The present invention relates to improvements in wet quenching coke stations for horizontal coking oven plants, and more particularly to improvements in such quenching stations of the offset stack or tower type of H. Koppers U.S. Patent 2,234,826 and J. Becker U.S. Patent 1,848,818.

In general, such quenching stations are operated as a part of the operation of the coking plant and must conform to the pushing schedule of such plants in which an oven chamber is discharged and recharged in sequence about every ten to fifteen minutes. For quenching the hot coke, the contents of an oven is pushed into a quenching car, which is then speedily run into a chamber for quenching with water. In general practice, the contents is showered with water in a large enough volume in the form of a spray to quench the glowing coke without water logging it. This requires the expeditious entrance and withdrawal of a quenching car about every ten to fifteen minutes into the station, with spraying of water from about one to three minutes. Consequently, it is customary practice in this art to have an opening or entranceway for entrance of the car with incandescent coke, and withdrawal of the coke quenched for discharge of the coke to storage, and return of the car to the coke oven battery to receive the contents of the next oven chamber, which is completed in the sequence or schedule, and usually another opening or entranceway is provided opposite such first-mentioned opening, depending on the track layout for removing the quenching car from the quenching track to shop for repair.

As a result of the practice of showering the quenched liquid in such a short interval of time to quench without saturating or overloading the quenched coke with water, there customarily results every ten to fifteen minutes a violent evaporation of quenching water within the quenching hood or chamber as steam in amounts as high as 340,000 c.f.m. within the one to three minutes of spraying along with the evaporation of a great amount of small particles in the form of ash and coke dust which is carried along with the steam formed in quenching.

Insofar as the proper quenching of the coke itself is concerned, this steam and dust may blow out of the quenching chamber through the open entranceways, but this is an objectionable practice, since it results in deposits of spray and dust from the clouds of quenching steam in the area surrounding the quenching chamber with attendant deleterious effects.

In the ordinary operation of the wet quenching stations, it has therefore been the common practice to provide a tower or stack above the quenching chamber to carry the quenching vapors to a more remote higher point in the atmosphere, where the objectionable solid constituents are more widely dispersed, and scattered. This is still particularly disadvantageous where the station is close to the coking port oven, or where the coke plant is located in an industrial area, such as a steel mill or near a residential area.

The application of means in the form of water scrubbing to the tower or stack, has not been regarded as satisfactory or entirely practical because of the large volume of water required, and the pumping and other operating costs involved, to wash down the impalpable ash, coke dust, or breeze in the vapors, or to condense some of the steam in the vapors as water droplets on the dust particles to precipitate a substantial amount of the solids from the steam quenching. The use of more effective filtering or packing medium for contacting the scrubbing liquor for the quenching steam vapors or for filtering of such vapors has likewise been regarded as impracticable or too expensive for the same purpose, because they increase the pressure drop through the tower or stack, which must be kept very low for rapidity of off-flow of vapors from the hot coke, and for sufficient economy of operation to warrant use to attain the desired end result of discharging the products of quenching into the atmosphere in an unobjectionable manner and composition.

I have now found that the cause of these defects, in practice, is due to the fact that with the entranceway left open during the prompt off-flow of the quenching vapors through the stack or tower, large quantities of air also entered the quenching chamber, through the entranceways and mixed with the steam. Hence, the amount of washing liquid and pumping costs thereof, required with the open entranceway, as the quenching has heretofore been carried out, necessarily was proportional to the total volume of air and steam, whereas the actual amounts involved for precipitation of the dust and condensation of some of the steam to provide water droplets to precipitate the dust from the quenching vapors alone, is much less.

The present invention therefore has for its object to improve such quenching tower systems of coking plants in such manner as to reduce the volume in which such steam and dust exists, as it rises from the hot coke and ascends the tower, to a minimum and by extremely simple means, thereby reducing substantially the amount of liquid and pumping cost, to the minimum required to remove the solids in sufficient amount to eliminate or minimize a nuisance in the immediate area or more remote surrounding community.

According to the invention a door or doors are provided to completely close the entranceway at the entrance end of the quenching chamber with the quenching car on the usual trackway in said chamber. The door or doors are movable to provide a clearance for insertion of the quenching car with its load of incandescent coke, and for its removal after quenching. When the door or doors are closed, during quenching of coke in a car in the chamber, they act as a barrier to the entrance of the large objectionable quantities of air as heretofore occurred into mixture with the steam given off on contact of the water spray with the incandescent coke, thus reducing to a negligible amount the inward flow of steam-diluting air. When the doors are closed the violent evaporation of the water of the spray generates pressure of steam which builds up in the chamber thus forcing the vapors actively upwardly through the tower, and the spray washing of such steam vapors may be more economically carried out since the volume of the vapors to be sprayed is greatly reduced in amount as compared with the volume that heretofore had to be sprayed due to the influx of air through the open entranceway or entranceways when kept open as heretofore during the quenching.

In the normal operation of a coke plant, each charge of coke to be quenched is alike. It therefore produces the same amount of steam to be scrubbed from each quenching operation, provided the doors are closed on each end of the tower. This quantity cannot be affected by air entering into this quenching system, since the closed doors prevent entrance of air in an amount to effect the volume
of the quenching steam. Thus operated the quenching station tower is similar to towers in which solids are removed. The incident condensation of some steam is of value for precipitation of dust, since only enough spray water is used to remove the solids in sufficient amount to eliminate a nuisance in the immediate area or more remote surrounding community. The quantity of water required to condense all the steam would be too large to be used practically.

In general, the best mode is to utilize the novel door feature with the tower in offset relation as in the forer said H. Keppers and J. Becker patents. However, the invention is also of utility with the tower immediately over the quenching chamber in vertical alignment there with. The former offset arrangement is preferred over the latter vertical alignment arrangement since the offset arrangement eliminates the restriction to flow which is imposed by use of the vertical alignment of the tower, due to the absence of provision of means to collect the condensed steam and spray liquor from the tower or stacks, which is necessary with the vertical alignment arrangement in order to prevent the scrubbing liquid from passing down onto the quenched coke.

Other objects and advantages of the invention will be apparent as it is better understood from the following description when considered in connection with the accompanying drawings illustrating a preferred embodiment thereof.

On the drawing:
Figure 1 is a vertical sectional view taken longitudinally of a quenching station showing the essential features of the preferred embodiment of my invention in sequential coaction with a battery of horizontal coking rerot ovens; Fig. 2 is a top plan view of the station shown in Fig. 1; Fig. 3 is a vertical section taken on the line III—III of Fig. 1 showing the tower or stack portion thereof; Fig. 4 is a horizontal cross sectional view taken on the line IV—IV of Fig. 1; Fig. 5 is an end elevational view partly in vertical section, taken on the line V—V of Fig. 1; Fig. 6 is a horizontal sectional view taken on the line VI—VI of Fig. 1.

Refferring to the drawings the quenching chamber 1 is constituted of a hood or housing composed of a roof 2 and supporting columns 3 of reinforced concrete. The chamber 1 is of a length to wholly contain a quenching car 4 of a size to contain the contents of at least one of the complete charges of one of the coking chambers 5 of the horizontal coke oven battery 6. The car runs on tracks 7 which extend alongside the coke side bench 8 of the battery 6 of horizontal coking retort ovens of the general type illustrated in J. Becker U.S. Patent No. 2,447,837 of 1948, where it receives the white hot coke cake or entire oven charge when pushed out of said battery. After the coke is filled into the quenching car 4, the car is propelled along the trackway 7 into the quenching chamber 1 by means of the motive means 9.

The hood or housing of chamber 1 is extended at the end opposite the end where the car 4 enters from the coke oven battery 4 to constitute one bay 13 beyond that necessary to accommodate the whole length of the quenching car 4, and the tower or stack 10 is surmounted on the extended bay to form an offset washing or treating tower or stack, for off-flow of the quenching vapors from the chamber 1 to the atmosphere at a level high enough to scatter any residual products of quenching more widely throughout the surrounding atmosphere. With this offset design any condensate of steam in said tower 10, and any scrubbing water used therein, will by-pass the coke in a quenching car 4 in the chamber 1 when falling through the same, without requiring deflectors which would im-
2,975,106

5 phere preferably, for example, by an upper wooden siding 27 and a lower side area by a brick wall, and the sides of the end bay 13 under the tower is likewise closed off, for example, by an upper wooden siding and a lower brick lining and the bay is open only to the tower 10 above, although obviously in other parts there are within the contemplation of the invention. As a result substantially only the minimum volume of gaseous vapors and solids that arise from the quenched coke pass upwardly through the tower 10 concurrently with the spraying of the packing 11. This reduction in volume of gas or vapor passing through the tower or stack reduces the tendency of the gases and other materials carried past the scrubbing zone in 10 and out into the atmosphere. In spraying the packing 11 in the scrubbing tower 10, a much smaller quantity of water, approximately equal to the quantity of water used for the quenching of the coke in the car in chamber 1, is required for scrubbing out the solids. This very much smaller volume of scrubbing water in combination with its intensive spray contact with the vapors, due to the dispersion action of the spray heads 12, results in partial condensation around entrained dust particles of a small percentage of the steam.

This novel method of scrubbing solids from a much smaller volume of such quenching steam that results from the absence of such doorway air, results in a more economical and hence a more effective removal of a larger percentage of impalpable dust particles than has heretofore been possible with the prior art tower or stack systems requiring treatment of such large volumes of coke quenching steam due to the influx of air during quenching.

In the normal operation of the system of the present invention, the volume of steam to be treated and the volume of water spray required is limited to the much smaller volume of quenching steam given off in the actual quenching, since each coke charge from an oven chamber of a coke plant to be quenched is always the same and produces the same amount of steam to be scrubbed. With the doors, this volume is not enlarged as heretofore by air entering the quenching chamber. Hence, only enough spray water is needed to remove the solids from such smaller volume of steam by an amount to eliminate a nuisance in the immediate area of the quenching chamber or the remote areas of the surrounding community.

The invention also contemplates, in operation, carrying out the quenching with the roof of the hood or chamber 1 and the supporting columns 3 also being made of pressure treated wood, as well as the siding, doors, and stack, in order to eliminate the erosive and corrosive action of the quenching water and steam on exposed concrete or brick surfaces as heretofore obtained in commercial practice. In such case, to prevent any possibility of damage to the wooden roof of the hood with this type of construction, the invention contemplates one of the quenching sprays 14 at the inlet end of the hood chamber 1 to be connected to the line 17 feeding the scrubbing sprays 12, with an automatic means comprising a four way valve 35 with a solenoid 36 and a limit switch 33 operable by a car 4 to then open a valve 39 in the line to the scrubbing sprays and to the end quenching spray as the quenching car 4 enters the hood 1. This provides a preliminary wetting of the surface of the coke as the car 4 enters the hood. A timing mechanism 34 with an adjustable delay period is included in the automatic means that the line valve 39 is held open by the balance line 18 to the balancer 32 for the quenching sprays 14 after sufficient time for the quenching car 4 to have fully entered the hood 1 and the door 21 to have been lowered into the closed position.

After a further adjustable period, the timer 34 cuts off the water to both the quenching sprays 12 and the scrubbing sprays 14.

The excess quenching water from 14 and scrubbing water from 12 drains from trough 19 to a settling sump of the conventional type and the settled water is recirculated to the quenching tank of chamber 1. As the scrubbing water utilized in tower 10 is approximately equal to the quantity of water used for quenching in chamber 1, the two quenching pumps of the size normally provided may be used in a normal operation to keep the quenching tank 15 filled. During periods of maintenance of one of these pumps the scrubbing sprays are taken out of service in tower 10 and only the quenching sprays 14 used. At this time, of course, little or no dust would be removed from the quenching steam.

Preferably, however, the water in the tank 15 is connected through the downstream line 18 with the header 31 for the sprays 14 by means of a gooseneck 33 located at a level below the header 31 and the valve 32 for effecting the through flow of water from the tank is located in the portion of the branch line below the header. With this arrangement there is no lag in time between the opening of the valve 32 and the discharge of water from the spray heads 14 onto the top surface of the coke as would result in a chance of the heat of the coke in the coke igniting any wooden or other inflammable matter in the quenching station. With this arrangement the header 31 is always filled with a reservoir of water for discharge through the spray heads 14. The spray heads are connected with the header above the lower half and preferably with the uppermost diametric half of the header so as to insure a reservoir of water to the outlets of the header to the conduits therefrom to the spray heads 14. Location of the valve 32 in the portion of the line 18 below the header 31 insures hydrostatic pressure of liquid in tank 15 on the entire line from the tank to the conduits for all of the spray heads 14 immediately upon opening of valve 32, with the result that there is no time lag between the opening of said valve 32 and the discharge of liquid from the said spray heads 14 with prior quenching systems which have the spray head in draining relation at all times with the lower diametric half of the header 31 and the valve 32, and connection of line 18 with the header 31, at a level above the upper diametric half of the header 31.

The invention as hereinabove set forth is embodied in a particular form of construction but may be variously embodied within the scope of the following claims.

I claim:

1. In combination with a wet coke quenching chamber adapted for quenching coke therein with liquid and having a doorway through which a car of coke may travel into and out of said chamber for quenching of coke therein, and spray means for discharging liquid in the form of a spray onto hot coke in a car in said quenching chamber, a tower at a level above said quenching chamber and communicating at its lower part with the upper part of said quenching chamber for upward outflow through said chamber to said tower of the products of vaporous and solid nature which may arise from the quenched coke, means for collecting and returning to said spray means most of the spray liquid as unvaporized spray which drains from said coke in a car in said chamber, said tower communicating at its upper part with the atmosphere so as to discharge said products from the quenching chamber upwardly through the tower into the atmosphere at the top of the tower during the quenching operation, sprayor means and contact means in said tower for washing steam therein to remove dust from said smoke in said tower concurrently with discharge of any residue of said products into the atmosphere from the tower at the top thereof, means for off-flow of liquid from said tower with by-passing of coke being quenched in a car in the quenching chamber by said liquid, said quenching chamber being completely enclosed against the entrance of atmospheric air except for a doorway for passage of said car, and having a door substantially closing all said doorway of said chamber while a coke quenching car is within said quenching chamber, to prevent the entrance through said doorway and upflow of large quantities of
atmospheric air through said chamber and tower during the quenching of, and upflow of quenching vapors from, coke in a said car in said quenching chamber.

2. In combination with a wet coke quenching chamber adapted for quenching of coke therein with liquid and having a doorway through which a car of coke may travel into and out of said chamber for quenching of coke therein, and spray means for discharging liquid in the form of a spray onto hot coke in a car in said quenching chamber, a tower at a level above said quenching chamber and communicating at its lower part with the upper part of said quenching chamber for upward outflow through said chamber to said tower of the products of vaporous and solid nature which may arise from the quenched coke, means for collecting and returning to said spray means most of the spray liquid as unvaporized spray which drains from said coke in a car in said chamber, said tower being offset from said quenching chamber and communicating at its upper part with the atmosphere so as to discharge said products from the quenching chamber upwardly through the tower into the atmosphere at the top of the tower during the quenching operation, sprayer means and contact means in said tower for washing steam therein to remove dust from said products in said tower concurrently with discharge of any residuum of said products into the atmosphere from the tower at the top thereof, means for off-flow of liquid from said tower with by-passing of coke being quenched in a car in the quenching chamber by said liquid, said quenching chamber being completely enclosed against the entrance of atmospheric air except for a doorway for passage of said car, and having a door for closing all of said doorway of said chamber while a coke quenching car is within said coke quenching chamber, to prevent the entrance through the doorway and upflow of atmospheric air through said chamber and tower during the quenching of and upflow of quenching vapors from, coke in a said car in said quenching chamber.

3. The method of removing through a tower products of a vaporous and solid nature that form and rise and flow upwardly therethrough to the atmosphere by reason of spraying in a closed quenching chamber at a lower level than the tower and having a doorway through which a car of incandescent coke may travel into and out of said chamber for wet quenching of coke in a said car in said closed chamber a quantity of liquid of such volume to quench said coke that there is drainage of most of the sprayed liquid as unvaporized liquid from the coke for recycling for further spraying which method comprises: flowing said products and the heat thereof from the chamber upwardly through the tower then outwardly into the atmosphere during quenching of the coke in said chamber; passing said products during such flow into contact with a descending spray of aqueous liquid and thereby precipitating objectionable solid products therefrom in said tower; and closing a door in said doorway during the descent of the quenching liquid spray onto the coke in the car in said chamber, to prevent the entrance through the doorway and upflow of large quantities of atmospheric air through said chamber and tower during the quenching of hot coke in a said car in said closed quenching chamber.

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