipe 17 for spraying the coke located thereunder. Ten seconds after the opening of valve 19c, valve 19d is opened to feed water to pipe 18 to spray the coke thereunder. Thus, the valves 19a-19d are opened in succession at ten-second intervals, whereby at the end of a thirty-second time lapse, all of the valves will be open and spraying water through their associated pipes onto the coke. The valves may be opened manually, however solenoid-operated valves may be employed for operation in the above-described manner from a re-

mote position. Timed operation of these valves may be further enhanced by providing a controller to sequentially open the valves in an automatic manner.

FIG. 3 illustrates the timing of the quenching process.

The abscissa of the graph shown in FIG. 3 represents time marked off in seconds and the ordinate of the graph in FIG. 3 represents kilograms of quenching water discharged per second per ton of coal. The final water discharge rate per ton of coal is assumed to be 20 kilograms.

The following discussion relates to the graph lines of FIG. 3. It is the heretofore customary manner of quenching coke to discharge water from the start of the quenching process at the full value of 20 kilograms of water per second per ton of coal. This water discharge rate remains unchanged until the termination of the quenching process which is assumed to be a duration of 100 seconds.

The process according to the present invention provides that initially the quenching of coke is effected with only one-fourth of the amount of water heretofore employed at the start of the quenching process. The water discharge rate is then increased in increments at 10-second intervals by 5 kilograms until the full water discharge rate has been reached requiring a total period of 30 seconds to achieve such a full discharge rate. In FIG. 3, reference numerals 1-4 indicate water discharge levels that increase after successive time intervals. To reiterate what was said in regard to FIGS. 1 and 2, the load of coke is quenched with water initially by way of pipe 15. Ten seconds later, pipes 15 and 16 discharge water onto the coke. During a third time segment, pipes 15, 16 and 17 discharge water onto the coke. After a lapse time of 30 seconds, all four pipes 15, 16, 17 and 18 discharge water onto the coke. The total quenching period involved, according to the process of the present invention, is assumed to be 115 seconds which is somewhat longer than the prior known practice of requiring 100 seconds to quench the coke.

In the graph of FIG. 3, curve A relates to the heretofore customary process for quenching coke. Curve A divides the rectangular space of the graph into two parts of which the portion above the graph line corresponds to the portion of quenching water that is returned for collection by the gutters 25 (FIG. 1). The area in the graph lying below curve A represents the amount of water that is vaporized according to the known quenching process. It is, therefore, evident that a substantial vaporization of water occurs within the first few seconds of quenching time but that the vaporization process diminishes very rapidly thereafter. The draft which occurs with a great uplifting force in the quenching tower is generated initially within the rising quenching steam and therefore it is very difficult to effect cleaning of the quenching steam to remove harmful materials by using apparatus located in the upper portion of the quenching tower.

The graph of FIG. 3 further includes curve B in the form of a broken line which also separates the graph into two areas. The area below the curve B represents the vaporized portion of the quenching water. The return portion of the water is delineated by the area above graph line B which lies to the right of the dot-dash line identified by reference numerals 1-4. From the representations of FIG. 3, it is obvious that the greatest amount of steam produced in regard to curve B is considerably lower than that amount of steam

which is produced as represented by curve A at the same time interval. The input of jets or bursts of steam into the quenching tower has been moderated. In this regard, the spray pipe 24a and closure or deflector plates 24 are far more effective to remove pollutants from the rising current of steam in the quenching tower.

Although the invention has been shown in connection with a certain specific embodiment, it will be readily apparent to those skilled in the art that various changes in form and arrangement of parts may be made to suit requirements without departing from the spirit and scope of the invention.

We claim as our invention:

1. A process for quenching hot coke from coke ovens by a water sprinkling system arranged above a container bearing hot coke while located beneath the chimney of a quenching tower, said process including the steps of:

sprinkling the hot coke throughout an initial time segment which is a fractional part of the duration time of a quenching process, the sprinkling being carried out at a first preselected water discharge rate, and

thereafter sprinkling the hot coke throughout the remaining time for the quenching process at a preselected final water discharge rate which is essentially and materially greater than said first preselected water discharge rate.

2. The process according to claim 1 including the further step of sprinkling the hot coke throughout a second time segment immediately succeeding said initial time segment at a second preselected water discharge rate which is greater than said first preselected water discharge rate and which is less than said final water discharge rate.

3. The process according to claim 1 including the further step of sprinkling the hot coke throughout a plurality of time segments each succeeding said first time segment and concluded by said sprinkling of the hot coke throughout the remaining time for the quenching process, the water discharge rate during said plurality of time segments being successively increased from time

period to time period in such a manner that said final discharge rate is essentially greater than all prior water discharge rates for the quenching process.

4. The process according to claim 1 including the further step of washing the quenching steam produced during the quenching process while the steam passes through the chimney of said quenching tower to remove polluting material entrained in the quenching steam.

5. The process according to claim 1 including the further step of supporting the hot coke upon an inclined floor surface forming part of said container to provide hot coke of increasing depths transversely of the container.

6. The process according to claim 5 including the further step of locating said container beneath a plurality of independently controlled water discharge pipes supported in said quenching tower in a parallel and spaced-apart relation to extend along the length of said container.

7. The process according to claim 6 including the further steps of controlling the water discharged by the pipe located above the maximum depth of coke in the quenching container to sprinkle the coke throughout said quenching process including said initial time segment, and controlling the water discharged by the other pipes located above the lesser depths of coke in said container to sprinkle the coke during essentially the time remaining for the quenching process after said initial time segment.

8. The process according to claim 6 further including the steps of controlling the discharging of water by each of said plurality of pipes to successively increase the water discharge rate during the quenching process in such a manner that the maximum coke depth in the container is sprinkled with water essentially throughout the entire coking process and the lesser depths of coke are sprinkled with water from the remaining pipes throughout successively shorter intervals of time so that the minimum coke depth is quenched with water for the shortest period of time of the quenching process.

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