United States Patent [19]

Ouwerkerk

[11] **3,862,015**

[45] **Jan. 21, 1975**

[54] **QUENCHING TOWER FOR QUENCHING COKE AND SIMILAR MATERIALS, AND A QUENCHING DEVICE AS PART OF SUCH A TOWER**

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[22] Filed: **Jan. 17, 1972**

[21] Appl. No.: **218,418**

[30] **Foreign Application Priority Data**

Jan. 28, 1971 Netherlands 7101162

[52] **U.S. Cl.** **202/227,** 201/39, 137/132

[51] **Int. Cl.** **C10b 39/08**

[58] **Field of Search** 202/227, 230, 228; 201/39; 137/132

[56] **References Cited**

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

For increased efficiency of coke quenching, the quenching water is supplied to the surface of the hot coke being quenched in the form of essentially vertically directed solid jets of substantial diameter (as distinguished from the conventional fine spray). These solid jets are preferably provided by a multiplicity of syphon tubes operating under very little hydrostatic head. In the illustrated embodiment the syphon tubes may have inside diameters of about 17 mm, and mouth opening diameters of about 14 mm located about 1.5 meters above the coke surface and spaced about 20 cm, substantially uniformly above the entire surface of the coke bed. The arrangement improves the uniformity and efficiency of quenching by reducing deflection, carry-over and evaporation of quenching water by the rising steam in the region above the coke bed and assures a more uniform distribution of water over the mass of coke, so that more of the water reaches and is uniformly distributed on the coke bed to be vaporized in contact therewith.

6 Claims, 5 Drawing Figures

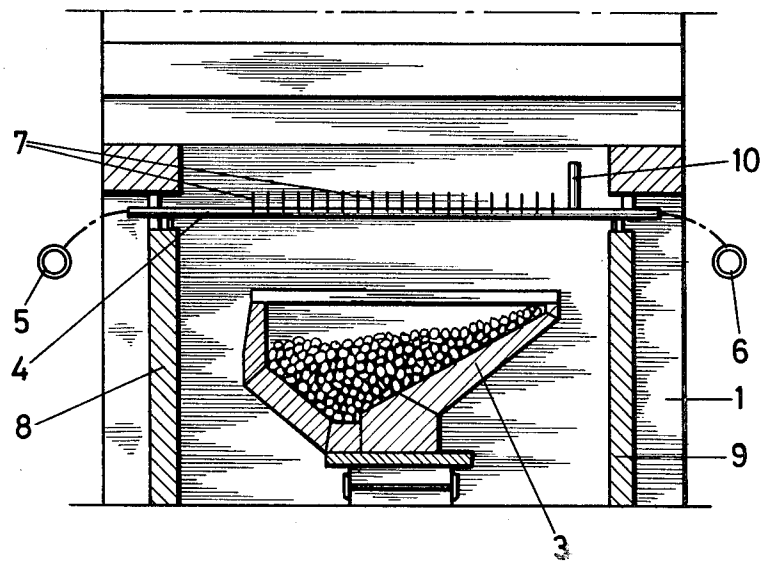


Fig_1

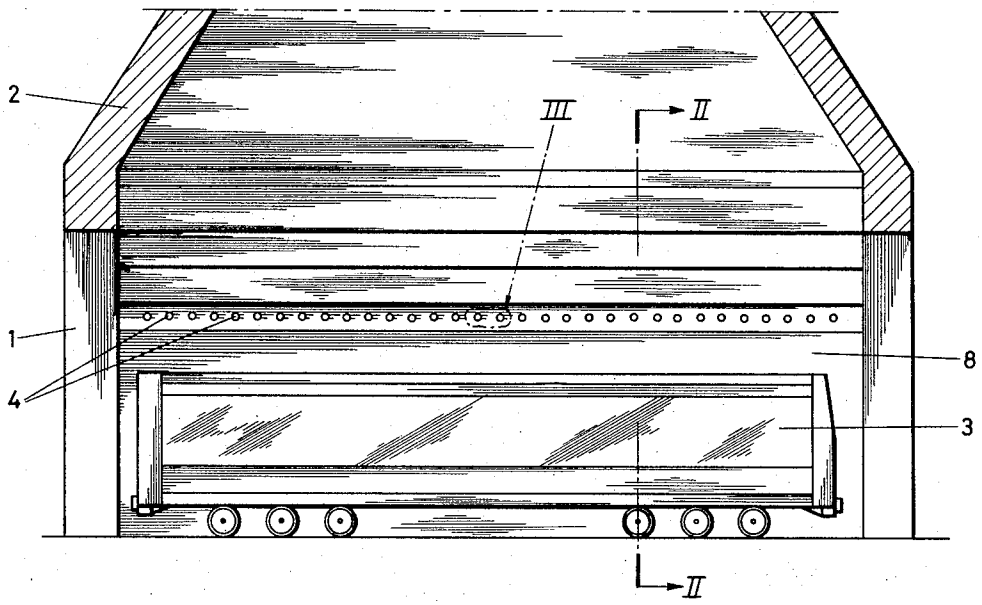


Fig_2

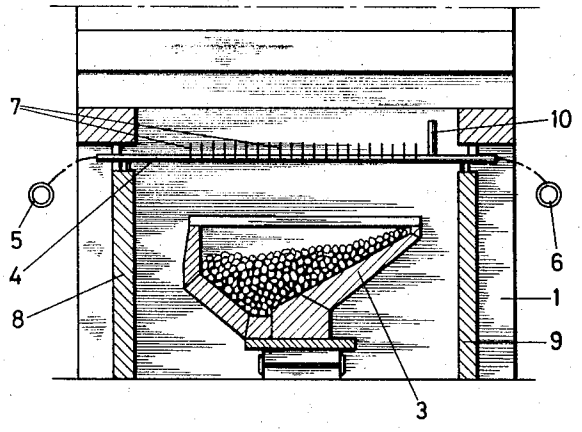


Fig_3

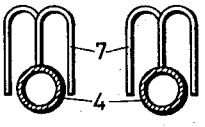


Fig_4

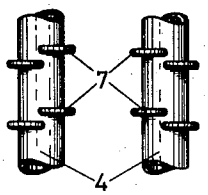
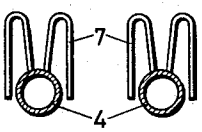


Fig_5



QUENCHING TOWER FOR QUENCHING COKE AND SIMILAR MATERIALS, AND A QUENCHING DEVICE AS PART OF SUCH A TOWER

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a quenching tower for quenching coke and similar materials, adapted to move the material to be quenched into the lower part of the tower by means of cars, onto which the material to be quenched is loaded, which tower is provided with a quenching device for delivering water onto the said material.

2. Description of the Prior Art

Moreover, the invention relates to the quenching device used in such a quenching tower.

When quenching coke the hot coke from the coke oven batteries is first loaded onto special rail cars, the so-called quenching cars, which thereafter are moved on rails into the lower part of a stack-shaped tower. In said tower a quantity of water is sprayed onto the coke, said quantity being sufficient to cool the coke down entirely. About half of the water sprayed onto the coke is vaporized in the process, the other half being discharged by passing through the coke and through the bottom of the quenching car. Thereafter the car is moved out of the quenching tower and the quenched coke is discharged onto a sloping surface. From this slope the coke is discharged, usually by a belt conveyor system.

The spraying system for the quenching water to be sprayed onto the coke often consists of a number of downwardly directed spray nozzles, spraying water in a conical jet or spray onto the hot coke. It is, however, also known to supply the quenching water through a system of tubes extending above the quenching car, from which tubes the water is sprayed through simple openings in the wall thereof onto the coke.

It has appeared that the known devices and methods for quenching coke are liable to improvement.

The quality of the quenched coke depends on the speed of quenching. Quenching periods of 110 sec. per charge or more are usual, but it has appeared that a considerable improvement of quality is obtainable if the quenching time can be shortened to about 1 minute or less. A further advantage of a shorter quenching time consists in that the entire cycle of loading the coke onto the quenching car, the rolling of the cars to the quenching tower, the quenching, the rolling of the cars to the sloping surface, the discharging of the coke onto said surface and the moving of the cars back to the coke oven battery can be shortened. When increasing the capacity of a coke oven battery by shortening the so-called coking or carbonizing time it often appears that the moving cycle of the quenching cars is a factor of importance in restricting the production capacity obtainable. By shortening the quenching time proper it is thus possible to obtain an increase of the coke production per quenching tower. Other advantages aimed at by the present invention will be explained in more detail below.

SUMMARY OF THE INVENTION

In view of the above the present invention consists in that the quenching system is embodied as a set of syphon tubes arranged in a regular pattern above the space in the tower, into which the cars are moved, said pattern extending over the entire upper surface of the charge of material to be quenched on said cars, the said system of syphon tubes being connected to a supply system for water.

It is remarked that the use of syphon tubes positioned according to a regular pattern for cooling purposes is known for cooling hot-rolled steel-sheet in sheet-rolling mills. However, in that case the cooling takes place on steelsheet moving with high speed underneath the syphon tubes, which gives problems being entirely different from the problems in quenching a stationary layer of glowing hot coke.

It has appeared that by the use of syphon tubes it is possible to obtain an extremely uniform and equal distribution of quenching water over the mass of coke, which is not possible if the water is brought into contact with the coke in an other manner. The water falls down as narrowly restricted jets of water onto the coke, said water flowing in an essentially laminar pattern, so that on the one hand a very good aiming and directioning of the water flow is possible and thus a very accurate distribution of the water, and on the other hand it is avoided to a considerable extent that a large part of the water already begins to vaporize before it comes into contact with the coke.

It has appeared that the water flowing onto the coke is distributed very rapidly and uniformly over the entire layer of coke, so that a more rapid quenching is obtained. Moveover, this has made it possible to reduce the quantity of water required from about 2 tons (tons of 1,000 kg) of water per ton of coke to about 1.5 tons of water per ton of coke. Thus a smaller quantity of water flowing from the quenching cars has to be recirculated and the necessary means for recirculation can be made lighter and less expensive. By using the quenching system according to the invention it appears very well possible to shorten the quenching time from about 110 seconds to about 60 seconds, which, as already remarked, gives a considerable improvement of the quality of the coke and also a shortening of the cycling time of the quenching car by about 50 seconds on a total cycling time of about 7 to 8 minutes. Thus an increase of production of the quenching plant by about 10 percent has become possible by the present invention.

Perhaps even more important than the advantages already mentioned is the fact that with the aid of the new device according to the invention the coke mass is quenched more homogeneously. Thereby it is avoided that in the quenched coke glowing coke parts remain present, which should be requenched (after-quenched) on the sloping coke surface. It is remarked in this respect that the presence of such glowing coke parts was up to now often unavoidable, so that the requenching (afterquenching) on the sloping surface was often common practice. If this requenching does not take place completely the result is not only a loss of coke, which burns away, but also it is possible that the conveyor belts of the discharge system for the coke from the sloping surface are considerably damaged by such hot coke parts. Not the least disadvantage is, however, that the requenching of the coke on the sloping surface is an unattractive and harmful operation from an ergonomic viewpoint. It has appeared that with the new quenching tower according to the present invention it is possible to quench the coke quite homogeneously, so that the occurrence of glowing coke parts after the

quenching is entirely avoidable. Moreover it is, due to this more homogeneous quenching, possible to control the moisture content in the quenched coke more accurately. In particular, if the queched coke is used for metallurgical purposes, for instance for the charging of blast furnaces for iron manufacture, it has appeared of considerable importance that the moisture content in the coke is maintained as uniformly as possible at a constant level.

During quenching a considerable development of steam takes place. This steam flows upwardly in the quenching tower and thus is in counterflow with the water descending therein. If the water is finely distributed and sprayed in a direction, which for a considerable part deviates from the vertical direction, which is the case when spraying according to a conical pattern with a considerable cone angle as usual, it appears that the distribution of water over the coke is considerably unfluenced by the steam which is generated. An additional advantage of the use of the new quenching tower according to the invention therefore also consists in that the water mass falling in compact jets vertically downwardly is hardly influenced by the rising steam. This again causes a better homogeneous distribution of water over the mass of coke compared with what was obtainable up to now. It is quite surprising that this at first sight less uniform distribution by compact vertical jets gives a better distribution of water over the mass of coke.

Due to the use of syphon tubes the quenching water falls from the quenching system substantially without pressure, which has as a result that the distribution of water is to a considerable extent insensitive to mutual variations of pressure in the supply system of the water to the syphon tubes. Simultaneously, however, it is very well possible to influence the speed of flow through the system of syphon tubes by the supply pressure of the water to the system.

It is possible to make the regular pattern, in which the syphon tubes are positioned, depending on the differences in the thickness of the layer of coke on the quenching car. It has appeared in practice that quite satisfactory results are obtainable if the syphon tubes are arranged in a pattern, which has a constant pitch. If this pitch is larger the uniform distribution of the water over the bed of coke will only be obtained at a greater depth in said bed. It is important to consider in this respect that coke is a reasonably good heat insulator, so that it is possible, with a non uniform distribution of water in the coke mass, that over very short distances very high differences in temperature can occur. In developing the present invention it has appeared that a sufficiently uniform distribution of the water is already obtained very close to the surface of the coke bed, if the pitch of the pattern is less than 25 cm and preferably about 20 cm. With a pitch of the pattern, decreasing below 20 cm, the water distribution in practice will improve only very slightly with smaller pitch, whereas the capital investment for the quenching system will increase considerably.

It is possible to arrange the syphon tubes in different manners and to connect them in different manners to a supply system for quenching water. It is moreover possible to connect such tubes to a system of mutually connected concentric annular ducts or to a spiral shape supply duct. It is also possible to connect the syphon tubes to supply pipes, which extend in longitudinal direction of the quenching tower. It has appeared, however, that such solutions in practice are not the best solutions possible, mainly because they have to be heavy in order to be sufficiently rigid. Thus according to the invention an arrangement is preferred, in which the syphon tubes are mounted onto a grid of ducts extending transversely to the longitudinal direction of the tower, said transverse ducts being connected to main supply tubes extending outside the tower. Thereby it is possible that in case of a necessary repair operation the smallest possible quantity of syphon tubes has to be taken out of operation and that a duct with a set of syphon tubes can be connected to the water supply system in a manner so as to be disconnectable therefrom. It is in this respect possible in such a system that a single disconnected duct can be removed simply in its own axial direction from the tower to be replaced by another duct with syphon tubes.

In practice good results have been obtained with syphon tubes, of which the inner diameter is about 17 mm, and in which said syphon tubes are provided at their entry opening with a restriction having a diameter of about 14 mm.

If the syphon tubes and the supply ducts to which they are mounted are arranged too closely to the surface of the bed of glowing coke there is the danger of an overheating of said syphon tubes. This may cause a deformation of said elements and of the ducts to which they are connected, but, moreover, a disadvantage thereof is that by evaporation of water in the syphon tubes salt deposits occur therein, impairing the water flow. On the other hand, if the syphon tubes are mounted in a too high position in the quenching tower, even small deviations in the direction of the falling water jets can cause an undesired deviation from the uniform water distribution in the bed.

It has appeared that both said disadvantages can be avoided by having the syphon tubes open at a height of about 150 cm above the top surface of the material to be quenched.

As already remarked the present invention not only relates to a quenching tower, but also to a quenching device to be used in such a tower. This quenching device comprises a set of syphon tubes positioned in a regular pattern, as described above. Such a quenching device can be mounted simply in existing quenching towers or can even, for particular applications, be used without any quenching tower at all.

BRIEF DESCRIPTION OF THE DRAWING

The invention will now be explained in more detail with reference to the attached drawing by way of example only.

FIG. 1 thereof shows diagrammatically a quenching tower in longitudinal vertical section.

FIG. 2 is a transverse vertical section along the line II—II in FIG. 1.

FIG. 3 is a view at a considerably larger scale of part of the detail surrounded by a dotted line and indicated by III in FIG. 1.

FIG. 4 is a view from above of the detail of FIG. 3.

FIG. 5 is a same detail as FIG. 3, but in a somewhat different embodiment.

DESCRIPTION OF PREFERRED EMBODIMENTS

In FIG. 1 reference numeral 1 indicates the lower part of a quenching tower shown only diagrammat-

ically. At the upper end this tower has an upwardly converging part **2.** This tower is of a structure known per se, so that it need not be described in detail. It is possible to roll a quenching car **3** in longitudinal direction into and out of the lower part of said tower on rails, so that it becomes positioned between two side walls **8** and **9** (FIG. **2**). Above the open top surface of the quenching car, at about 1.5 m above the upper edge thereof, there is a grid of ducts **4,** each supported by brackets on the upper edge of the walls **8** and **9.** The ducts **4** are disconnectably connected to main supply ducts **5** and **6.** After being disconnected the ducts **4** can be removed in their longitudinal direction from the tower, so as to be replaced by other ducts.

Onto the ducts **4** a large number of syphon tubes **7** is mounted. In FIG. **3** two of the ducts **4** are shown with syphon tubes **7** from detail III in FIG. **1** at an enlarged scale. In FIG. **4** this detail is shown in a view from above. The syphon tubes **7** extend from the upper edge of the ducts **4** first vertically upwardly and thereafter they bend outwardly and downwardly into the vertical downward direction alongside the duct **4.** Each set of four openings of the syphon ducts forms a substantially square pattern with a side of the square of 20 cm. The total field of such openings of the syphon tubes covers the entire upper surface of the quenching car between its upstanding edges and sidewalls. Of course, another regular pattern is also possible, for instance according to equilateral triangles, but squares seem to be preferable.

As the syphon tubes **7** are connected to the ducts **4** at their upper edge with the connection along the top generating line of said ducts **4** it is necessary to position the syphon ducts in a staggered way onto the ducts **4.** This gives a slight deviation from a pure pattern of squares. FIG. **5** shows an alternative structure in which it is possible to have the syphon tubes **7** with their openings cover an accurately square pattern. However, in this case it is necessary to apply connecting points of these syphon tubes **7** to the ducts **4,** which are at an angular distance along the periphery of said ducts. It will be clear that several other embodiments and connecting points of the syphon tubes with respect to the ducts **4** are possible. An advantageous arrangement is also one in which the vertical planes through each syphon duct are not exactly perpendicular to the longitudinal axes of the ducts **4,** but are at a small angle thereto, so that it is possible to have the openings of the syphon tubes cover exactly a pattern of squares with their connections to the ducts **4** being exactly along the upper line of the ducts **4** as in FIG. **3.**

Moreover, it is possible to mount a standpipe **10** at one or both ends of each duct **4.** Such a standpipe **10,** open at its top, is shown in the right part of FIG. **2.** Thereby it is possible to interrupt the water flow through the ducts **4** quite rapidly. This is so because, if the water supply through the main ducts **5** and **6** is interrupted, the syphon action of the syphon tubes will go on syphoning water from the ducts **4** during a very short period and thereupon air will be able to flow into the ducts **4** through the standpipe(s) **10,** so that this air in the ducts **4** interrupts the syphon action and terminates the water discharge through the syphon tubes **7.** This also makes the system ready for a new spraying cycle for a following mass of coke in a very short time as only a very small quantity of water has to be supplied to have the system operate uniformly again.

I claim:

1. In a quenching tower for receiving in the lower part thereof a quenching car loaded with coke or like material which is to be quenched therein, and having means for applying quenching water to the surface of the coke to effect a quenching thereof, the improvement of means for applying quenching water which comprises syphon tube means mounted in said tower above the space in which the car will be positioned for delivering the quenching water vertically downwardly in a multiplicity of narrowly restricted, compact jets of water in an essentially laminar pattern so that the water will be distributed uniformly over the entire layer of coke in the car, the pitch of said jets in said pattern being less than 25 cm between adjacent jets, said syphon tube means being mounted onto a grid of ducts extending transversely to the longitudinal direction of the tower with their respective delivery portions extending vertically downwardly, said transversely extending ducts being connected to the main tubes extending outside the tower.

2. A quenching tower in accordance with claim **1,** wherein the pitch of said jets in said pattern have a constant pitch of about 20 cm between adjacent jets.

3. A quenching tower in accordance with claim **1,** wherein said transversely extending ducts, onto which the syphon tubes are mounted, are easily disconnectable from the water supply system and are removable in their axial direction from the tower.

4. A quenching tower in accordance with claim **1,** wherein said ducts include means for limiting the hydrostatic pressure therein thereby insuring delivery of the water from said syphon tube means in the manner set forth.

5. A quenching tower in accordance with claim **1,** wherein the syphon tube means each has an inner diameter of about 17 mm and each is provided with an entry opening with a diameter of about 14 mm.

6. A quenching tower in accordance with claim **1,** wherein the syphon tube means open at a distance of about 150 cm above the material to be quenched.

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