

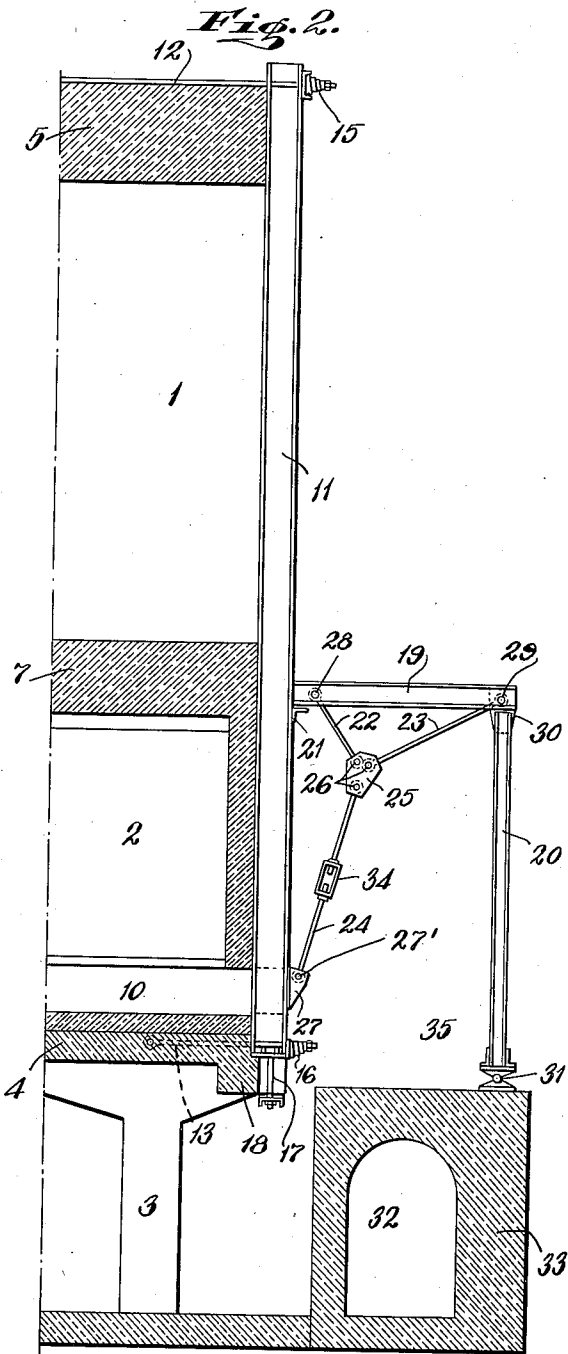
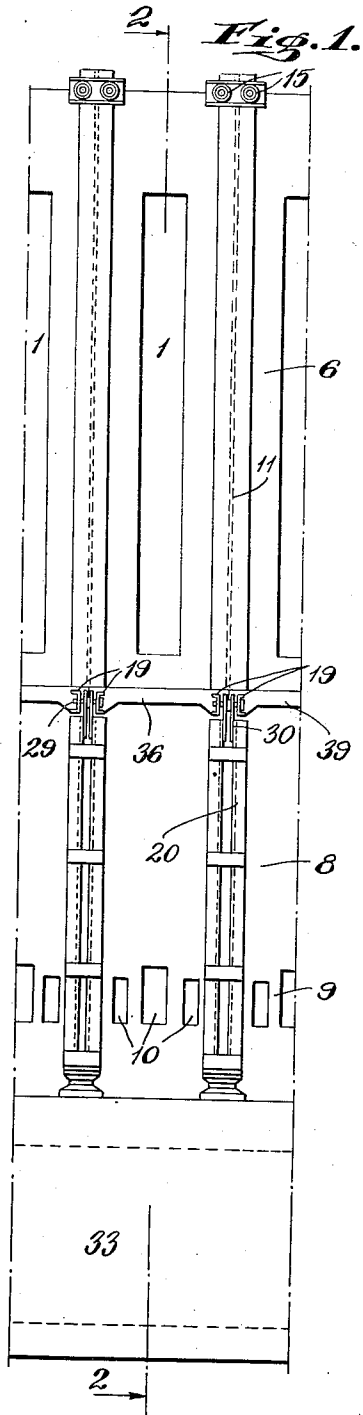
May 7, 1940.

C. OTTO

2,199,510

COKE OVEN REINFORCING MEANS

Filed Nov. 1, 1937



INVENTOR
CARL OTTO

BY
John E. Hubbell
ATTORNEY

UNITED STATES PATENT OFFICE

2,199,510

COKE OVEN REINFORCING MEANS

Carl Otto, Essen, Germany, assignor to Fuel Refining Corporation, Dover, Del., a corporation of Delaware

Application November 1, 1937, Serial No. 172,125
In Germany December 18, 1936

7 Claims. (Cl. 202—268)

The general object of the present invention is to provide a horizontal coke oven battery oven having preheating means below the oven chamber, with improved means for reinforcing the oven brickwork at the sides of the battery, so as to minimize trouble due to the considerably greater thermal expansion increase in battery width at levels adjacent and between the top and bottom of the oven chambers than at levels adjacent the top and bottom of the brickwork mass.

In the construction of coke ovens of the above mentioned type, it is the substantially universal practice to provide vertically disposed metallic posts or buckstays, one in front of, and bearing against each end of each of the heating walls alongside each coking chamber, and to connect the upper end of each such buckstay at one side of the battery to the directly opposed buckstay at the other side of the battery by a tie rod, and to anchor the lower end of each buckstay, as by means of an anchor belt imbedded in the support or foundation for the brickwork mass, in which the coking chambers, heating flues, and air preheating provisions are incorporated.

While the buckstays are employed to control the expansion to some extent, and to minimize the battery deformation resulting therefrom, they are not intended to prevent the battery from increasing in width as it is heated up, or to prevent the increase in width from being considerably greater adjacent and between the oven floor level and the level of the tops of the oven chambers than at levels adjacent the top and adjacent the bottom of the battery brickwork. On the contrary, it is customary to interpose springs, lead plates or other yielding devices between the buckstays and the nuts on the tie and stay bolts through which said bolts operatively engage the ends of the buckstays, which yield as the battery expands in width. The yielding devices are of such stiffness, however, that the buckstays are ordinarily bowed outwardly to an appreciable extent, as a result of the relatively large increase in battery width adjacent and between the levels of the tops and bottoms of the oven chambers at the oven level than at lower levels.

Heretofore various expedients had been proposed to minimize and control the bowing of the buckstays, and other objectionable results of the battery expansion conditions giving rise to that bowing, but all of such prior expedients have been found inadequate or open to practical objection, which it is the object of the present invention to avoid.

In accordance with the present invention, the

bowing of the buckstays by the battery brickwork expansion, is regulated and minimized by means of a brace which is attached to the lower portion of each buckstay and extends outwardly therefrom, and which is of a special form or type which may be designated as semi-portal or semi-truss. The specially formed truss is characterized by its inclusion of a portion which extends outwardly from the buckstay for several feet, and is subjected to a depressing force by the force tending to bow the buckstay and which is prevented from moving downward under said depressing force by a post or strut, provided for the purpose and having its upper end in supporting engagement with the said brace portion, and which has an earth support independent of the battery structure.

While the invention permits of the use of a rigid brace structure rigidly attached to the buckstay along the length of a considerable portion of the buckstay below the oven floor level, the brace advantageously comprises parts hinged or flexibly connected to one another, and hinged or otherwise flexibly connected to the buckstay adjacent the oven floor level, and also at a considerably lower level. In the preferred embodiment of the invention, the brace comprises a head beam and a tension member. Said head beam extends horizontally away from the buckstay adjacent the oven floor level and has one end hinged to the buckstay while its other end forms the portion of the brace engaging a supporting post. The said tension member is a jointed structure and is hinge connected to the head beam adjacent the respective ends of the latter, and is hinge connected to the buckstay adjacent the lower end of the latter. Advantageously, the tension member includes a turnbuckle or the like arranged for easy manipulation and adapted to adjust the length of a tension connection formed by the member between the outer end of the head beam and the lower portion of the buckstay, in the initial oven heating up operation, or whenever changes in operating conditions make such adjustment desirable. In a particularly advantageous form of the present invention, the head beams of the tension members at each side of the battery, serve as supports for the platform or "bench," customarily provided at that side of the battery, at a level, which ordinarily is slightly below the oven floor level.

For a further understanding of the invention and its advantages and objects, reference should be had to the accompanying drawing and descriptive matter, in which I have illustrated a

preferred embodiment of the invention. Of the accompanying drawing:

Fig. 1 is a side elevation of a portion of a coke oven battery; and

5 Fig. 2 is a partial section on the line 2—2 of Fig. 1.

The coke oven battery structure conventionally illustrated by way of example, in the drawing, is of a well known and extensively used type, commonly referred to as the "Otto underfired" type, in which the brickwork mass in which the coking chamber 1 and regenerator spaces 2 are formed, rests on a reinforced concrete slab 4, carried by pillars 3. The major elements of the brickwork mass comprises the battery cover or roof 5, the heating walls 6, one between each adjacent pair of coking chambers and each ordinarily formed with vertical heating flues, an oven bottom or base portion 7, regenerator brickwork 8, and the walls 9, of the regenerator sole channels 10. In front of, and engaging the central portion of each heating wall end and the subjacent regenerator partition wall, is an anchor post or buckstay 11. Each buckstay 11 is connected at its upper end to the directly opposite buckstay at the other side of the battery, by a corresponding pair of tie rods 12 located above the oven roof 5. The lower end of each buckstay is anchored to the slab 4 by means of an anchor bolt 13 extending into and secured in the slab. Reversing valves may be connected to the outer ends of the channels 10, in the customary manner. As shown, springs 15 and 16 are interposed between the upper and lower ends of each buckstay and the nuts on the corresponding tie rod and anchor bolts, so that the force impressed by said bolts on the buckstay, and through the latter on the battery brickwork, is transmitted to the buckstay by said springs and corresponding to the tension thereof.

In front of, and connected to each buckstay 11 is a brace member in the form of a semi-portal or semi-truss, comprising a head beam 19, extending horizontally away from the buckstay at a level a short distance below the oven floor level. As shown, the beam 19 is formed of two oppositely facing channel bars and rests loosely upon an angle bar part 21 secured to the corresponding buckstay against the outer edge of which the adjacent end of the beam 19 abuts. The outer end of the beam 19 rests on the upper end of a vertical post or strut 20. Each brace also comprises a tension member, which in the form shown comprises three iron bars or rods, each formed with an eye at each end.

The lower ends of the bars 22 and 23, and the upper end of the bar 24 are pivotally connected to a connecting element 25, which advantageously consists of a pair of metal plates spaced away from one another to permit the ends of the bars to extend between the plates. Each bar is mechanically connected to the plates of element 25, by a bolt 26 passing through the eye at the end of the bar. The lower end of the bar 24 is pivotally connected by a bolt 27 passing through the eye at the lower end of the bar, to a bracket 27 secured to the corresponding buckstay 11, adjacent the lower end of the latter. The upper end of the bar 22 extends into the space between the two channel bars forming the beam 19 and is connected to said channel bars adjacent their ends in engagement with the buckstay 11 by a bolt 28. The upper end of the bar 23 also extends into the space between the channel bars forming the beam 19, and is con-

nected thereto, adjacent the outer end of the beam, by a bolt 29.

The bolt 29 also passes through plate-like parts 30 secured to the upper ends of oppositely facing channel bars constituting the vertical elements of the upright support or post 20. The latter, as shown, rests on a roller element 31, supported as shown on the masonry 33 surrounding the usual waste heat tunnel or flue extending longitudinally of the battery at the side of the latter. As shown, the rod 24 is divided into two end to end sections connected by a turn-buckle 34, which is readily accessible for adjustment by a workman in the gallery or passageway 35 above the masonry 33, and between the battery structure and the posts 20.

In the preferred construction illustrated, the usual bench at the side of the battery and at a level slightly below the oven floor level, is formed by a series of end to end cement slabs 36, ordinarily reinforced in the usual manner, and each having its ends extending into overlapping engagement with, and supported by, the horizontal flanges of adjacent channel bar portions of the two adjacent head beams 19.

The location of air preheating provisions, such as the regenerators of the construction shown, in the portion of the battery brickwork beneath the oven chambers contributes, when the battery is heated up, to the large and more or less gradual decrease in brickwork temperature of the heat from the oven floor level to the bottom of said brickwork.

In heating up a coke oven battery provided with my improved reinforcing means, the expansion of the brickwork, as its temperature rises, increases the battery width adjacent and between the levels of the tops and bottoms of the oven chambers relative to the battery width at the top and bottom of the battery. In consequence, the portion of each buckstay 11 intermediate said levels, and the corresponding beams 19 are moved horizontally away from the longitudinal central plane of the battery. Corresponding horizontal movements of the ends of the buckstay are opposed by the corresponding tie rod 12 and stay bolt 13, which thereby tend to bow or bend the buckstay outward. Such bowing or bending of the buckstay tends to lower the outer end of the corresponding head beam 19. Down movement of the outer end of the beam 19 is prevented, however, by the corresponding strut or post 20. Such bending or bowing of the buckstay tends, therefore, to an increase in the distance between the lower end of the buckstay and the outer end of the beam 19, but the tension connection between the lower portion of the buckstay and the beam 19 opposes an increase in the last mentioned distance. As will be apparent, the resultant stresses to which the different bar or rod elements 22, 23 and 24 are subjected, are all tension stresses, and as the heating up operation proceeds, the tension stress to which each of said bars is subjected, may be minimized, and kept within safe limits, by rotation of the turnbuckle 34 from time to time to suitably increase the effective length of the bar 24.

The formation of the tension connection between each beam 19 and the lower end of the corresponding buckstay, by the three bars 22, 23, and 24, pivotally connected to one another by the connecting means 25, as described, is especially advantageous, because it displaces said tension connection away from the line extending between the outer end of the beam 19 and the bracket 27

and toward the battery, whereby the width of the portion of the gallery passage or space 35 through which the battery attendants may move, is increased.

5 Having now described my invention, what I claim as new and desire to secure by Letters Patent, is:

10 1. The combination in a horizontal coke oven battery structure having coking chambers and walls formed with heating flues alternating with said chambers, said chambers and walls extending between the opposing sides of the battery, and having air preheating means below the oven chambers, of vertical buckstays at the sides of the battery, one in front of and adapted to engage each end of each of said walls, separate bracing devices for the different buckstays, each device including a rigid element having a portion engaging the corresponding buckstay adjacent the oven floor level and held against movement relative to said buckstay downwardly or inwardly toward said battery structure and extending outwardly away from the battery, a tension connection between said element and the lower portion of said buckstay, and means engaging a portion of said element at a distance from the battery and opposing downward movement of the last mentioned portion.

20 2. A combination as specified in claim 1, in which the element of each bracing device extending outwardly from the battery adjacent the oven floor level is a horizontal beam.

25 3. A combination as specified in claim 1, in which the bracing devices at one side of the battery provide supports for a bench or platform adjacent the oven floor level.

30 4. A combination as specified in claim 1, in which the said element of each of the bracing devices at one side of the battery, is a horizontal beam having a horizontal flange extending away from the beam at each side of the latter, and in which concrete platform slabs are supported by the adjacent flanges of each adjacent pair of said beams, whereby said slabs form a bench or platform at the side of the battery.

35 45 5. A combination as specified in claim 1, in which the tension connection of each bracing device is adjustable to permit variations in the distance between the lower end of the corresponding buckstay and the said portion at a distance from the battery of the said rigid element.

50 55 6 The combination in a horizontal coke oven battery structure having coking chambers and walls formed with heating flues alternating with said chambers, said chambers and walls extending between the opposing sides of the battery, and having air preheating means below the oven

chambers, of vertical buckstays at the sides of the battery, one in front of, and adapted to engage one end of each of said walls, separate bracing devices for the different buck stays, each of said devices including a beam extending horizontally away from the battery adjacent the oven floor level and having one end abutting against the corresponding buckstay, means connected to the latter supporting said one end of said beam against down movement, a tension member pivotally connected at its upper end to said beam adjacent the outer end of the latter, a second tension member pivotally connected at its upper end to said beam adjacent said one end of the latter, a third tension member having its upper end pivotally connected to the lower ends of the two first mentioned tension members, and a pivotal connection between the lower end of said third tension member and the buckstay adjacent the lower end of the latter, and supporting means engaging and preventing down movement of the end of said beam remote from the battery.

7. The combination in a horizontal coke oven battery structure having coking chambers and walls formed with heating flues alternating with said chambers, said chambers and walls extending between the opposing sides of the battery and having air preheating means below the oven chambers, of vertical buckstays at the sides of the battery, one in front of, and adapted to engage one end of each of said walls, separate bracing devices for the different buckstays, each of said devices including a beam extending horizontally away from the battery adjacent the oven floor level and having one end abutting against the corresponding buckstay, means connected to the latter and supporting said one end of said beam against down movement, a tension member pivotally connected at its upper end to said beam adjacent the outer end of the latter, a second tension member pivotally connected at its upper end to said beam adjacent said one end of the latter, a third tension member having its upper end pivotally connected to the lower ends of the two first mentioned tension members, a pivotal connection between the lower end of said third tension member and the buckstay adjacent the lower end of the latter, one of said tension members including a turnbuckle for adjusting the effective length of the member, and thereby of the tension connection collectively formed by said members between said beam and the lower portion of said buckstay, and supporting means engaging and preventing down movement of the end of said beam remote from the battery.

CARL OTTO.