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Knappstein et al.

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[54] METHOD AND APPARATUS FOR THE EVACUATION OF COKE FROM A FURNACE CHAMBER

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[51] **Int. Cl.** **C10b 39/04,** C10b 33/00
[58] **Field of Search** 201/39; 202/227–230, 262, 263

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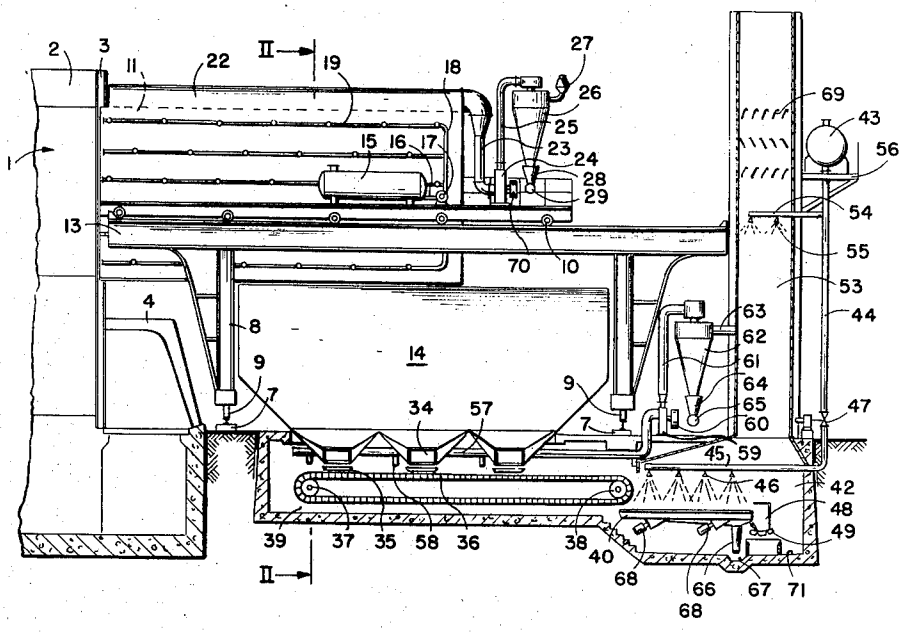
[57] **ABSTRACT**

A method and apparatus for the evacuation of coke from a furnace chamber and for the wet quenching of the coke includes a coke box which is mounted for movement toward and away from the horizontal coking furnace. The coke box may be moved directly adjacent the furnace battery on a track which can place the box directly in front of the door frames of the furnace chambers. The coke box is made substantially to the dimensions of the coking mass to be received and it includes a bottom closure flap which may be opened after the coke box is moved away from the furnace and over a coke bin which also has a closable upper opening which is substantially of the plan dimensions of the coke box. The coke bin has a discharge arranged in a coke discharge flue at the bottom of the coke bin and means are provided to pass the coke into a quenching chamber which is provided with a chimney for advantageously includes spray means.

19 Claims, 6 Drawing Figures



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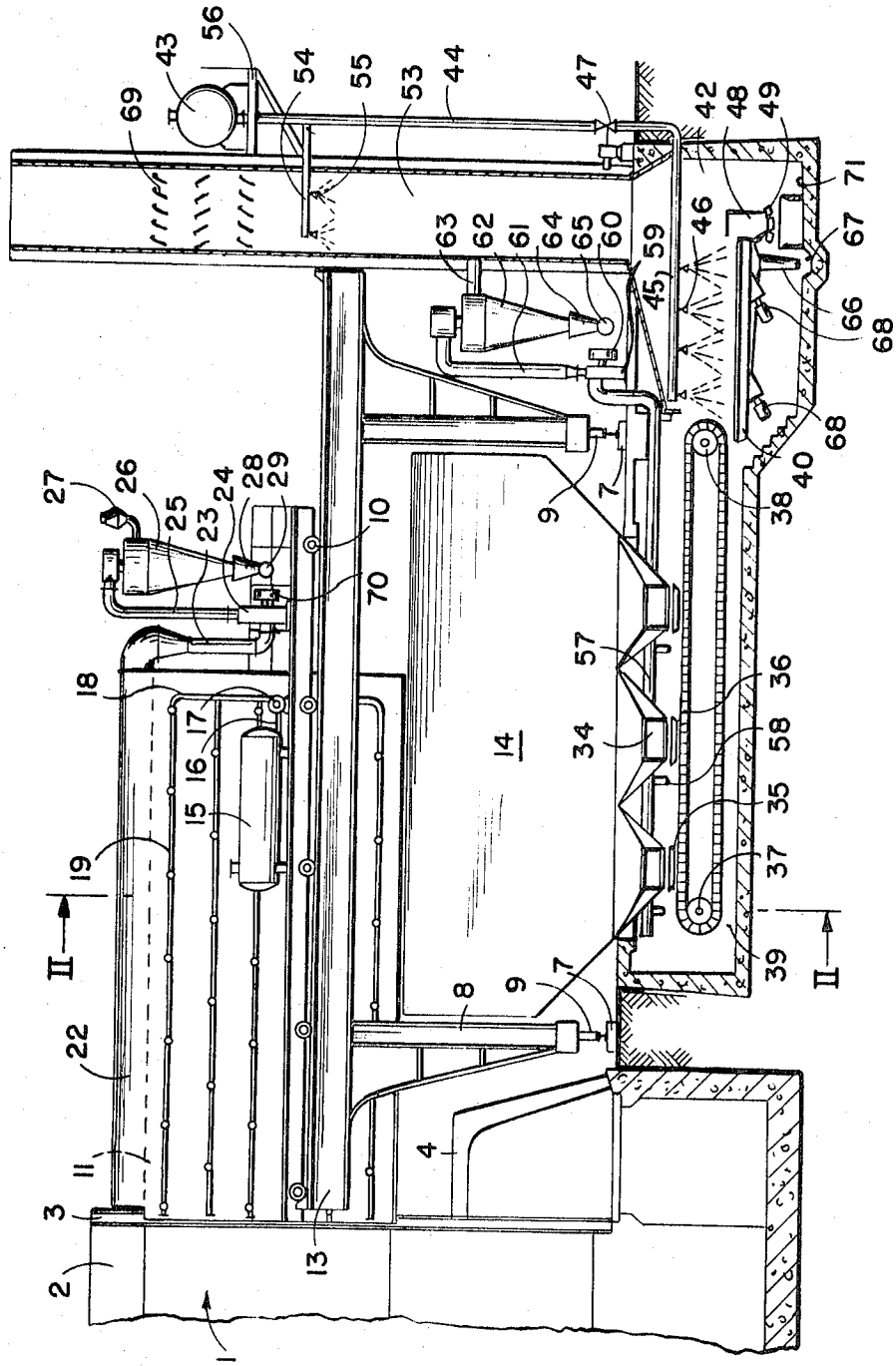

FIG. 1

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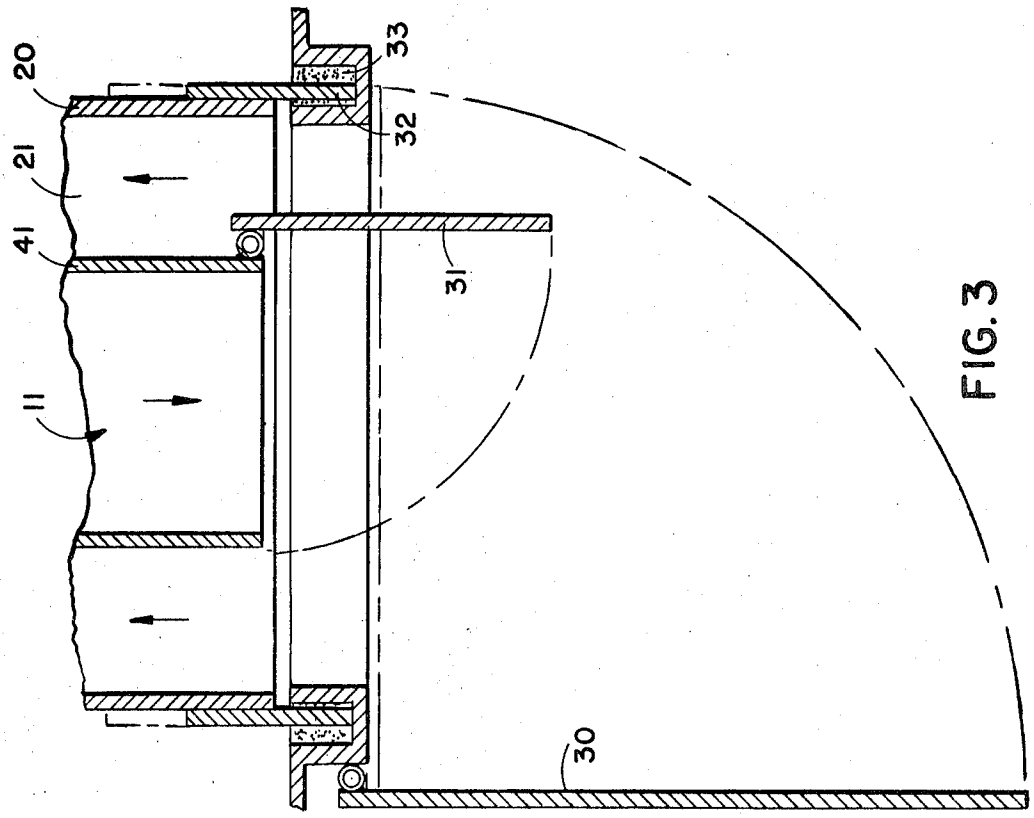

FIG. 3

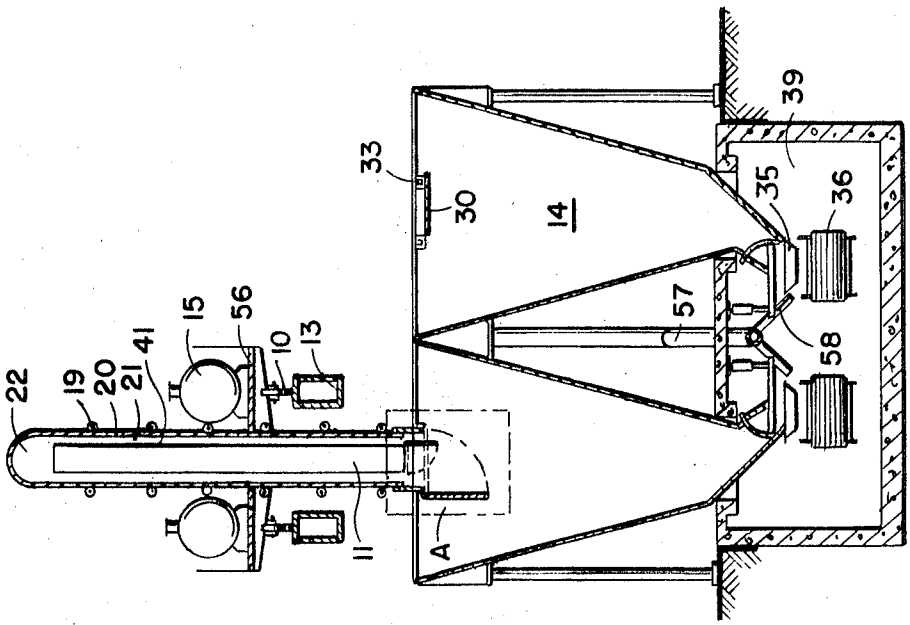

FIG. 2

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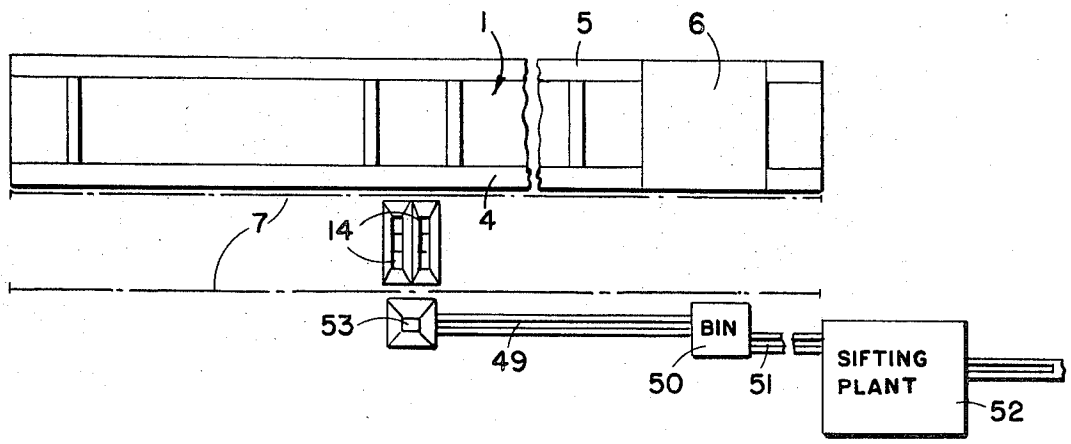

FIG. 4

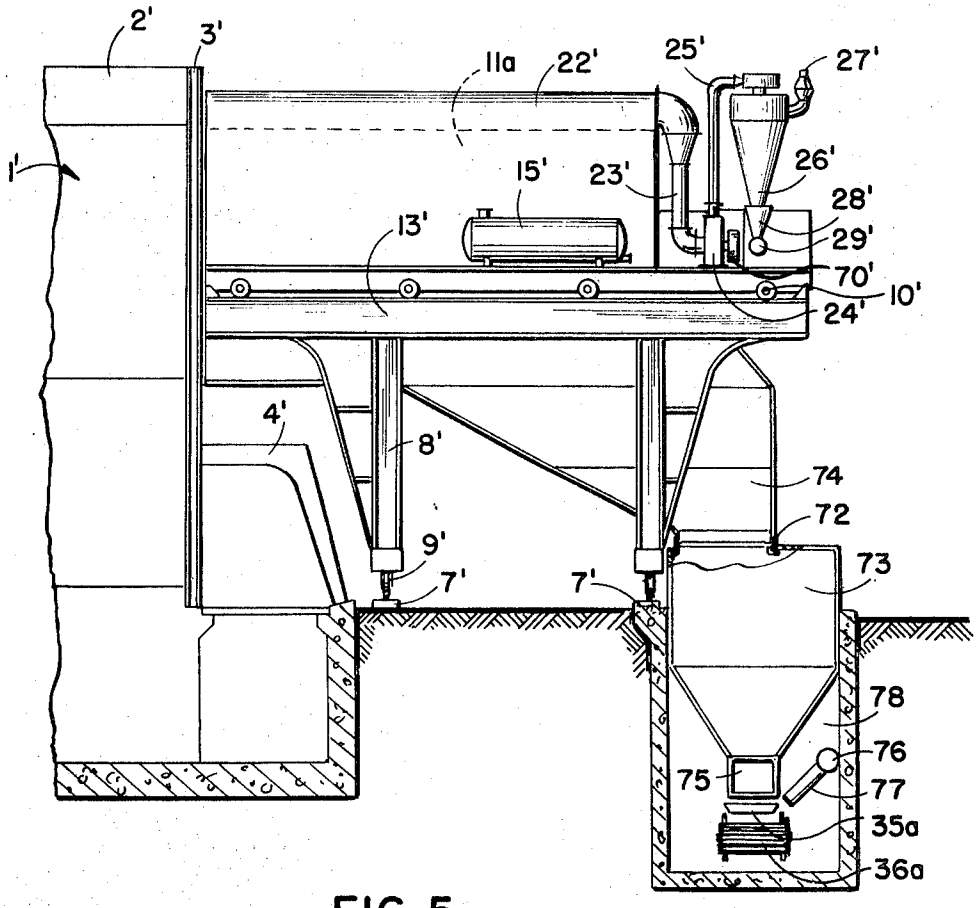

FIG. 5

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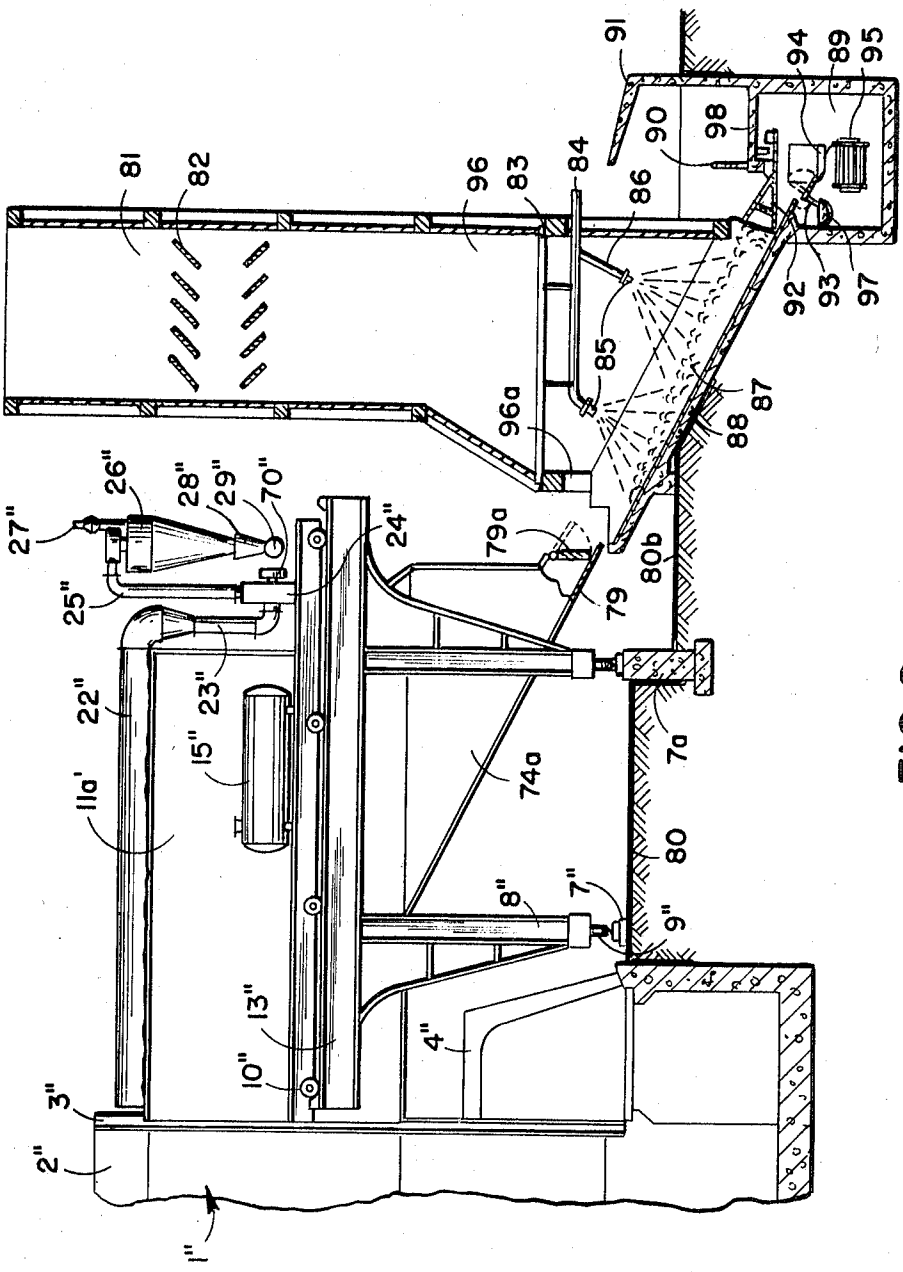

FIG. 6

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METHOD AND APPARATUS FOR THE EVACUATION OF COKE FROM A FURNACE CHAMBER

SUMMARY OF THE INVENTION

This invention relates in general to the construction of coking furnaces and in particular, to a new and useful method and arrangement for the receiving an evacuation and for the wet quenching of glowing coke from a furnace with a minimum emission of gases and dust.

In conformity with the efforts of the public to keep the air clean it has been tried to limit or avoid the emission of gases and dust in the operation of coking plants and to take these requirements into consideration in the construction of the coking plant batteries. Numerous arrangements are already known, or have been suggested, which provides some degree of cleanliness of operation. Hopper cars for example, having outlets attached thereto which engage tightly on the hopper frame and which are provided with a seal against charging gases and provide a coal cushion in the charging bins are known. Such devices provide a sealing to the outside of a leveling rod which is introduced into the furnace chamber. Also known are coking mass cars with exhaust hoods which cover the quenching car. Such apparatus are also equipped with the exhaust and washing devices for the gases and dust emitted by the glowing coke.

Numerous arrangements are known which retain the dusts carried along by the quenching vapors during the wet quenching of the coke in a quenching tower and thus prevent the gases for escaping to the atmosphere with the dust. In this connection tanks are provided for receiving the glowing coke from the chamber which is thereafter closed. The coke is quenched with liquid hydrocarbons and water generating gases and vapors. The known arrangement has a disadvantage that the transportation of the glowing coke in an open quencher car to the quenching tower cannot be avoided and thus the gases and dust do escape into the atmosphere.

An arrangement which prevents the escape of gases and dust during the charging of the glowing coke into the tanks to be closed is not known at the present time. In addition tanks which could receive the entire contents of a modern large size coking furnace are not easy to operate. For this reason a chamber charge is distributed over several tanks and the escape of the dust into the atmosphere is unavoidable when the tanks are exchanged. A disadvantage of the wet quenching in closed tanks is also that the corrosion problem has not yet been solved satisfactorily.

An emission-free arrangement for pushing, receiving, evacuating and wet quenching in a quenching tower of glowing coke which is ejected from horizontal coking furnaces has been suggested which includes a closed coke receiving chamber extending over the entire length of the battery and including the doors of the furnace chambers. Such a closed coke receiving chamber is provided with gas and dust exhaust means on the coke side at a location ahead of the coking battery. In such a construction one longitudinal wall is the coke side of the battery itself, and this is connected with the quenching tower.

In accordance with the present invention the new emission-free arrangement is suggested for pushing, receiving, evacuating and wet quenching in a quenching tower of glowing coke which issues from horizontal coking furnaces where the coke receiving chamber which requires much space is eliminated. The new arrangement is characterized by a coke box approximately of the dimensions of the coking mass to be received which moves on a track in front of the battery and is provided with a door which can be positioned directly in front of the door frames of the furnace chamber. The coke box is provided with a bottom flap which closes and seals the coke box interior and this flap may be oriented within any receiving recess of a coke bunker which is arranged along the track and which includes a closable opening in the recess substantially of the size of the plan dimensions of the coke box. A coke discharge flue is arranged under the coke bin and the quenching chamber and is provided with a chimney.

In the coke discharge flue there is arranged a steel conveyor belt which drops the glowing coke onto a conveyor device arranged in the quenching chamber, for example, a steel link belt is employed or a shaker loader. The coke is quenched with water and subsequently dropped onto a conveyor belt which brings it to a processing plant, for example, to the screening plant. In such an arrangement, the coke box, the coke bin and the conveyor belt arranged underneath in the coke discharge flue are all made of a high heat resistance steel.

In a special embodiment of the invention, the parts are made of an ordinary steel and it comprises a coke box which is equipped with double walls between which there is a space or interval. The inner wall is formed of perforated plates or in the manner of a basket or bands or latches with spaces. The quenching pipes with inwardly directly nozzles are arranged in the solid outer walls. Above the coke box is arranged a quenching vapor collecting chamber connected with a dust separator. The lower outer walls carry slide plates which are raisable and lowerable and the upper opening of the coke bin is surrounded by a sealing trough which is filled with sand or tar which provides a seal or packing into which the side plates can be lowered. This permits sealing of the discharge of the coke box when it is in position to discharge the coke into the coke bin.

The inventive arrangement permits a surface quenching of the glowing coke mass as soon as it has entered into the coke box and the front door is closed and in this way the material is protected from the effect of heat. The resulting quenching vapors flow all through the intervals of the walls and they accumulate in the quenching vapor collecting chamber. They are freed of dust in a dust separator, for example, a cyclone separator, and are permitted to escape into the free atmosphere after they have been thoroughly cleaned. The sealing by the lowered slide plates of the coke box walls prevents emissions if the coke which is only quenched on the surface, but is still glowing inside, is dropped from the coke box into the coke bin after the bottom flap has been opened. Water tanks are arranged on the undercarriage to supply quenching water to the coke. In addition to the coke discharge flue under the coke bin is equipped with a gas and dust exhaust system which includes ejection lines for purifying the exhaust gas which is connected to the chimney of the quenching tower.

It is also possible to install, on the track, several of the coke boxes according to the invention, a battery with several coke bins, if necessary with a common chimney, can be arranged in the range of the track. Two or more coke boxes can be arranged on the undercarriage in accordance with the invention in a side-by-side relationship but spaced from each other so that the coke can be received simultaneously by several adjacent chambers.

A further development of the invention includes a coke pocket or intermediate chamber arranged under the coke box which is freely accessible from the coke box for the discharge coke. This coke pocket is connected after the displacement of the arrangement over a coke bin with the coke box into which the coke is emptied. The coke pocket can also be emptied directly, for example, laterally into a quenching tower to eliminate the coke bin. In this latter embodiment the double walls of the coke box with the cooling device can be eliminated and thus the steel receiving pocket for the coke will not require any cooling devices. This steel receiving pocket and a hinged bottom therefore is lined with a ceramic material. This is possible because the pocket can be unloaded over its width under the furnace chambers and it can be made so large that it can receive the entire glowing coke of a chamber without any amount remaining in the box which is arranged thereabove.

The evacuation flap of the coking receiving pocket is arranged in dependence upon whether the mouth of the receiving bin is located between or in front of the rails of the track, either in between or laterally thereof. In this latter case, it is

not necessary that the coke box receive the entire coking mass in a longitudinal direction since its front part drops inside into the coke receiving pocket arranged underneath. The coke box can therefore be shorted in its length relative to other embodiments. For this reason, the embodiment is particularly suitable for installation in existing plants with limited space between the coke side of the battery and the coke ramp. With very limited space axially the particularly space saving embodiment of the coke pocket with the coke discharge flap arranged underneath is selected. The receiving bunker for the coke is then arranged between the rails.

Accordingly, it is an object of the invention to provide an improved arrangement for the emission free pushing, receiving, evacuation and the wet quenching of glowing coke which is ejected from a horizontal coking furnace and which includes a coke box which is adapted to move directly in front of the furnace door and is of a dimension comparable to the coking mass to be received and which is movable away from the door to position a closable flap thereof at the bottom over a closable upper opening of a coke bin, and wherein the coke bin discharges into a flue which is provided with a chimney.

A further object of the invention is to provide a coking furnace construction which is simple in design, rugged in construction and economical to manufacture.

The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, its operating advantages and specific objects attained by its use, reference should be had to the accompanying drawings and descriptive matter in which there are illustrated and described preferred embodiments of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a side elevational view of a coking furnace arrangement constructed in accordance with the invention;

FIG. 2 is a section taken along the line II—II of FIG. 1;

FIG. 3 is greatly enlarged sectional view of a portion of the apparatus shown in FIG. 1;

FIG. 4 is a top plan view on a reduced scale;

FIG 5 is a view similar to FIG. 1 of another embodiment of the invention; and

FIG. 6 is a view similar to FIG. 1 of still another embodiment of the invention.

GENERAL DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings in particular, the invention embodied therein as indicated in FIGS. 1 to 4 comprises a horizontal coking furnace generally designated 1 having a roof structure 2. The coking furnace or battery 1 is in a form of a furnace battery with a plurality of individual furnace units along side of which there are ramps 4 and 5. A coal tower 6, as best indicated in FIG. 4, is provided adjacent one end of the battery.

In accordance with the invention a track structure comprising spaced track elements 7, 7 are arranged along the front end of the furnace battery and an undercarriage or supporting frame structure 8 includes wheels 9 which engage on the trackway to permit shifting movement of the carriage structure across the front of the furnace. The invention includes a coke box 11 which has rollers 10 which engage over a beam 13 of the undercarriage structure 8 to permit the coke box to be shifted toward and away from the front of the individual chambers of the chamber furnace battery 1.

With the coke box 11 positioned as indicated in FIG. 1, the glowing coking mass is pushed from the open furnace chamber into an opened coke box 11. After the coke box 11 is moved backwardly a little, away from the furnace, both the furnace chamber and the end face of the coke box are closed by doors (not shown).

The coke box 11 is movable on its rollers 10 backwardly away from the furnace until it becomes aligned with a coke bin 14 which is located centrally between the rails 7 and below the supporting beam 13 of the carriage structure 8.

Quenching water is forced from water tank 15 through pipes 16, pumps 17 and pipes 18 into quenching pipes 19 to continuously quench the coking mass on the surface of the coke box 11 during the transfer movement. The quenching vapors flow through chambers 21 and between outer wall 20 and perforated partition wall 41 into a quenching vapor collecting chamber 22 extending along the length of the coke box top portion. The vapors are then sucked through a pipe 23 by an exhauster 24 which is driven by a motor 70 and are then pushed through a pipe 25 into a cyclone separator 26. After the vapors have been cleaned and liberated of dust they escape through the chamber 27 into the atmosphere. The separated dust is removed from the lower parts 28 of the cyclone separator 26. A seal 29 is located at the bottom of the cyclone separator 26.

When the coke box 11 is aligned over the coke bin 14, as indicated in FIG. 3, a closing flap 30 of the coke bin 14 is opened and slide plates 32 lowered into sand filled or tar filled troughs 33 to seal the coke bin and the coke box at their interconnection against the escape of vapors during the dumping of the coke from the box into the bin. Dumping is effected when the bottom flap 31 of the coke box is opened which permits the surface quenched coke to drop into the coke bin 14 and then move downwardly and through outlets 34 at the bottom thereof onto an armored belt 36 of a conveyor which runs over sprockets 37 and 38 (FIG. 1). The height of the coke layer which will accumulate on the armored belt 36 is set by box attachments 35 which depend from the lower end of the coke bin. Dusts and gases escape both through the coke bin 14, the chambers 21, and the quenching vapor collecting chamber 22 arranged at the upper end of the coke box. In addition the dust and gases are collected in suction pipes 58 and 57 and are drawn off by an exhauster 59 which is driven by a motor 60 through a pipe 61 and into a cyclone separator 62 which discharges the dust free gases through a pipe 63 into a chimney 53 of a quenching tower. In the quenching tower 53 there are located a plurality of shower assemblies 54 and 55 to provide quenching action of the gases and cleaning of the gases as they move upwardly through the chimney.

Separated dusts are withdrawn from the lower end 63 of the cyclone separator 62. The bottom of the separator 62 includes a seal 65.

The coke is delivered off the armored belt 36 of the belt conveyor and dropped onto a shaker loader 40 in a quenching chamber end 42 of the flue 39 adjacent the quenching tower. The shaker is driven by drive elements 68, 68. The coke which drops onto the shaker loader 40 is quenched by quenching water supplied from the tank 43 through pipes 44 and 45 and it sprayed into the nozzles 46. A shut off valve 47 is located pipes 44 and 45. The quenching vapors flow into the chimney 53 and dust contained in the vapors are deposited and retained by the shower assemblies 54 and 55 and by the baffle 69. The baffles 69 are wetted by trickling water.

Quenching water which flows off the shaker loader 40 and trickles down from the chimney will flow through a pipe 66 and over the inclined bottom 71 of the coke quenching chamber 42 and directly into the trough 67 which flows to the preparation plant. The quenched coke is dropped from the shaker loader 40 through the chute 48 and onto the conveyor belt 49. The conveyor belt 49 moves as indicated in FIG. 4 into the evaporation bin 50 and from there by a conveyor belt 51 the coke is moved to a sifting plant 52.

The quenching water and the trickling water valves are opened in a known manner when the coke box 11 is moved over the coke bin 14. After the coke has been discharged from the coke box 11, the bottom flap 31 and the seal 30 are closed again and the side plates 32 are lifted. A front door (not shown) of the coke box 11 is then opened. The arrangement is thus ready to be moved back adjacent the furnace chamber to receive the next coking mass.

In the embodiment indicated in FIG. 5, parts which are similar to embodiment of FIGS. 1 to 4 are similarly designated but with primes. In this construction, a shortened coke box 11*a* is provided and a coke receiving pocket or intermediate chamber 74 is disposed between a coke bin 73 and the coke box 11a.

The coke bine 73 is provided with a lower outlet 75 in a housing 78 and it discharges onto a charging hopper or frame 35*a* which is located above an armored conveyor belt 36*a*. Gas exhaust devices 76 and 77 are located in the chamber 78. In this construction, a closing device 72 for the connection between the coke receiving pocket 74 and the coke bin 73 is provided. It is substantially identical in operational principle with the arrangement described in respect to FIGS. 1 to 4 in other respects.

In the embodiment illustrated in FIG. 6, similar parts are designated in a manner similar to that indicated in FIG. 1, but with double primes. In this construction there is a coke receiving pocket or intermediate chamber 74*a* which has a lateral outlet 79 with a closure flap 79*a*. The closure 79*a* is opened to permit the glowing coke 87 to slide outwardly onto an inclined ramp 88 which is arranged in a quenching tower 96 having a chimney 81 with baffles and water trickling means 82 therein. Quenching means 84, 85 and 86 are secured on a girder 83 and directed toward the sliding coke. The quenched coke accumulates in front of a baffle rake 92 and the excess quenching water flows off over the edge of the ramp 88 into the trough 97. The trough 97 conducts the quenching water to a quenching water preparation plant (not shown). A dosing frame 94 above the conveyor belt 95 prevents overloading of the conveyor belt. A brick lines cellar ditch 89 surrounds the conveyor belt 95. A foot path 98 is defined above the conveyor 95 and a railing 90 extends therealong. A protective wall 91 forms a partial roof over this chamber. The ground is indicated 80 and 80b.

The operation of the plant is so effected in accordance with the embodiment of FIG. 6, for example, that the doors are removed from the chamber of the coke box 11*a'*. The coke box 11*a'*, which is mounted for movement along the trackway on wheels 10'', is moved directly in front of the opened furnace chamber door. The coke is then pushed into the coke box 11*a'* and drops there directly into the receiving pocket 74*a*.

After the entire coke charge has been received by the receiving pocket, the coke box 11a with the receiving pocket 74*a* is moved back and the opening of the coke box toward the furnace chamber is closed by a door, not shown. The gases and dust formed during the stay in the receiving pocket 74*a* accumulate in the quenching vapor collecting chamber 22'' and flow from there into the cyclone assembly 26'' as in the first embodiment. The geases are liberated from the remaining dust by means of water from the tank 15'' and escape into the atmosphere.

In the meantime, the entire arrangement including the receiving pocket 74*a* is moved to position the outlet 79 within the opening 96*a* to the grounding tower 96 and then the closure flap 79*a* is opened to cause the coke to be is discharged onto the inclined ramp 88 and it is baffled by means of the rake 92. After the closure flap 79*a* is closed again, the complete assembly of the coke box 11*a'* and the pocket 74*a* are moved backwardly toward the furnace once more. After the coke has been quenched sufficiently by means of the quenching devices 84, 85 and 86 a lower flap 93 is turned so that it forms an extension of the inclined coke ramp 88 of the quenching tower. This conducts the quenched coke through the dosing frame 94 to a conveyor belt 96 when the rake 92 is lifted by hand or mechanically.

A sliding connection can also be provided between the coke box 11a and the coke receiving pocket 74*a* or between the opening 79 and the opening 96*a* of the quenching tower. In such a case the coke receiving pocket is arranged stationarily on the undercarriage 8'' or at a fixed location below it and only the coke box 11*a'* is moved up to the coke furnace chamber and back again, or the coke box may be long enough so that its to and fro movement is not necessary.

What is claimed is:

1. A device for effecting the discharge and quenching of glowing coke from a coking furnace chamber, comprising a coke receiving box of a size to enclose the opening of the furnace chamber and being of a dimension substantially the same as that of the coking mass to be received from the furnace chamber, track means for said coke box permitting movement of said box toward and away from the furnace chamber, a coke bin located below said coke box having a closable top opening, said coke box having a lower discharge opening which may be aligned over the top opening of said coke bin, a closure flap associated with said coke box and being openable to drop all of the coke in said coke box into said coke bin while maintaining the seal therebetween, wall means defining a coke discharge chamber below said coke bin with a quenching chamber portion and a chimney for the coking gases, and quenching means associated with said quenching chamber portion for providing a quenching action on the coke.

2. A device, according to claim 1, wherein said coke box includes upright perforated plates defining a substantially vertically elongated coke receiving chamber with a gas exhaust chamber on the opposite side of said perforated plates, said gas exhaust chamber communicating with a vapor collecting chamber at the upper end of said coke box.

3. A device, according to claim 2, wherein said coke box includes a vertical elongated gas chamber on each side of said coke chamber which is connected at the upper end to said vapor collecting chamber, and separator means connected to said vapor collecting chamber for removing the entrained dust from the vapors collected therein.

4. A device, according to claim 3, including slide plates on said coke box arranged adjacent the lower end of each side thereof and which are raisable and lowerable adjacent the lower end to provide a sealing of the lower end at the exterior of said coke box when said coke box is positioned in the top opening of said bin, said bin defining a sealing trough adjacent the opening for receiving the sliding plates of said coke box.

5. A device, according to claim 1, including means associated with said flue for removing and separating vapors and entrained dust, and quenching means in said chimney for purifying the exhaust gases.

6. A device, according to claim 1, including a plurality of coke boxes mounted for movement toward and away from the furnace chamber on said track means and a coke bin associated with each of said coke boxes each being connected to said chimney.

7. A device, according to claim 1, including an undercarriage movable in a direction transverse to said track means, said undercarriage including a beam defining said track means.

8. A device, according to claim 1, wherein said coke bin is positioned at a spaced location from said furnace chamber, said coke box being displaceable along said track means to orient the lower discharge opening thereof in the top opening of said coke bin.

9. A device, according to claim 1, including means defining an intermediate chamber at a level between said coke bin and said coke box, said intermediate chamber being connected to said coke bin and having a closing device associated therewith for isolating said intermediate chamber from said coke bin, said coke box being orientable to position its lowermost discharge opening to discharge first through said intermediate chamber.

10. A device, according to claim 1, wherein said bin comprises a fixed pocket having a top opening which is aligned with the bottom discharge opening of said coke box when said coke box is in position adjacent said furnace for receiving a massive coke therefrom, said intermediate pocket including a lower wall which is inclined downwardly to facilitate the discharge of the coke therefrom, said wall means defining the coke discharge chamber comprising a chimney having an opening through which the lower end of the pocket is adapted to extend, said pocket having a flap which may be opened to

permit the sliding discharge of the coking mass into said chimney, said quenching means being located at the lower end of said chimney in a position to quench the coke which passes outwardly from said pocket.

11. A device, according to claim 9, wherein there is provided a sliding connection between said coke box and said receiving pocket.

12. A device, according to claim 9, including an undercarriage defining said track means and being movable TRANSVERSE to said track means, said pocket member being carried on said undercarriage.

13. A device, according to claim 1, wherein said pocket member is connected to said coke box, and including an undercarriage supporting said track means and being movable transversely to said track means, said coke box with said pocket being shiftable away from said furnace to position said pocket within said discharge chamber.

14. A method for effecting the discharge and quenching of glowing coke from a coking furnace using a coke box of a size to receive the mass of coke to be discharge and an intermediate bin or chamber, comprising pushing the coke into a coke box while quenching the coke at least along the top surface thereof as it arrives in the coke box and while removing the quenching vapor from the coke box, positioning the coke box in a position to align a bottom opening thereof over an opening of the bin, sealing the opening between the bin and the coke box during the discharge of the coke from the coke box, and permitting the coke to flow from the bin into a discharge chamber having a flue for the carrying off of the gases while quenching the coke and while purifying the gases by a spray of quenching liquid and cleaning liquid respectively.

15. A method, according to claim 14, wherein said coke box is moved to said furnace to receive the coke and away from the furnace to position it in association with said bin.

16. A method, according to claim 15, wherein said bin is moved with said coke box toward and away from the furnace.

17. A coking furnace discharge apparatus for a horizontal coking furnace having a plurality of coking furnace chambers arranged in a horizontal row, comprising an undercarriage movable in a direction along the row of furnace chambers, a coke receiving box carried on said undercarriage and movable in directions substantially perpendicular to the direction of movement of the undercarriage in directions to approach and to move backwardly away from the individual furnace chambers, said coke receiving box being of a size to enclose the opening of each furnace chamber and being of a dimension substantially the same as that of the coking mass to be received from the furnace chamber, said coking box being movable after it receives a charge of coke from the coking chamber in a direction outwardly away from the coking chamber, at least one coke bin located along the path of movement of said undercarriage at a location below the path of movement of said coke box, said coke box and said coke bin having interengageable closure means which are openable to permit the discharge of the coke box into the coke bin without emission to the atmosphere.

18. A device according to claim 17, wherein said closure seal means comprises a closure flap associated with said coke box which is openable to drop all of the coke in said coke box into said coke bin while maintaining the seal therebetween, and wall means defining a coke discharge chamber below said coke bin with a quenching chamber portion and a chimney for the coking gases, and quenching means associated with said quenching chamber portion for providing a quenching action on the coke.

19. A device according to claim 18, wherein said coke discharge camber comprises a chamber located directly below said coke bin and being sealed therewith and including a side chamber portion forming the quenching portion with conveyor means for transporting the coke discharged from said bin into said quenching portion.

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