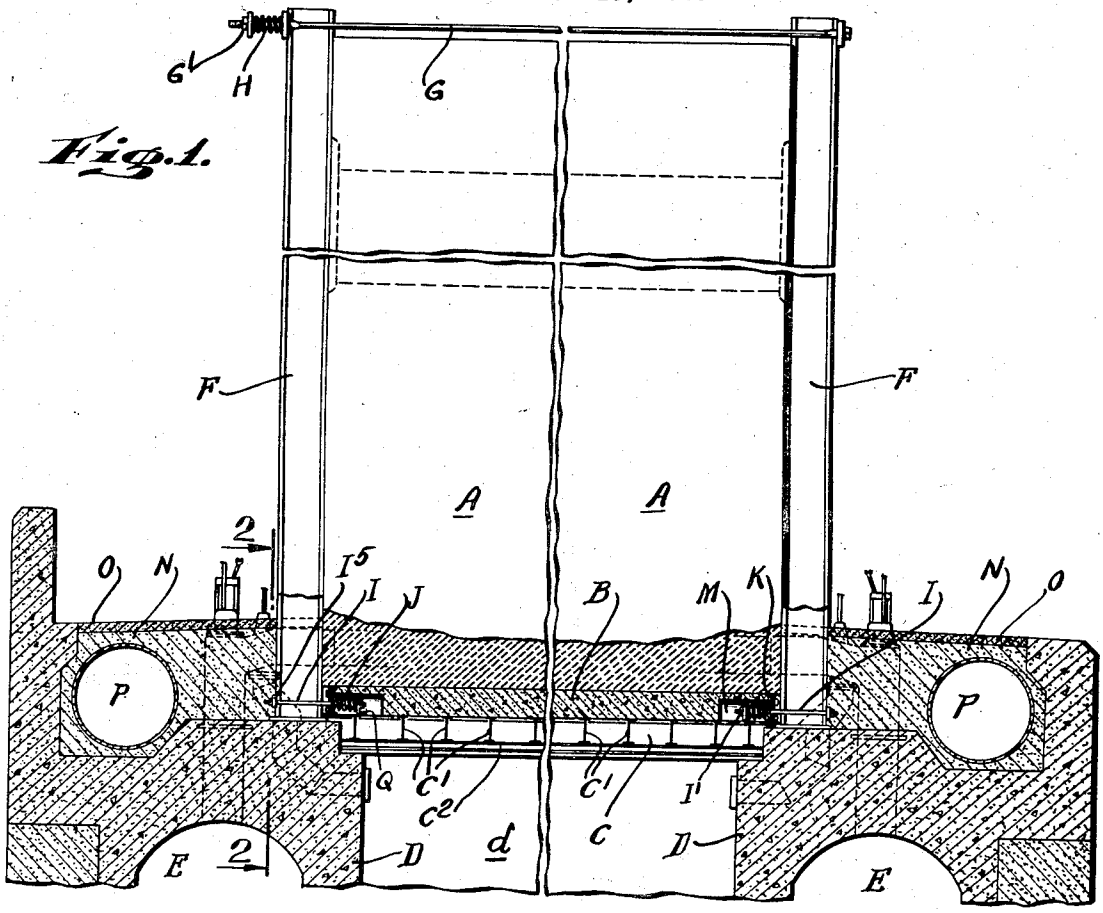
March 25, 1941. L. WILPUTTE 2,235,970

UNDERFIRED COKE OVEN

Filed June 19, 1940

Fig. 1.



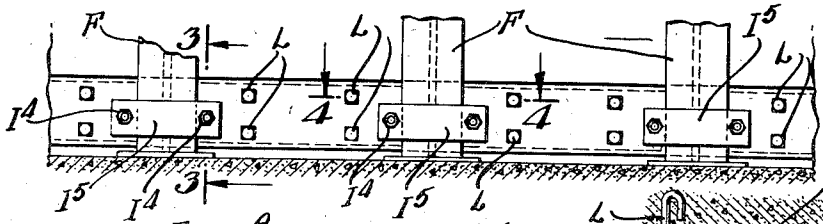


Fig. 2.

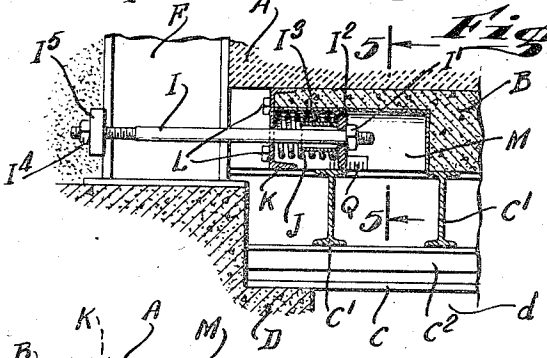


Fig. 3.

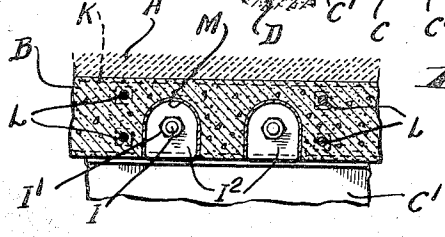


Fig. 5.

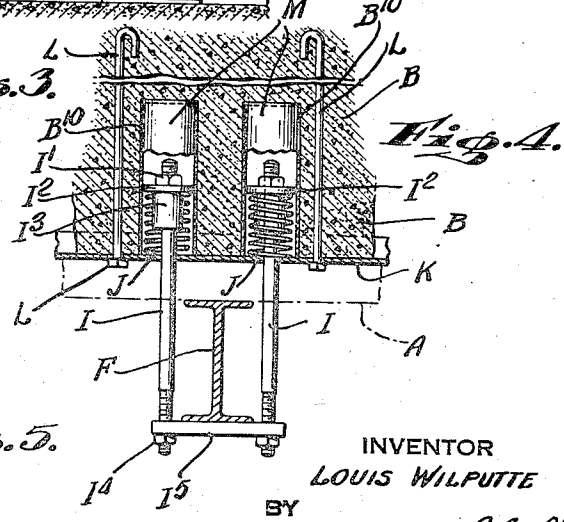


Fig. 4.

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UNDERFIRED COKE OVEN

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Application June 19, 1940, Serial No. 341,259

6 Claims. (Cl. 202—268)

The present invention relates to the construction of a coke oven battery structure of the underfired type and having coking chambers and heating walls of the general character commonly employed in this country and abroad for the manufacture of metallurgical coke, and the general object of the present invention is to provide a structure of the type mentioned including novel and desirable means for resiliently opposing the tendency of the lower ends of the vertical buckstays at each side of the battery, to move outwardly away from the center of the battery.

The usual underfired coke ovens used in the production of metallurgical coke are all alike in having vertical buckstays at the sides of the battery, each of which has an upper portion bearing against a corresponding heating wall end and has a lower portion in abutting relation with the end of a regenerator division wall directly beneath the heating wall. Each vertical buckstay at one side of the battery customarily has its upper end connected by means including a tie bolt and a spring to the corresponding buckstay at the opposite side of the battery. Heretofore, the lower end of each buckstay has been yieldingly held against movement away from the center of the battery, by means customarily including an anchor bolt rigidly anchored in the reinforced concrete supporting deck, or slab, on which the coke oven brickwork mass is directly supported, and a cushion spring interposed between the outer side of the buckstay and an abutment nut threaded on the outer end of the anchor bolt, and requiring adjustment to keep the cushion spring under proper tension notwithstanding changes in the width of the battery occurring in its operation.

In accordance with the present invention, the lower ends of the buckstays are yieldingly restrained against outward movement by bolts connected at their outer ends to the buckstays and each extending into a chamber or space which is formed in the supporting deck of the battery and which also receives a cooperating cushion spring. The outer end of the spring engages the outer end wall of the spring receiving chamber or space. The inner end of the spring is engaged by an abutment nut threaded on the inner end of the corresponding tie bolt, and angularly adjustable to vary the extent to which the spring is compressed. The said chambers or spaces are open at their underside to the characteristic basement space of the battery so that each of said abutment nuts is accessible for angular adjustment at any time. In the preferred form of the present invention, the outer end walls of the spring receiving chambers or spaces are formed by metal bars which form the side edge portions of the supporting deck, and are secured to the reinforced concrete body portion of the deck by anchor bolts.

By locating the cushion springs and associated adjusting provisions within chambers or spaces in the deck structure with access for their adjustment from the basement space of the battery, I avoid disadvantages experienced with prior arrangements. In particular, the new arrangement makes the adjusting provisions for the lower ends of the buckstays readily accessible for adjustment at all times, and those provisions and the associated cushion springs are housed in a dry clean space in which they are out of the way, and are shielded from injurious accidental contacts.

The various features of novelty which characterize my 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, however, its advantages, and specific objects attained with its use, reference should be had to the accompanying drawing and descriptive matter to which I have illustrated and described a preferred embodiment of the invention.

Of the drawing:

Fig. 1 is a somewhat diagrammatic end elevation of the battery with parts broken away and in section;

Fig. 2 is a partial section taken on the line 2—2 of Fig. 1, and on a larger scale than the latter;

Fig. 3 is a partial section on the line 3—3 of Fig. 2;

Fig. 4 is a partial section on the line 4—4 of Fig. 2; and

Fig. 5 is a partial section on the line 5—5 of Fig. 3.

The underfired coke oven battery illustrated by way of example in the drawing, comprises an elongated masonry mass A. The masonry mass A may be formed with transversely extending coking chambers, heating walls and regenerator spaces, which need not be illustrated or described herein as they form no part of the present invention, and may be of any usual or suitable type, such, for example, as the type shown in the Pavitt Patent 2,098,013. The masonry mass A rests upon and is directly supported by a slab B of reinforced concrete commonly called a deck, and customarily divided into a series of sections running longitudinally of the battery with transversely extending expansion joints between the sections.

The deck B, as shown, is supported by a metallic structure comprising beams C and C'. The beams C extend transversely of the battery, and are spaced apart by a distance which ordinarily is twice the distance between the center lines of adjacent coking chambers. As shown, the deck B is directly supported by the beams C' which extend longitudinally of the battery each between two adjacent beams C, and are supported by flange parts C^2 attached to the webs of the beams C. The beams C are supported at their ends by the masonry D which forms the side walls of the characteristic underfired battery basement space *d* and which, as shown, surrounds, and forms the walls of, waste heat tunnels E running longitudinally of the battery. Intermediate their ends, the beams C are supported at intervals by reinforced concrete columns D extending up through the basement space *d* from the battery foundation proper (not shown), which forms the bottom wall of said space.

At each side of the battery are the usual vertical buckstays F each with its upper portion in front of and in supporting relation with one end of a corresponding heating wall, and with its lower portion in front of and in supporting relation with one end of a regenerator division wall directly beneath the heating wall. As shown, the two buckstays F at the opposite ends of each heating wall are connected at their upper ends in the usual manner by means comprising a tie rod G and a cushion spring H surrounding a threaded end portion of the tie rod, and interposed between the upper end of one of the buckstays and an adjustable abutment nut G' threaded on the tie rod. In respect to the above mentioned parts A—H, the battery structure illustrated is of known type and includes nothing claimed as novel herein.

The present invention comprises the novel means now to be described, for resiliently opposing the tendency of the lower end of each buckstay to move outwardly away from the center of the battery under the mechanical and thermal stresses to which the battery structure is subjected when heated up and in regular operation. As shown, said means comprise tie bolts I, each of which has its threaded inner end extending into a corresponding cell or spring chamber B^{10} formed in the adjacent edge portion of the deck B. A nut I' threaded on the inner end of each tie rod I and an associated washer I^2 form an adjustable abutment for the inner end of a cushion spring J. The latter surrounds the tie rod and is positioned relative to the latter by a tubular body or thimble I^3 which may or may not be welded or otherwise attached to the corresponding washer I^2. The outer end of the spring J engages a metal bar K which forms the outer end wall for the chambers B^{10} formed along the corresponding edge of the deck section. Each member K is rigidly connected to the corresponding deck section by the bolts L anchored in the reinforced deck structure.

As shown best in Fig. 4, the resilient connection for the lower end of each buckstay F, comprises two tie bolts I, one at each side of the beam, and each acting on the beam through a cross bar I^5 engaging the outer edge of the buckstay. Each of the tie rods I extends through the corresponding bar I^5 and engages the latter through a nut I^4 threaded on its outer end. As shown, each cell or chamber B^{10}, has its side, top, and inner end walls lined by a metallic casing element M, which may be put in place prior to the pouring of the concrete which forms the body portion of the deck section in which the casing element is thus embedded. As shown in Fig. 5, each casing element M may well be in the form of an inverted trough with a rounded bottom as shown in Fig. 4, and with its mouth open to the basement space *d*, so that, as shown best in Fig. 3, the nut I' is readily accessible from the basement space, for wrench engagement and adjustment as required to subject the corresponding cushion spring J to the proper compression.

As is well known to those skilled in the art, a modern coke oven battery used in the production of metallurgical coke, ordinarily is about 40 feet wide and is formed of silica bricks, and each oven elongates about 8 inches during the period in which the battery is being heated up to working temperatures. The transverse expansion at the bottom portion of the battery structure A is smaller but still substantial. While the tie bolts G and I do not restrain or restrict the thermal expansion of the individual bricks, they do control the transverse expansion of the battery structure as a whole, in the sense and to the extent that they restrict the tendency to irregular local joint opening effects. To properly serve their purpose, the tie bolts must oppose the tendency of the buckstays to move away from the center of the battery under the expansion thrust of the brickwork with a definite force large enough to suitably restrict the joint opening tendency and low enough to avoid crushing the bricks or rupturing the tie bolts.

In the construction shown, the yielding, retaining force acting upon the buckstays, depends upon the extent to which the cushion springs H and J are compressed, and to keep said force within suitable limits, the adjustment nuts G' and I' must be adjusted from time to time. While little change in the width of the battery structure occurs after the battery is initially brought up to full working temperatures, the capacity for adjustment of the compression to which the cushion springs G and J are subjected, is desirably maintained throughout the operative life of the battery. With the described construction, each of the cushion springs J, and the corresponding adjustment nut I' are housed in a clean dry space, with the nut at all times accessible for adjustment from the basement space. In the respects just noted, the present invention has great advantages over the prior practice in which the lower ends of the buckstays are held in place by cushion springs at the outer sides of the buckstays and acting between the latter and adjusting nuts on the outer ends of tie bolts anchored in the deck member B, generally as are the tie bolts L.

With the present invention, the cushion springs J are in a much better location than when in the space at the outer side and immediately adjacent the lower ends of the buckstays. That space is necessarily restricted as a result of the pipe connections to the regenerators and the reversing valves also located in the space. Moreover, if the battery is adapted for optionally firing with rich gas or lean gas, as is customary, lean gas supply mains are usually arranged at the sides of the battery at about the level of the lower ends of the buckstays as are the mains P shown in the drawing. In consequence, the cushion springs located in the space at the outer side of the lower ends of the buckstay, are apt to interfere with battery operations, and are ex-

posed to accidental blows and other injurious contacts unless embedded as they sometimes are, in a slag or analogous foundation for a bench plate pavement, such as the foundation N for the pavement O shown in the drawing.

When the cushion springs are at the outer sides of the lower ends of the buckstays and embedded in a pavement foundation, the corresponding adjustment nuts are not accessible for adjustment, and the operativeness of the springs is apt to be destroyed in whole or large part, by the entrance of solid slag particles into the spaces between the spring convolutions.

To facilitate the proper adjustment of the adjusting nuts I' particularly during the initial heating up operation, one or more scale marks Q may advantageously be placed on the inner wall of the casing member M, in position to cooperate with the washer I^2, in providing an accurate and easily read measure of the actual length of the compressed spring, or of the difference between the actual spring length and the spring length corresponding to the desired compression of the spring.

While in accordance with the provisions of the statutes, I have illustrated and described the best form of embodiment of my invention now known to me, it will be apparent to those skilled in the art that changes may be made in the form of the apparatus disclosed without departing from the spirit of my invention as set forth in the appended claims and that in some cases certain features of my invention may be used to advantage without a corresponding use of other features.

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

1. An underfired coke oven battery having a basement space and comprising a mass of coke oven brickwork, a reinforced concrete deck above said space and supporting said brickwork mass and having spring chambers in its side edge portions and spring abutments at the outer ends of said chambers, vertical buckstays at the sides of said mass, and connections between the lower ends of the buckstays and said deck member, each such connection comprising a cushion spring in an adjacent spring chamber with its outer end in engagement with the abutment at the outer end of said chamber and means acting between the inner end of said spring and an adjacent buckstay.

2. An underfired coke oven battery having a basement space and comprising a mass of coke oven brickwork, a reinforced concrete deck above said space and supporting said brickwork mass and having spring chambers in its side edge portions and spring abutments at the outer ends of said chambers, vertical buckstays at the sides of said mass, and connections between the lower ends of the buckstays and said deck member, each such connection comprising a cushion spring in an adjacent spring chamber with its outer end in engagement with the abutment at the outer end of said chamber and means acting between the inner end of said spring and an adjacent buckstay, and including adjustable means accessible for adjustment from said basement space for varying the extent to which the spring is compressed by the first mentioned means.

3. An underfired coke oven battery having a basement space and comprising a mass of coke oven brickwork, a reinforced concrete deck above said space and supporting said brickwork mass and having spring chambers in its side edge portions and spring abutments at the outer ends of said chambers, vertical buckstays at the sides of said mass, and tie bolts extending into said spring chambers and each connected at its outer end to a corresponding buckstay and provided at its inner end with an adjusting nut accessible for adjustment from said basement space and cushion springs within said spring chambers and each compressed between a corresponding one of said adjusting nuts and the abutment at the outer end of the corresponding spring chamber.

4. An underfired coke oven battery having a basement space and comprising a mass of coke oven brickwork, a reinforced concrete deck above said space and supporting said brickwork mass, metallic casing parts incorporated in the side edge portions of said deck and forming walls of spring chambers open at their undersides to said basement space, said deck comprising an abutment portion at the outer end of each of said chambers, vertical buckstays at the sides of said mass, and connections between the lower ends of the buckstays and said deck member, each such connection comprising a cushion spring in an adjacent spring chamber with its outer end in engagement with the abutment portion at the outer end of said chamber, and a tension member acting between the inner end of said spring and an adjacent buckstay, and adjustable means accessible for adjustment from said basement space for varying the extent to which the spring is compressed by the first mentioned means.

5. An underfired coke oven battery having a basement space and comprising a mass of coke oven brickwork, a reinforced concrete deck above said space and supporting said brickwork mass and having spring chambers in its side edge portions and including metallic parts at its side edges forming spring abutments at the outer ends of said chambers, and metallic anchoring means for said parts extending inwardly into said deck from its side edges, vertical buckstays at the sides of said mass, and tie bolts extending into said spring chambers and each connected at its outer end to a corresponding buckstay and provided at its inner ends with an adjusting nut accessible for adjustment from said basement space and cushion springs within said spring chambers and each compressed between a corresponding one of said adjusting nuts and an abutment at the outer end of the corresponding spring chamber.

6. An underfired coke oven battery having a basement space and comprising a mass of coke oven brickwork, a reinforced concrete deck above said space and supporting said brickwork mass and having spring chambers in its side edge portions and spring abutments at the outer ends of said chambers, vertical buckstays at the sides of said mass, and tie bolts extending into said spring chambers and each provided at its inner end with an adjusting nut accessible for adjustment from said basement space and cushion springs within said spring chambers and each compressed between a corresponding one of said adjusting nuts and the abutment at the outer end of the corresponding spring chamber, and a yoke member at the outer side of each buckstay and to which is connected the outer ends of two of said tie bolts, one at each side of said buckstay.

LOUIS WILPUTTE.