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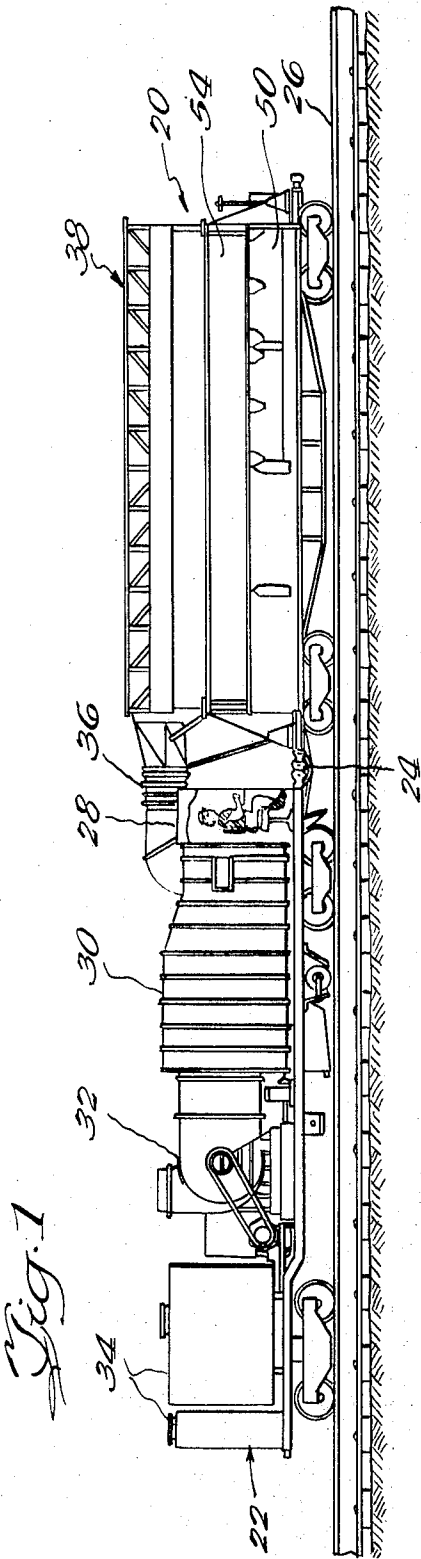
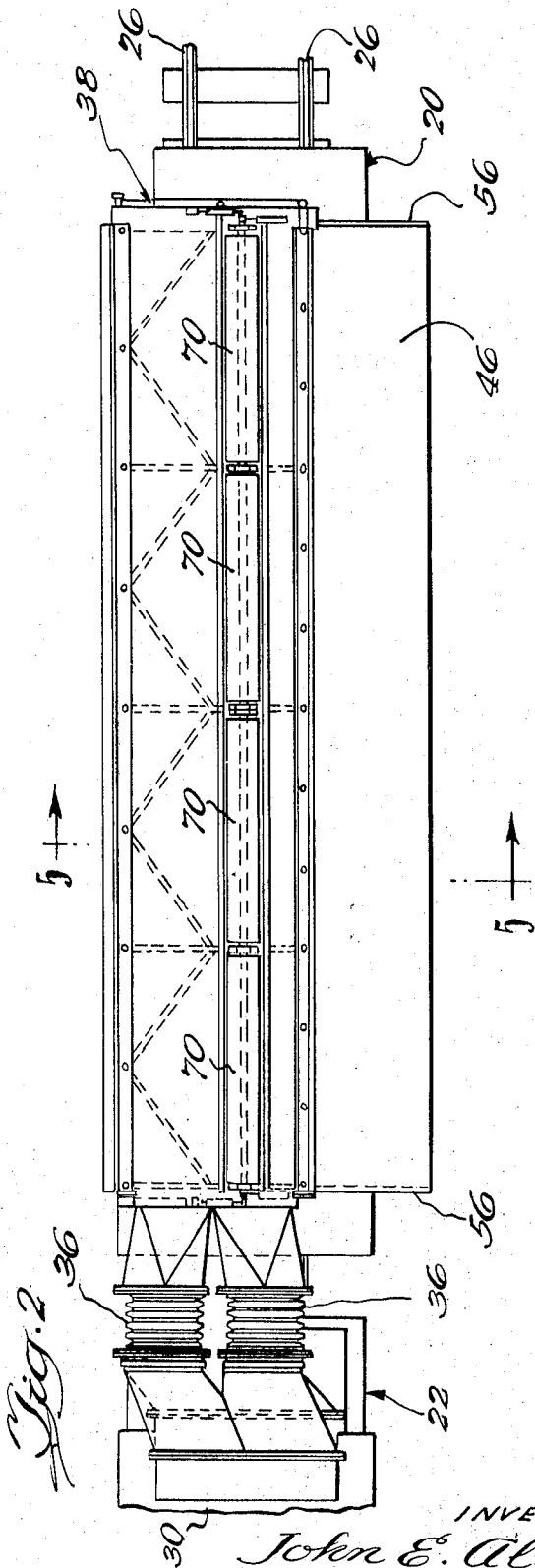
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3,843,461

COKE-QUENCHING SYSTEM

Filed April 7, 1971

4 Sheets-Sheet 1



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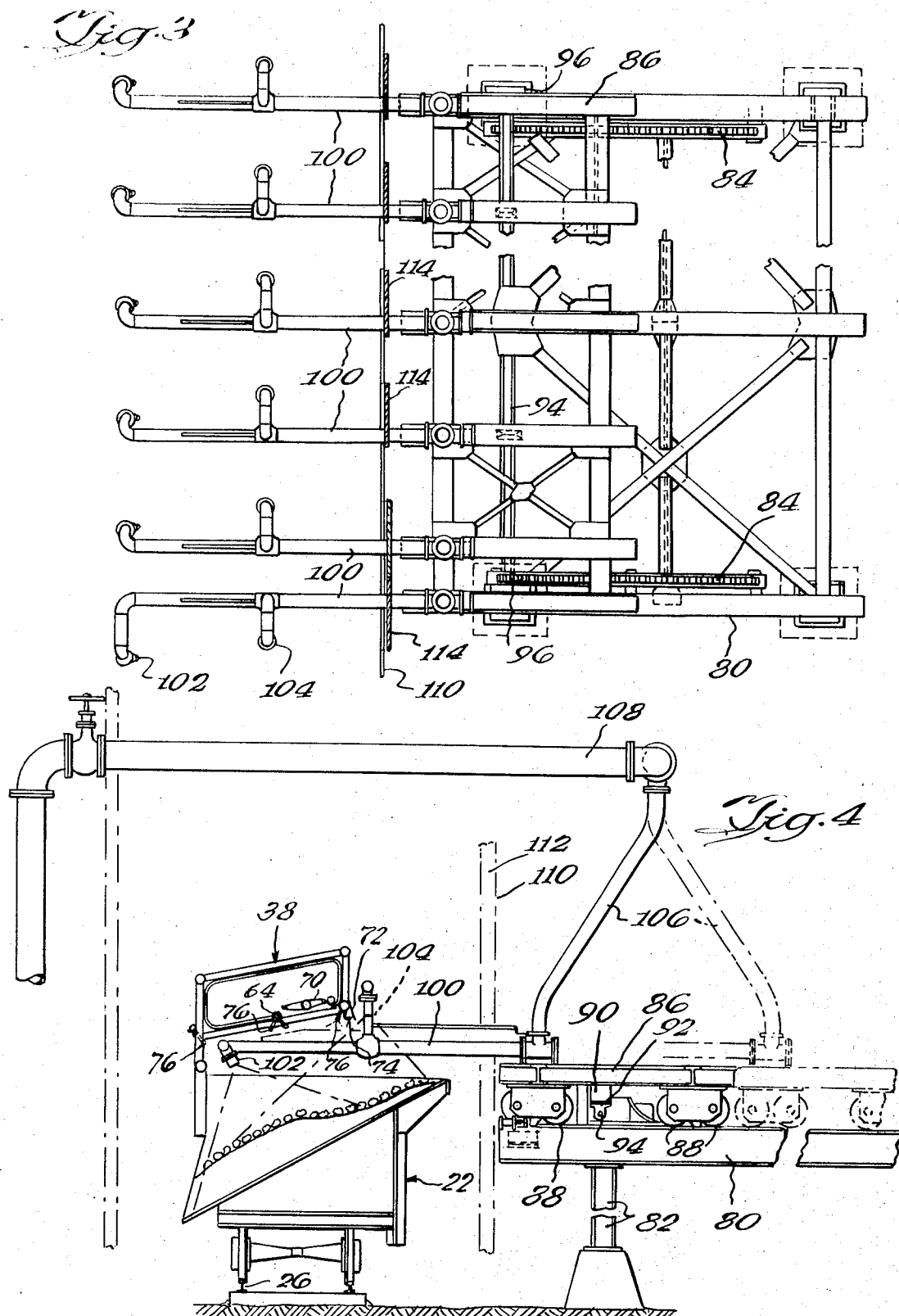
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COKE QUENCHING SYSTEM

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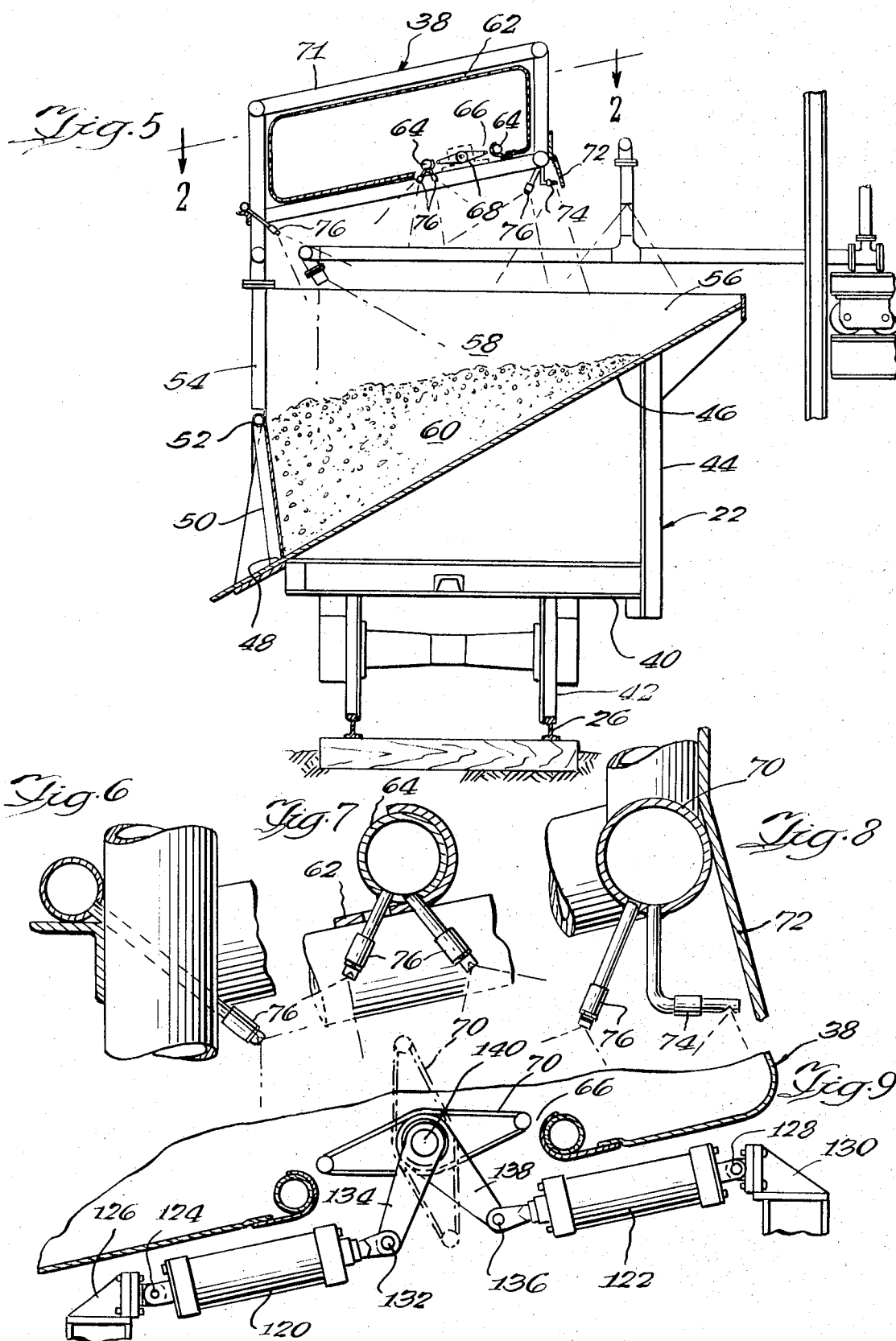
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COKE QUENCHING SYSTEM

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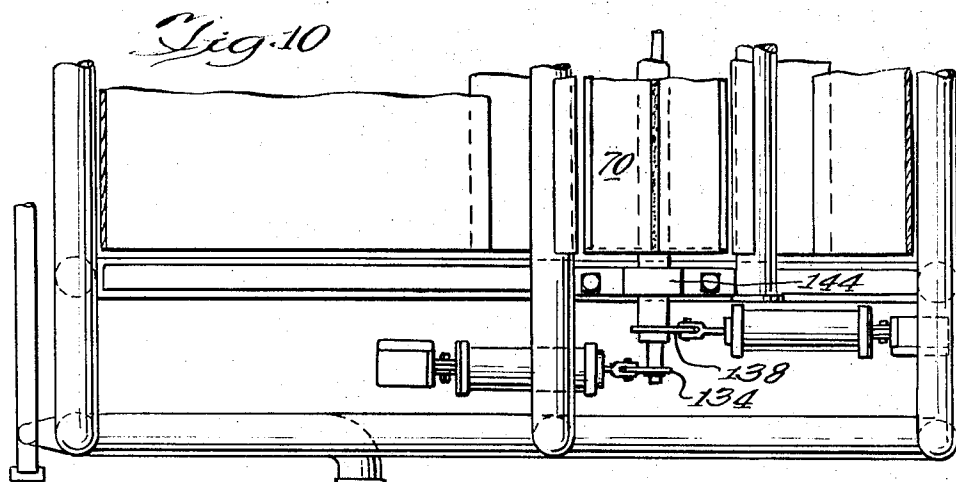
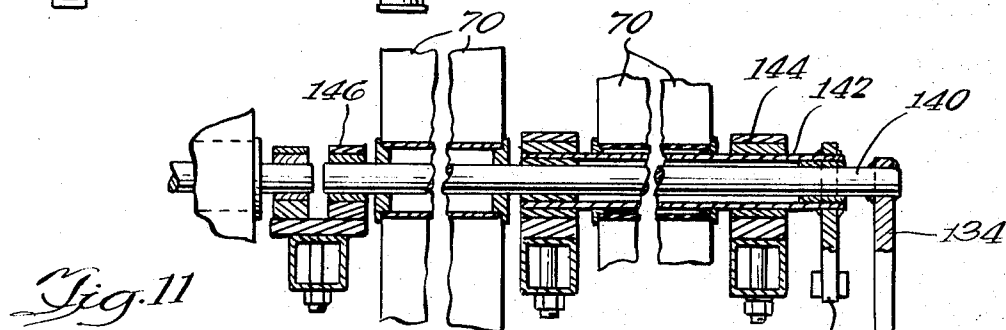
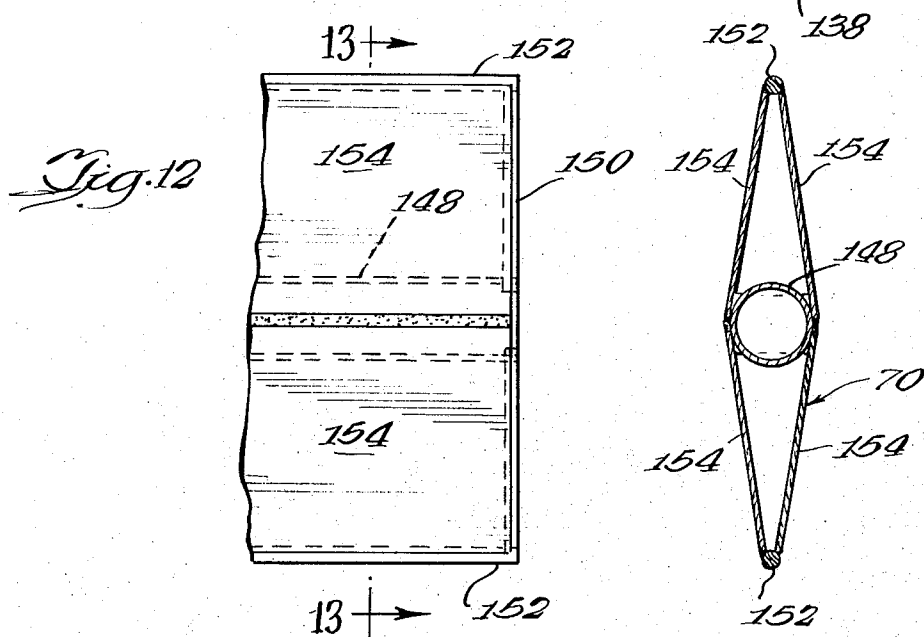
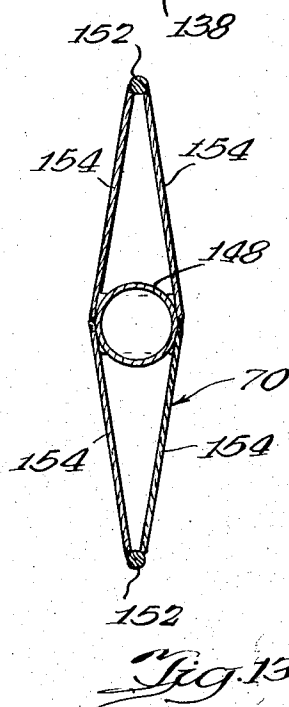
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COKE QUENCHING SYSTEM

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COKE QUENCHING SYSTEM

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9 Claims

ABSTRACT OF THE DISCLOSURE

A coke quenching system employing a coke receiving vehicle movable on rails between a coke receiving station, a coke quenching station and a coke dumping station. The vehicle includes a coke receiving cavity defined by a closed bottom and terminating in a generally upwardly facing coke receiving opening bounded on three sides by a hood connected to an exhausting device for withdrawing gaseous and particulate emissions from the coke as it is received in the cavity. Along an edge of the hood adjacent the coke receiving opening there is provided a plurality of nozzles for generating a water spray barrier across the opening so that the emissions will be withdrawn through the hood and cannot escape through the opening. Additionally, the opening is configured so as to allow the admission of coke quenching spray devices into the cavity at the quenching station to quench the coke.

BACKGROUND OF THE INVENTION

This invention relates to coke quenching systems and more particularly to a coke quenching system that minimizes emissions of gaseous and particulate material during the total quenching operation into the surrounding atmosphere.

Ever increasing concern over environmental pollution has focused on a number of industrial operations that emit substantial amounts of gaseous and particulate materials (including entrained solid matter). Various devices have been employed to capture such emissions such as electrostatic precipitators, scrubbers, etc. However, such devices have generally been applicable to use only in stationary structures.

One particular movable industrial operation producing substantial gaseous and particulate emission is the quenching of coke prior to its subsequent use in, for example, iron production. Typically, the quenching operation is accomplished by pushing an oven load of coked coal into a special railroad type car at a loading point adjacent the coke ovens. As the coke emerges from the oven, the gaseous and particulate emission is negligible until the same begins to break up as it leaves a coke guide to drop into the quench car. This operation normally results in the generation of substantial quantity of gas normally regarded as air polluting. Thereafter, the filled quench car is then moved to a quenching station wherein the contents of the car are sprayed with water or the like to quench the same. The spraying of water on the hot coke results in the generation of a so-called "quench cloud" comprised of water vapor, gaseous emission from the coke, and various particulate matter, again regarded as an air polluting gaseous emission.

SUMMARY OF THE INVENTION

It is the principal object of the invention to provide a new and improved coke quenching system that will substantially reduce or eliminate air polluting emissions generated during the pushing of coke into a quench car, during the travel of the quench car and during the quenching of the coke in the car.

2

The exemplary embodiment achieves the foregoing objects through a construction wherein the quench car is provided with a hood partially overlying a generally upwardly open coke receiving cavity. Connected to the hood is an exhaust device so that emissions generated within the coke receiving cavity of the car may be drawn off to be scrubbed or the like. In addition, the hood is provided with a plurality of spray heads for generating a water spray barrier across the opening through which coke is introduced into the car so that the emissions cannot escape through the coke admitting opening.

Further, the hood is configured so that a movable spray quenching system at a quenching station may be moved into the cavity for quenching the coke without substantially disturbing the effective isolation of the cavity produced by the aforementioned spray heads.

According to the exemplary embodiment, the hood is formed as an elongated duct extending the length of the quench car and having a downwardly facing, elongated opening fronting on the coke receiving cavity. A plurality of independently operated louvers are located within the opening and are selectively openable to permit the withdrawal of gases from any given portion of the quench car as, for example, when the same is filled in differing stages.

Also provided is a fog spray system on the underside of the hood for the purpose of generating fog to minimize temperatures within the quench car to protect metal parts thereof, and to reduce the temperature of the gases thereby also reducing the gas volume to be handled.

Other objects and advantages of the invention will become apparent from the following specification taken in conjunction with the accompanying drawings.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevation of a vehicle embodying the coke quenching system;

FIG. 2 is a plan view of the hood and quench car;

FIG. 3 is a plan view of a movable coke quenching spray system;

FIG. 4 is a side elevation of a coke quenching spray system;

FIG. 5 is a vertical section taken approximately along the line 5—5 of FIG. 2 and additionally showing cooperation between the quench spray system and the quench car;

FIGS. 6—8, inclusive, are fragmentary vertical sections of fog spray generating means within the quench car with FIG. 8 additionally depicting a spray for generating a liquid barrier across the coke receiving opening of the quench car;

FIG. 9 is a fragmentary vertical section illustrating operating mechanism for louvers employed in conjunction with the hood on the quench car;

FIG. 10 is a sectional view of one end of the quench car hood and operating mechanisms for the louvers;

FIG. 11 is a vertical section of the louver operating mechanism;

FIG. 12 is a fragmentary plan view of one of the louvers; and

FIG. 13 is a section of one of the louvers taken approximately along the line 13—13 of FIG. 12.

DESCRIPTION OF THE PREFERRED EMBODIMENT

An exemplary embodiment of a coke quenching system is illustrated in FIG. 1 and is seen to comprise a quench car, generally designated 20, secured to an equipment trailer, generally designated 22, by means of a railroad coupler 24 and movable on rails 26. The quench car 20 and the equipment trailer 22 are movable as a

3

unit between a coke receiving station, a quench station and a coke dumping station whereat the coke is received in the quench car 20, quenched and dumped for further use, respectively. To this end, the equipment trailer 22 may be provided with electromotive trucks (not shown) provided with power by any suitable means.

In addition, the equipment trailer 22 mounts an operator's cab 28 provided with suitable controls for the entire system, a vapor scrubber 30, an exhaust blower 32 and water tanks 34. The exhaust blower 32 is operative to draw gases emitted by coke in the quench car 20 through the scrubber 30 by means of flexible duct work 36 connected to a hood, generally designated 38, on the quench car 20.

With reference to FIGS. 2 and 5, the quench car 22 is seen to comprise a horizontal frame 40 such as that typically found on a flat car to which wheels 42 are journaled for traversing the rails 26. On one side of the car there are provided upwardly extending frame elements 44 which support, at their upper ends, a chute-like, coke-receiving bottom panel 46 which slopes downwardly therefrom to a coke discharging opening 48 at the opposite side of the car. The opening 48 is normally closed by a gate 50 pivotally mounted at 52 to the underside of a side wall 54. Additionally, the car is provided with end walls 56. The end walls 56, the side wall 54 and the bottom panel 46 define a coke receiving cavity 58 for receiving coke 60 from a conventional coke pusher associated with a coking oven. Of course, the gate 50 may be provided with a suitable latching and operating mechanism (not shown).

As best seen in FIG. 5, the hood 38 comprises an elongated duct 62 formed of sheet metal or the like and, as indicated in FIG. 2, extends the length of the quench car 20. The sides of the sheet metal used in forming the duct 62 may be secured to elongated structural members 64 as illustrated in FIG. 5 which structural members are spaced from each other to define an elongated opening 66. Louver means 68 are provided to close the opening 66 and as best seen in FIG. 2, the louver means 68 comprise four independently operable louvers 70.

The elongated duct 62 forming the hood is supported by a structurally sound frame 71 formed of piping which also serves as a conduit for a fog generating system as well as a water barrier generating system. More particularly, as seen in FIG. 5, the frame 71 mounts at its lower right side a depending flange 72 as well as a plurality of spray nozzles 74 (only one of which is shown). As best seen in FIG. 8, the spray nozzle 74 is of the type that will direct a spray downwardly toward the upper end of the bottom panel 46 as well as to positions about 90° on either side thereof. As a result, the coke receiving cavity 58 is closed from the atmosphere exterior of the quench car 22 by the liquid barrier produced by the sprays 74 so that gaseous emissions within the cavity 58 from the coke 60 may be drawn through the opening 66 into the hood 38 through the scrubber 30 by the fan 32 before being discharged to the atmosphere. Of course, at such time, the gases will essentially be cleaned by action of the scrubber 30, which is conventional. The flange 72 serves to protect the nozzle 74 against damage during the pushing of coke from the oven into the quenching car 22.

Because of the extremely high temperature of the coke when it is admitted into the quench car 22, it is desirable to provide means for protecting the various metal parts from the high temperatures such that excessively expensive alloys need not be required in fabricating the same. To this end, a plurality of fog nozzles 76 are employed to blanket the entire cavity 58 to preclude the metal parts of concern from being exposed to temperatures in excess of 250°. The structural details of the fog nozzles 76 are illustrated in FIGS. 6 through 8 and it is to be specifically noted that the same are connected to the structural piping elements 71 in a number of instances whereby the hood support frame provides the additional function of directing water to the nozzles. The fog water may be piped

4

to the nozzles 74 and 76 from the water tanks 34 on the equipment trailer 22 by any suitable means.

With reference now to FIGS. 3, 4 and 5, a movable spray quenching system to be located at a quenching station will be described. As best seen in FIGS. 3 and 4, the same includes a stationary frame 80 mounted on a pedestal 82 to one side of the railway defined by tracks 26. Adjacent each end of the frame 80 is an upwardly facing rack 84. Overlying the stationary frame 80 is a movable frame 86 mounting a plurality of depending rollers 88 which engage the upper surface of the stationary frame 80. A cross member 90 on the underside of the movable frame 86 mounts depending pillow block bearings 92 which journal a shaft 94 which may be driven by a motor (not shown) carried by the movable frame 86. Each end of the shaft 94 mounts a pinion gear 96 in engagement with the respective one of the racks 84 so that when the shaft 94 is driven, the movable frame 86 will be driven relative to the stationary frame 80 in a direction dependent upon the direction of rotation of the shaft 94.

Extending to one side of the movable frame 86 is a plurality of conduits 100 each mounting a pair of spray nozzles 102 and 104. The conduits 100 are also connected by a flexible hose 106 to a supply of water under pressure such as a water main 108.

Preferably, a vertical wall 110 is interposed between the tracks 26 and the stationary frame 80 and is provided with vertically extending guide ways 112 receiving movable shields 114 which may close the openings through which the conduits 100 may be extended as illustrated in FIG. 3. Suitable operating means may be provided for the shields 114 to raise the same when the carriage 86 is to be advanced to extend the conduits 100.

As can be seen from FIGS. 4 and 5, when the conduits 100 are extended by reason of leftward movement of the movable carriage 86, the same pass under the hood 38 through the coke receiving opening in the quench car 22 to enter the coke receiving cavity. Upon the application of water under pressure to the conduits 100, the spray nozzles 102 and 104 will spray quenching water on the coke contained within the quench car 22 in the spray pattern illustrated in FIG. 4. Upon the completion of the quenching operation, the motor driving the shaft 94 may be reversed to withdraw the conduits 100 from the quench car and the movable shields 114 may thereafter be closed.

With reference now to FIGS. 9 through 13, the construction of the louvers 70 and their respective operators will be described. Since the construction of the operators at each end of the car is identical, only one need be described.

With particular reference to FIGS. 9 and 10, each end of the car is provided with a pair of oppositely directed air cylinders 120 and 122 which may be of the double acting variety. The cylinder 120 has one end pivotally secured as at 124 to a frame member 126 while the cylinder 122 is pivotally secured as at 128 to another frame member 130. The piston of the cylinder 120 is pivotally connected as at 132 to a lever arm 134 while the piston of the cylinder 122 is pivotally connected as at 136 to a lever arm 138. As best seen in FIG. 10, the lever arms 134 and 138 are horizontally displaced from each other as are the cylinders 120 and 122 so that the same may operate independently without interference. Each of the lever arm arrangements is such that actuation of its corresponding cylinder may rotate the lever arm approximately 90° about a pivot axis defined by a shaft 140 and, as will be seen, such results in movement of an associated louver 70 between the full line and dotted line positions shown in FIG. 9.

As best illustrated in FIGS. 10 and 11, the lever arm 134 is secured to the shaft 140 as by welding while the lever arm 138 is secured to a tubular shaft 142 journaled concentrically about the shaft 140. The concentric shaft

5

142 is in turn journaled in any suitable bearings 144 secured to the frame while an end of the shaft 140 extending from the shaft 142 is similarly journaled in bearings 146.

As best seen in FIG. 11, the endmost louver 70 is fixedly secured to the concentric shaft 142 while the innermost louver from the given end is fixedly secured to the shaft 140 so that the louvers may be independently operated. And since identical constructions are provided at both ends, it will be appreciated that each of the four louvers 70 is independently operable under the control of an associated air cylinder to either open or close its respective portion of the elongated opening 66 in the hood 38.

FIGS. 12 and 13 illustrate the construction of the louvers and each is seen to basically include a center tube 148 which may be secured to its respective shaft and which mounts, at both ends, a diamond-shaped end plate 150 (only one of which is shown). Extending between opposite points of the end plates 150 are elongated rods 152 and as a result, a frame is defined. Four plates 154 extend between the rods 152 and the central shaft 148 to complete each louver 70.

Suitable manual or automatic controls may be provided to control the sequence of operations as mentioned previously. For example, the louvers 70 may be operated sequentially by means of a timer if the coke is pushed into the quench car 22 beginning at one end and finishing at another. It is also preferable that the louver control be such that at least one of the louvers is maintained open for the period of time that the car moves from the loading station to the quenching station to permit continual exhausting of gases. Of course, various safety interlocks may be employed. Moreover, means may be provided at the quenching station for capturing the quench water which may then be filtered and returned to the tanks 34 for subsequent use as the fog spray.

From the foregoing, it will be appreciated that a coke quenching system made according to the invention produces a number of advantages over those heretofore employed. Principally, air pollution is minimized by reason of the unique arrangement of spray emission barriers and a hood to withdraw gaseous and particulate material for subsequent scrubbing to eliminate such gases and particulate material in the resulting discharge. In addition, the use of sprays to generate a fog in the coke receiving cavity cools the emitted gases thereby significantly reducing their volume so that the same may be easily handled by the unit. As a result, the problematic quench cloud and its polluting effects are essentially eliminated through the use of the invention.

I claim:

1. In a coke quenching system, the combination comprising:

means defining a vehicle having a coke receiving cavity, a coke admitting opening communicating with said cavity and a coke releasing exit communicating with said cavity, and adapted to travel between a coke receiving station, a coke quenching station and a coke dumping station;

a hood over said coke receiving cavity and adjacent one side of said coke receiving opening, said hood including an elongated duct having an elongated opening facing said coke receiving cavity and a plurality of individual louvers in said elongated opening, each said louver being movably mounted for movement between open and closed positions, each said louver being movable independently of the others of said louvers;

exhaust means in fluid communication with said hood for withdrawing gases within said coke receiving cavity; and

means mounted on said hood adjacent said coke receiving opening for generating a fluid barrier across said opening whereby gases emanating from coke re-

6

ceived in said cavity may exit the vehicle substantially only through said hood.

2. In a coke quenching system, the combination comprising:

means defining a vehicle having a coke receiving cavity, a coke admitting opening communicating with said cavity and a coke releasing exit communicating with said cavity, and adapted to travel between a coke receiving station, a coke quenching station and a coke dumping station;

a hood over said coke receiving cavity and adjacent one side of said coke receiving opening;

exhaust means in fluid communication with said hood for withdrawing gases within said coke receiving cavity;

means mounted on said hood adjacent said coke receiving opening for generating a fluid barrier across said opening whereby gases emanating from coke received in said cavity may exit the vehicle substantially only through said hood;

said hood being defined by an elongated duct having an elongated opening facing said coke receiving cavity and louver means movably mounted in said elongated opening for selectively opening or closing the same, said louver means comprising at least two louvers;

means mounting said louvers for independent movement within said opening between open and closed positions and comprising a first shaft mounting one of said louvers, a second shaft telescoped about said first shaft and mounting the other louver; and a pair of motors, one associated with each of said shafts, for rotating the same to move the associated louver between said open and closed positions.

3. The coke quenching system of claim 1 wherein said coke receiving opening is configured to permit coke quenching spray means to enter said coke receiving cavity; and movable coke quenching spray means located at said coke quenching station; and means for moving said coke quenching spray means into and out of said cavity to said coke receiving opening.

4. The coke quenching system of claim 3 further including stationary means mounting said movable coke quenching spray means for movement into and out of said cavity and said moving means comprises a shaft mounting a pinion journaled on one of said stationary means and said movable spray means, a rack in engagement with said pinion and mounted on the other of said movable spray means and said stationary means, and a reversible motor for rotating said shaft.

5. The coke quenching system of claim 1 further including a plurality of means on said hood for generating a fog spray within said cavity during the receipt of coke therein.

6. In a coke quenching system, the combination comprising: means defining a first vehicle having a coke receiving cavity, a coke admitting opening communicating with said cavity and a coke releasing exit communicating with said cavity, and having railroad trucks thereon for travel on rails between a coke receiving station and a coke dumping station; means defining a second vehicle connected to said first vehicle and movable therewith between said stations, said second vehicle further mounting gas scrubbing means and exhaust means in fluid communication with said gas scrubbing means for driving gases through said scrubbing means; means defining a hood over said coke receiving cavity adjacent said coke receiving opening; means interconnecting said hood with said scrubbing means whereby gases from said cavity may be withdrawn therefrom through said hood and scrubbed; means adjacent said coke receiving opening for generating a fluid barrier across said opening whereby gases emanating from coke received in said cavity may exit said first vehicle substantially only through said hood; and means for propelling said vehicles between said stations; said

7

hood being defined by an elongated duct having an elongated opening facing said coke receiving cavity and further including a plurality of louvers in said elongated opening, each mounted for movement between positions opening and closing an associated portion of said opening, and a plurality of means, each operable independently of the other, for moving a respective one of said louvers between said positions.

7. In a coke quenching system, the combination comprising: means defining a first vehicle having a coke receiving cavity, a coke admitting opening communicating with said cavity and a coke releasing exit communicating with said cavity, and having railroad trucks thereon for travel on rails between a coke receiving station and a coke dumping station; means defining a second vehicle connected to said first vehicle, said second vehicle further mounting gas scrubbing and exhaust means for driving and scrubbing gases emanating from coke received in said cavity; means defining a hood over said coke receiving cavity adjacent said coke receiving opening; means interconnecting said hood with said scrubbing and exhaust means whereby gases from said cavity may be withdrawn therefrom through said hood and scrubbed; means adjacent said coke receiving opening for generating a fluid barrier across said opening whereby gases emanating from coke received in said cavity may exit said first vehicle substantially only through said hood; means for quenching coke received in said cavity; means for propelling said vehicles on rails between said stations; said hood being defined by an elongated duct mounted on said first vehicle and having an elongated opening facing said coke receiving cavity and further including a plurality of louvers in said elongated opening, each mounted for movement between positions opening and closing an associated portion of said opening, a plurality of means, each operable independently of the other for moving a respective one of said louvers between said positions; and wherein said means for generating a fluid barrier comprises a plurality of spray nozzles mounted on said hood adjacent said coke receiving opening for generating a liquid curtain across said opening.

8. In a coke quenching system, the combination comprising: means defining a first vehicle having a coke receiving cavity, a coke admitting opening communicating with said cavity and a coke releasing exit communicating with said cavity, and having railroad trucks thereon for travel on rails between a coke receiving station and a coke dumping station; means defining a second vehicle

8

connected to said first vehicle and movable therewith between said stations, said second vehicle further mounting gas scrubbing means and exhaust means in fluid communication with said gas scrubbing means for driving gases through said scrubbing means; means defining a hood over said coke receiving cavity adjacent said coke receiving opening; means interconnecting said hood with said scrubbing means whereby gases from said cavity may be withdrawn therefrom through said hood and scrubbed; means adjacent said coke receiving opening for generating a fluid barrier across said opening whereby gases emanating from coke received in said cavity may exit said first vehicle substantially only through said hood; and means for propelling said vehicles between said stations; said means for generating a fluid barrier comprises a plurality of spray nozzles mounted on said hood adjacent said coke receiving opening for generating a liquid curtain across said opening; and further including a plurality of spray devices mounted on said hood for generating a fog spray within said cavity during the receipt of coke therein.

9. The coke quenching system of claim 7 wherein said coke receiving opening and said hood are constructed and arranged to permit sideways entrance of coke quenching spray means when said vehicles are located at a coke quenching station between said receiving and dumping stations.

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202—263; 55—385, Dig. 29