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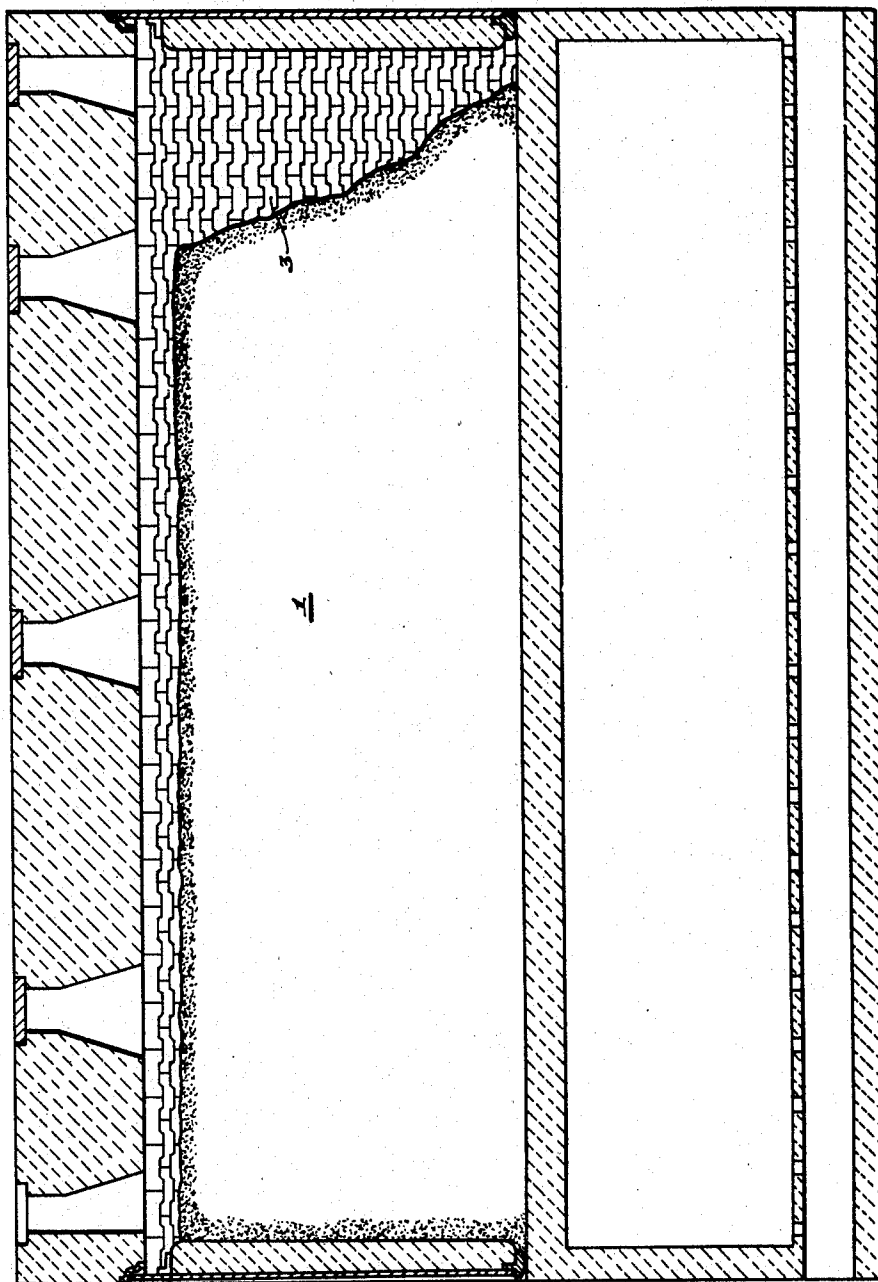
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2,433,253

BY-PRODUCT COKE OVEN WALL CONSTRUCTION

Filed May 9, 1944

4 Sheets-Sheet 1



*Fig. 1*

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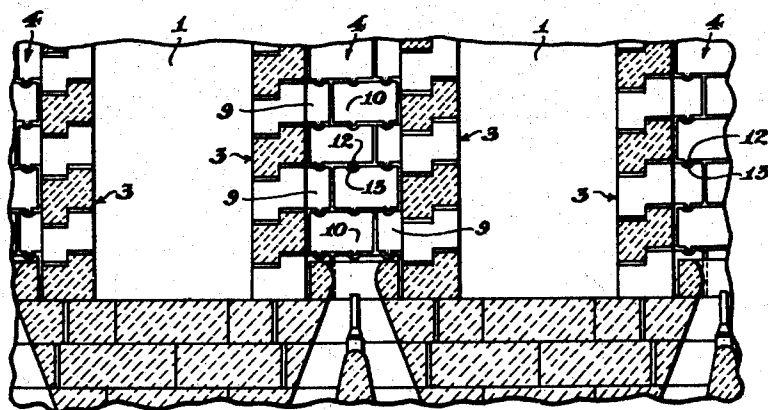
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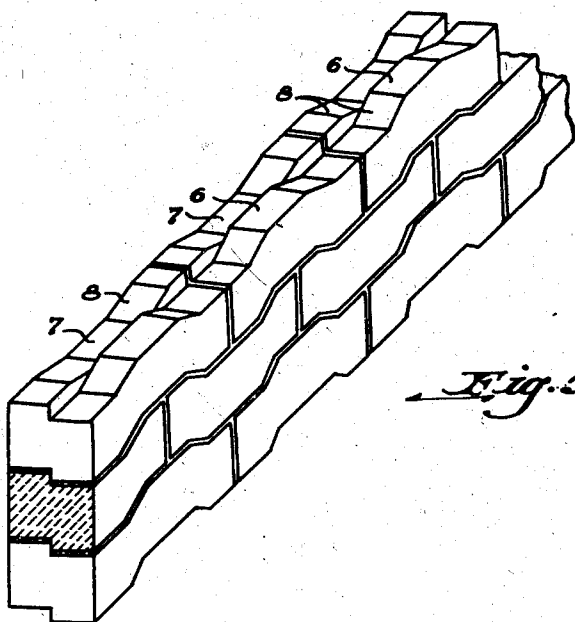
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*Fig. 2.*



*Fig. 5.*

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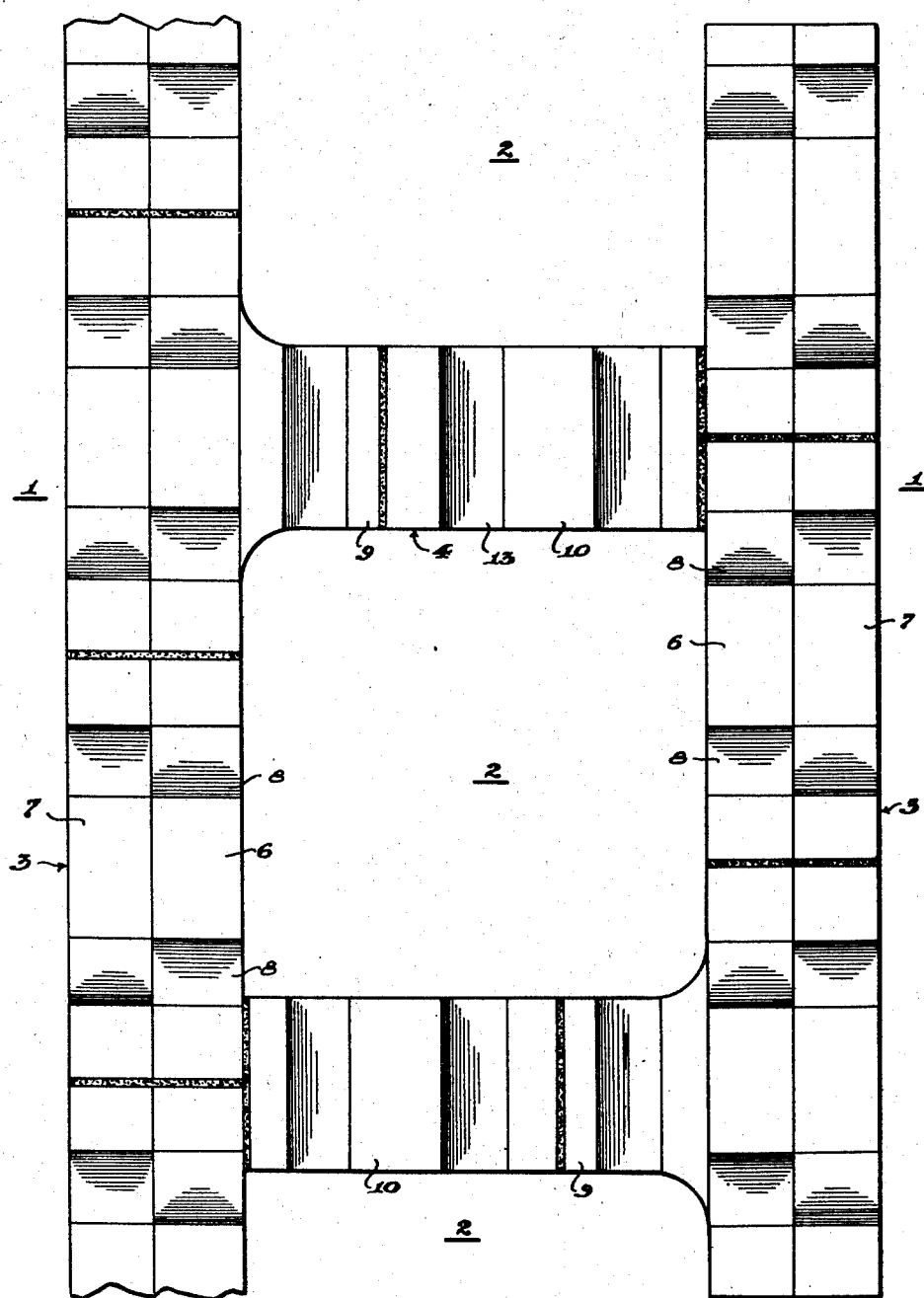


Fig. 3.

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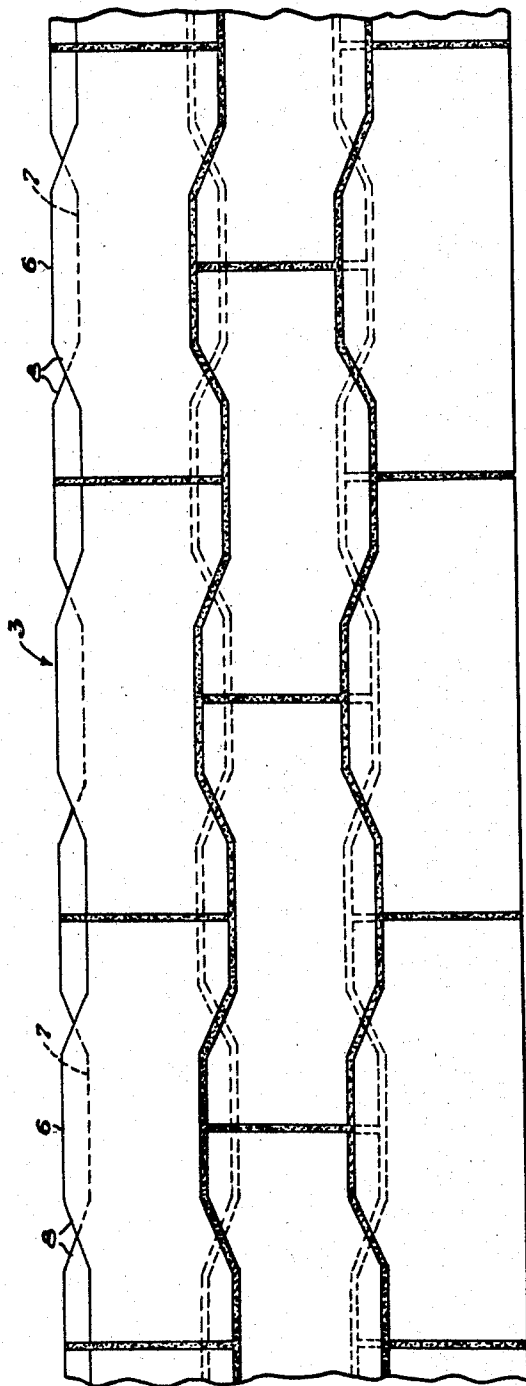
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4 Sheets-Sheet 4



*Fig. 4.*

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## UNITED STATES PATENT OFFICE

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BY-PRODUCT COKE OVEN WALL  
CONSTRUCTION

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Application May 9, 1944, Serial No. 534,744

4 Claims. (Cl. 202-223)

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This invention relates to by-product coke ovens.

It is desirable that the horizontal joints between the brick courses of the side walls of by-product coke ovens be broken to help prevent gases from escaping through the joints and into the flues. Another problem arises in connection with thermal expansion and contraction of the oven walls. To take care of this condition in coke ovens, the bricks of the long side walls of the ovens are tightly bound together lengthwise by stays extending the length of the ovens. As the ovens are heated, these stays are gradually loosened to allow for expansion of the side walls. Even then the pressure of the bricks against one another lengthwise of the walls is often great enough to cause their end faces to spawl or crumble. If the ovens are permitted to cool later, the stays are gradually tightened in an endeavor to keep the vertical joints between the bricks closed, but nonetheless, they frequently open and permit gases to leak through the walls. The time and trouble involved in adjusting the stays also are undesirable factors.

In coke ovens there normally is considerable lateral pressure on the walls which is greatly increased when the coke is pushed out, and this pressure is likely to bulge the walls or dislocate or break the bricks. To guard against this, an attempt has been made to tie the bricks together against both lateral and longitudinal movements by providing them with interlocking tongues and grooves, but it has been found that such an expedient is not capable of successfully solving the problems. There is not sufficient interlocking, and the tongues do not have much strength and are easily broken in laying the bricks or by pressure in the walls.

It is among the objects of this invention to provide a by-product coke oven wall which has great lateral stability, which does not require stays or the like to hold the bricks together lengthwise of the wall, in which the horizontal joints between the courses are broken effectively, in which the bricks are not damaged by longitudinal thrust due to thermal expansion, and in which weak interlocking brick projections are avoided and corners are reduced to a minimum.

In accordance with this invention, a coke oven wall is formed from a plurality of superimposed brick courses that are staggered lengthwise in the usual way. Each of the upper and lower faces of each course is divided lengthwise into a plurality of surface bands disposed side by side. This is true even though the wall is only one

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brick thick, as is generally the case with coke oven partition walls that separate the ovens from the heating flues. At least one of the surface bands along each face of any given course extends up and down to intersect the edge of the adjacent band of that face at points spaced longitudinally of the wall. By having the adjacent edges of the bands cross wherever they intersect, the horizontal joint between adjoining courses is broken except at the points of intersection.

Preferably, there are at least two sinuous surface bands along each face of a course with the high areas of each of the bands located beside the low areas of the other band so that the bands are, in effect, staggered lengthwise. The high and low areas of each band are most suitably flat and horizontal and are connected by substantially flat inclined areas that cross the edge of the inclined areas of the adjacent band. The high portions of the surface bands resemble lugs while the low portions are in the form of recesses. It is preferred that each of the upper and lower faces of each brick be provided with only one of these lugs and one of these recesses so that the lugs can be made large enough to have considerable strength. Also, the lugs and recesses preferably are relatively shallow and the flat inclined areas are not steep, thereby further decreasing the likelihood of the lugs becoming broken. Due to the sinuous horizontal joints between the staggered courses, the bricks in one course lock those in the adjoining courses together so that expansion and contraction of the wall can not open the vertical joints between the ends of the bricks an appreciable amount. The staggered sinuous surface bands extending along the courses provide staggered vertical shoulders that lock the bricks together transversely to give the wall great lateral stability.

The invention is illustrated in the accompanying drawings in which Fig. 1 is a vertical longitudinal section through a by-product coke oven containing a charge; Fig. 2 is a fragmentary vertical transverse section through two coke ovens and an intervening flue; Fig. 3 is an enlarged fragmentary horizontal section through a flue and parts of two ovens; Fig. 4 is a fragmentary elevation of the brick side wall of an oven; and Fig. 5 is a fragmentary isometric view of the side wall showing the shape of the bricks.

It is well known that in by-product coke ovens a large number of long, narrow ovens are disposed in spaced parallel relation in a group or bank. The various ovens are separated from one

another by flues in which gas is burned and through which products of combustion pass to heat the ovens to coke the coal. That is, the walls that form the partitions between the flues and ovens are the common side walls of both. Each oven is charged with coal from the top, and the coke is pushed out through a door in one end of the oven by a ram or pusher inserted from the opposite end of the oven. The flues are provided at intervals with vertical transverse walls which help support the sides of the ovens against the lateral pressure of the coal and coke in the ovens.

Referring now to the drawings, in Fig. 1 one of the ovens 1 in a bank is shown, while in Fig. 2 parts of two of the ovens in a bank are illustrated, as well as portions of the adjoining flues 2. The common partition or side walls 3 of the flues and ovens are substantially parallel and extend straight across the bank of ovens. Inside each flue, its side walls are connected at longitudinally spaced points by vertical transverse walls 4 which strengthen the oven walls. Hot gases passing through the flues heat their side walls which, also being the side walls of the ovens, heat the ovens and thereby convert the coal in the ovens into coke. Each of the side walls is generally only one brick thick with the bricks laid in longitudinally staggered courses so that each brick straddles the joint between the ends of two bricks below it. It is not necessary, in view of the improved shape of the bricks disclosed herein, to provide the adjoining ends of the bricks with the usual registering vertical tongues and grooves, although this may be done if desired.

It is a feature of this invention that the side wall bricks, and therefore the side wall courses, have each of their upper and lower faces divided lengthwise into a plurality of surface bands, such as two, which extend up and down; that is, they are sinuous as shown in Figs. 4 and 5. The bricks are thus provided with alternate lugs or ribs 6 and recesses 7. The bands shown in the drawings are all the same width, but there may be cases where it is desirable to make those on the flue side narrower than the bands on the oven side. The two bands of each pair are staggered lengthwise so that the high areas or ribs of one band are midway between the ribs of the other band and therefore are located opposite to the low areas or recesses of the latter. All of the vertically spaced bands on each side of the wall are parallel to one another, and the ribs and recesses of each band are all the same size and shape so that the bricks of the different courses will fit together.

It will be noted that the ribs along the top of our course project into the recesses in the bottom of the course above, while the ribs on the bottom of the latter course register with the recesses in the top of the course below. As shown in Figs. 2 and 5, the inner ends of the ribs form vertical shoulders with those of one course engaging those of the adjoining courses. This fact, together with the staggered relation of the ribs, prevents the individual bricks from being moved laterally relative to one another and from being turned on a vertical axis. An interlocking of the bricks is thus provided which makes the side walls of the ovens very resistant to lateral pressures.

In the preferred embodiment of the invention the tops of the ribs and the bottoms of the recesses are substantially flat and horizontal and are connected together in each surface band by flat inclined areas 8 each of which preferably is about

half as long as one of the horizontal areas. The inner edges of these inclined areas of each band cross the inner edges of the inclined areas of the surface band beside it, whereby the inner edges of the two bands extend up and down across each other at points spaced longitudinally of the wall. Between the inclined areas, the inner edges of the two bands extend parallel to each other in vertically spaced relation, but it should be noted that there is no flat surface that extends entirely across the bricks. It is obvious that the horizontal joints between the courses have the same shape as the surface bands, so each horizontal joint is divided lengthwise along its center into a pair of bands that intersect each other only at their crossing points. The result is that the horizontal joint is broken except at those points, and they are so small that they hardly need be considered. Between the crossing points the vertical inner end faces or shoulders of the ribs of adjoining courses substantially engage one another in pairs as previously explained, thereby forming a vertical wall extending along the center of each horizontal joint which substantially seals the joint against leakage of gases there-through. As the horizontal joints are not straight, but sinuous, their edges on the oven side of the walls are not enlarged and cut away a material amount by the abrasive action of the coke while it is being pushed out of the oven.

It is preferred, as shown in the drawings, that each of the upper and lower faces of each brick be provided with only one complete rib and one complete recess. This not only facilitates manufacture of the bricks, but also permits the ribs to be of maximum thickness lengthwise of the bricks in order to make the ribs as strong as possible. By locating the ribs and recesses midway between the ends of the bricks, the bricks are symmetrical and the vertical joints between the ends of adjacent bricks can be made to extend through the centers of the ribs and recesses at the ends of the bricks to form half ribs and half recesses at the ends of each brick. Thus, the outer ends of the inclined areas of each brick are joined to flat horizontal areas only half as wide, measured lengthwise of the brick, as the flat horizontal areas of the centrally located ribs and recesses. It will also be noted that the ribs and recesses are quite shallow relative to their length, whereby there is little danger of knocking off the ribs in handling the bricks. The inclined areas 8 are not steeply, but gently inclined, such as in the neighborhood of 45°. As a result, the lower ends of each pair of crossing inclined areas are spaced a considerable distance apart lengthwise of the wall so that the horizontal joints are positively broken at their inclined portions as well as at their horizontal portions. This form of brick also has a very small number of sharp projecting corners exposed on the oven side of the wall. Sharp corners are objectionable because they are fairly easily broken, so the fewer the better. The number of corners can be reduced to a minimum of four by joining inclined areas 8 to the horizontal areas with a slight curve.

Another feature of this invention is that the divided ribs that are formed at the meeting ends of bricks in the same course project into the recesses in the bricks that straddle those ribs and are held by the walls of those recesses from spreading apart when the bricks contract, which would open the vertical joints. Moreover, the vertical pressure of the inclined walls of those recesses against the inclined walls of the divided

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ribs has a wedging effect on those ribs which urges the bricks endwise toward each other. The walls can thus expand and contract without opening the vertical joints between the ends of the bricks, thereby making it unnecessary to use longitudinal stays to tie the wall together. When the bricks expand, a material amount of the longitudinal thrust thus created is transmitted from the inclined sides of the central ribs on each brick to the inclined sides of the ribs of the bricks in the adjoining course. This decreases the pressure on the ends of the bricks so that they are not as likely to break or crumble as heretofore.

As shown in Figs. 2 and 3, the transverse walls 4 in the flues may be formed advantageously by providing the flue side of some of the side wall bricks with integral brick-like projections 9 that extend into the flues a short distance. These projections essentially are rectangular horizontally and vertically. The space between the end of each of these projections and the opposite wall of the flue is closed by one or more conventional bricks 10. The upper and lower surfaces of these bricks and projections 9 may be provided with transverse tongues 12 and grooves 13 which are satisfactory for tying the bricks of these transverse walls together, because they are subjected to no lateral pressure and to very little pressure tending to pull them apart endwise.

The shape of the bricks disclosed herein is not complicated, and rights and lefts do not have to be provided except in the case of half bricks that fill out one end of each course. With only one main shape to handle, the bricks can be laid faster than where several shapes have to be used, and the walls are more uniform in construction. In spite of the relative simplicity of shape, the bricks interlock with one another in a greatly improved manner and produce broken horizontal joints between the courses even though the wall is only one brick thick. The longitudinal interlock is a great improvement over coke oven walls that had to be held together lengthwise by horizontal stays. By making it unnecessary to provide vertical tongues and grooves at the ends of bricks, piling of the bricks on end for shipment is facilitated and relatively weak projections are avoided.

According to the provisions of the patent statutes, we have explained the principle and construction of our invention and have illustrated and described what we now consider to represent its best embodiment. However, we desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

We claim:

1. A by-product coke oven provided with a coking chamber extending horizontally therethrough having flued side walls formed from a plurality of superimposed courses of solid refractory bricks, the upper and lower faces of the courses each being divided lengthwise into a set of bands which are sinuous lengthwise of the wall to restrain relative movement of said courses lengthwise of the wall, the high areas of each of said bands being located beside the low areas of the adjacent band of the same set with the adjacent edges of said bands extending up and down across each other at a gentle inclination in the neighborhood of 45° at points spaced longitudinally of the wall to break the joint between adjacent courses, each of the upper and lower faces of each brick being provided midway between its

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ends with one of said high areas and one of said low areas, and each of said upper and lower faces of each brick being provided at each end of the face with substantially half of one of said low areas, the vertical thickness of each brick being substantially uniform throughout its length.

2. A by-product coke oven provided with a coking chamber extending horizontally therethrough having flued side walls formed from a plurality of superimposed courses of solid refractory bricks, the upper and lower faces of the courses being sinuous lengthwise of the wall to restrain relative movement of said courses lengthwise of the wall, the high areas of each of said faces of the courses being connected to the low areas of the same face by gently inclined areas, each of the upper and lower faces of each brick being provided midway between its ends with one of said high areas and one of said low areas, and each of said upper and lower faces of each brick being provided at each end of the face with substantially half of one of said low areas, the vertical thickness of each brick being substantially uniform throughout its length.

3. In a horizontal by-product coke oven battery, a heating wall for coking chambers, said wall comprising spaced side walls for the coking chambers with intermediate transverse walls tying together said side walls and together therewith forming inside the heating wall vertical heating flues for burning combustion gases to heat said side walls, the side walls comprising a plurality of individual solid refractory bricks arranged in superimposed horizontal courses with the vertical joints between the ends of the bricks of a said course staggered relative to similar vertical joints in adjacent horizontal courses, said side walls having their outer surfaces forming sides of coking chambers located on opposite sides of said heating wall, and the side walls also having adjacent horizontal brick courses keyed together against relative horizontal movement by means of registered upper and lower faces of the courses, and each of said faces being divided lengthwise thereof into a plurality of sinuous bands wherein high and low substantially horizontal areas of the individual bands are connected by gently inclined areas and with all of said areas intersecting vertical side surfaces of the side walls, the high and low areas of each band being of substantially equal lengths and together constituting the major portion of the length of that band with alternate said areas of that band divided substantially midway by said vertical joints between bricks, whereby said gently inclined areas in combination with their connected high and low areas exert a wedge-like action in a side wall tending to force the brick ends of an adjoining brick course closer together in response to longitudinal pressure expansion and contraction of the wall, there being engaging vertically disposed surfaces between the bands of contiguous faces of adjacent courses adapted to retain superimposed bricks of the side wall in alignment and keep them from rotating about a vertical axis,

4. A by-product coke oven provided with a coking chamber extending horizontally therethrough having flued side walls formed from a plurality of superimposed courses of solid refractory bricks, the upper and lower faces of the courses each being divided lengthwise into a set of bands extending lengthwise of the courses, the bands adjacent the exposed coking chamber sides of said courses having their outer edges ex-

tending along said sides, each of said last-mentioned bands being sinuous lengthwise to restrain relative movement of the courses lengthwise and having substantially horizontal high areas connected to substantially horizontal low areas thereof by gently inclined areas, the inner edges of the inclined areas extending up and down across the inner edge of the adjacent band in the same set, and said high and low areas of each sinuous band being of substantially equal lengths and together constituting the major portion of the length of that band with alternate said areas of that band divided substantially midway by vertical joints between the ends of the bricks.

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