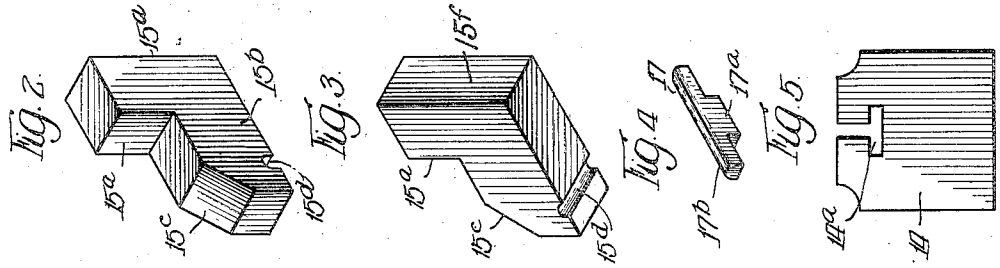
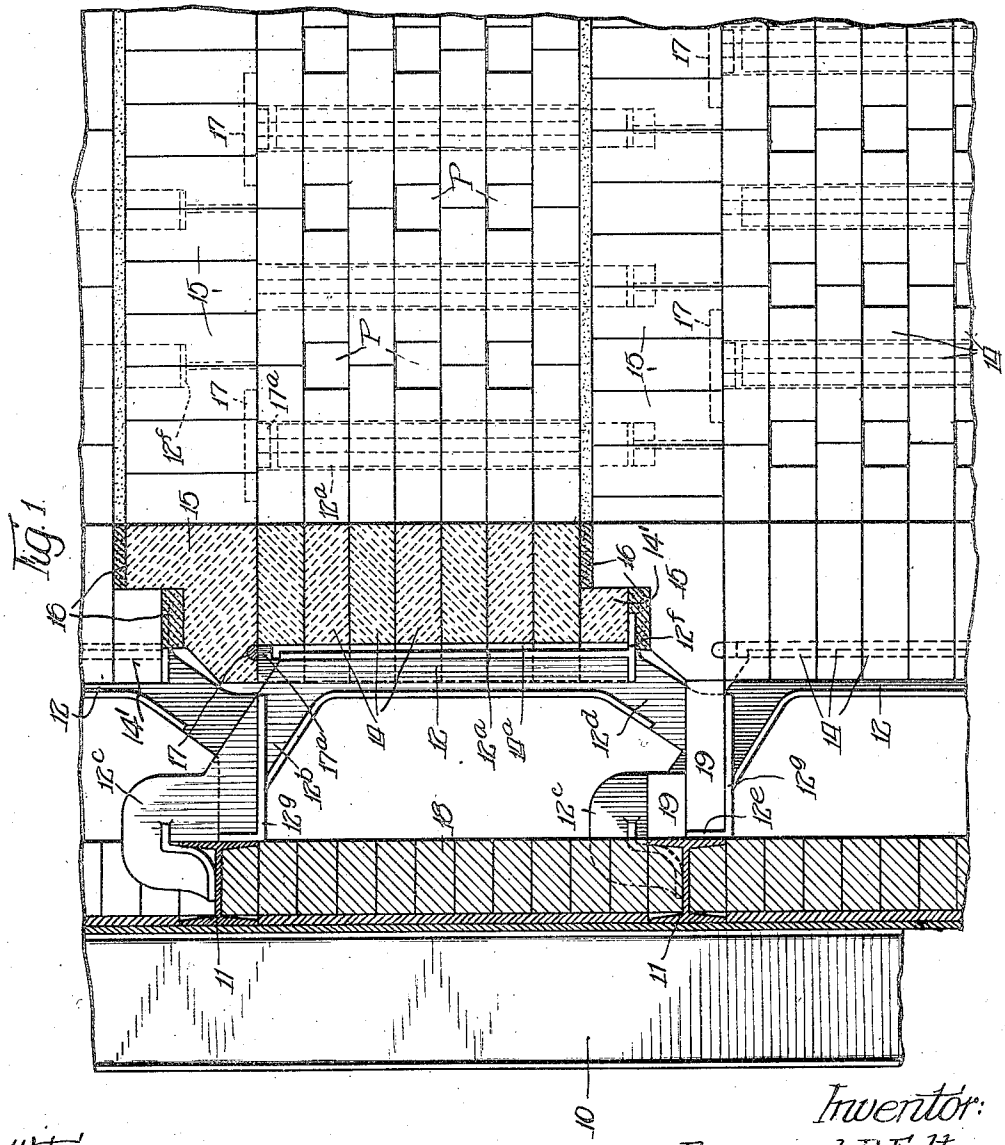
Feb. 18, 1930. R. D. FOLTZ 1,747,824

FURNACE WALL CONSTRUCTION

Filed Sept. 16, 1926





Witness:
A. Burkhardt.

Inventor:
Raymond D. Foltz,
By Cromwell Breitzwieser
attys.

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UNITED STATES PATENT OFFICE

RAYMOND D. FOLTZ, OF SOUTH ORANGE, NEW JERSEY, ASSIGNOR TO M. H. DETRICK COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS

FURNACE-WALL CONSTRUCTION

Application filed September 16, 1926. Serial No. 135,747.

This invention relates to the construction of furnace walls of the type described in my co-pending applications Serial Nos. 684,689 and 711,557, and has to do primarily with improvements in construction for retaining the wall refractories in place, and for protection of supporting metal work.

The general object of the invention is the improvement of the wall construction in particulars further qualifying it to withstand high temperatures over extended periods without critical distortion of supporting frame portions or displacement of wall refractories.

A further object is a construction whereby such improvements may be effected without curtailing the flexibility of the refractory structure or the facility of removal or replacement of wall refractories or wall supporting portions for purposes of repair or the like.

A further object is the provision of a novel wall refractory which is specially qualified for attaining in the structure the advantages and results above indicated.

Other and further objects of the invention will be pointed out or indicated hereinafter, or will be apparent to one skilled in the art upon an understanding of the invention or its employment in practice.

In the drawing forming a part of this specification, I illustrate one form in which the invention may be embodied in structure, but it is to be understood that this is presented for purpose of illustration only and is not to be accorded any interpretation having the effect of limiting the claims short of the true and most comprehensive scope of the invention in the art.

In the drawing,

Fig. 1 is a part sectional elevational view of a portion of a furnace, same being taken through a part of a side wall looking in the direction of the adjoining front wall;

Fig. 2 is a perspective view of a special wall refractory;

Fig. 3 is another perspective view of same;

Fig. 4 is a perspective view of a tile retaining member; and

Fig. 5 is a top view of a wall tile.

In modern boiler installations, the tendency is toward increased sizes and high ratings. The resulting increase in the height of furnace walls, as exemplified particularly in installations for the burning of powdered fuel in suspension, and the high temperatures required, subject the wall refractories to destructive influences much more acute than is the case with smaller installations which are operated at lower furnace temperatures. The high temperatures generated in a furnace result in considerable expansion of the refractories and also a softening of the refractories in their highly heated condition. As a result, it is not feasible to build high furnace walls in the fashion most generally heretofore employed for such constructions, as the weight of the material in the walls tends to "squash" or deform the refractories in their softened condition. Likewise, the destructive effects from erosion, and spalling resulting from heating and cooling of refractories subjected to heavy superimposed weight, are appreciably increased. The form of furnace wall construction disclosed in my two co-pending applications identified above is effective to minimize these destructive influences, and among other advantages, to provide a construction in which repairs may be made easily in any portions of the refractory wall, without requiring extensive dismantling of associated portions of the structure. In the construction referred to, the refractory wall is built in a plurality of sections, associated both collaterally and in superimposed relationships, respective sections being supported independently of the others, so that the weight imposed upon any of the refractories is limited, and refractories may be removed from any of the sections without necessitating the dismantling of other sections. Suitable expansion joints are provided between vertically associated sections, so that the stresses from expansion occurring in one section are not transmitted to sections above or below it. The present invention pertains to a wall construction of this character and will be described with reference to the illustrative embodiment shown in the drawing.

In the arrangement illustrated, let it be

understood that the numeral 10 designates one of a number of column members which are disposed along the furnace walls, being supported on suitable foundations at their lower ends and tied together at various points with transverse members to form a supporting frame work for the furnace wall. Secured to the column members at suitable vertical intervals are the transverse frame members 11, which may be appropriate commercial rolled steel shapes. On the transverse members 11 are supported the section supports, which are suitable heat resisting iron castings. Each of these section supports comprises a web portion 12 having narrow laterally extending flanges 12^a at its margin and at its top a deflected tension arm 12^b terminating in a hook portion 12^c adapted for supporting engagement with one of the frame members 11. At the lower end of the web 12 is a deflected compression arm 12^d terminating in a foot 12^e adapted to bear against the inner face of another of the frame members 11. At the lower terminus of the flanges 12^a is a projecting shelf 12^f, while the tension arm 12^b and the compression arm 12^d are provided with laterally projecting narrow flanges 12^g. The section supporting members are arranged in collateral relationship along the horizontal frame members 11, and upon each of them is disposed a stack or tier of the wall refractories 14, the stack having support on the shelf 12^f of the section supporting member. These wall refractories are tiles provided with slots 14^a which receive the flanges 12^a, by which the refractories are retained against movement in a horizontal direction from the section supporting member. These stacks or tiers or tiles are disposed in lateral abutment, but with spaces between adjacent vertically associated stacks. The section supporting members of adjacent vertically associated stacks are disposed in staggered relationship, so that the compression arms 12^d of the upper row come between the tension arms of those in the next lower row.

The space between adjacent vertically associated rows of stacks is filled with shoe tile 15. These are refractories of a generally L-shape having the upright arm 15^a and the transverse arm 15^b, and are of a length corresponding to that of the refractories 14. They are narrower than the latter, however, so that a plurality of the shoe tile is required to complete the course width of a stack of the tiles 14. The bottom face of the transverse arm 15^b is at right angles to the rear face 15^c of the upright arm 15^a and the front face 15^f of the latter arm is parallel to its rear face. The top surfaces of both the upright and transverse arms are parallel to the lower face of the latter. The upper corner of the transverse arm is bevelled off at 15^c, and toward the outer end of the transverse arm 15^b and in a location corresponding to that of the slot 14^a of the tile 14, the bottom face is provided with a transverse groove 15^d. When the shoe tile are assembled in the structure, they rest with their lower faces on the topmost tile of one of the stacks, with the front face of the upright arm 15^a in alignment with the ends of the tile 14 in the stack, and the rear face of the upright arm overlapping the lowermost tile 14′ of the superadjacent stack or stacks so as to form a close joint between the sections. A proper clearance is left between the upper surfaces of the shoe tile and the lower surfaces of the tile and tile supporting member of superadjacent sections, the clearance space being filled with an appropriate heat resisting compressible material 16, such as asbestos or a mixture of asbestos and fire clay, to accommodate upward expansion of the lower section without imposing the expansion stresses upon the upper sections. Particularly in walls of considerable width, it is desirable to anchor the shoe tile in place at intervals, to prevent their being displaced inwardly by the cumulative expansion of the tile in the horizontal row or course. To afford this anchorage for the shoe tile, while permitting their ready removal, I provide the tile retaining members 17. These are small castings of the form illustrated in Fig. 4. One of these tile retaining members has an anchoring portion 17^a of proper dimension to fit in the slot 14^a of the uppermost tile 14, and a ledge portion 17^b extending beyond the ends of the anchoring portion and adapted to rest on the upper face of the tile 14. The ledge portion 17^b is received in the groove 15^d of the shoe tile, and thereby the latter is anchored against shifting inwardly. It is not essential that these tile retaining members be employed in each stack of tile, but they may be employed where desired, thus affording anchorage for the row or course of shoe tile at intervals. I prefer to have the ledge members of sufficient length, however, to engage a plurality of shoe tile. In the event the clearance between superadjacent stacks is not sufficient to permit the shoe tile being fitted on to the retaining members from above, the shoe tile may be slid on to the retaining members from the ends of the latter.

In the construction of various types of furnaces, it may be desirable to provide air ports through the refractory wall, as indicated at P in Fig. 1. As a means for supplying and properly controlling air for admission through these ports, air compartments are provided about the refractory wall by building up a sheathing wall 18, which is supported in sections on the frame members 11. Air is supplied to the intervening air space, under suitable control, and therein is circulated over the section supporting members with the result that the latter are safeguarded against overheating, and the air receives a certain amount of preheating before passage

into the furnace chamber through the ports P. The bevelled portions 15^c of the shoe tile afford a proper clearance between the tile and the compression members 12^d to allow for an intervening circulation of air. Due to the provision of the ports P, more or less radiant heat may be projected into the air chamber. As a means for protecting the steel members 11 from this heat, and also for the purpose of subdividing the space between the walls into compartments, whereby the supply of air to ports at different levels may be controlled, suitable bricks 19 are laid upon the flanges 12^g of the juxtaposed tension and compression arms, thus forming horizontal partitions. The dimensions and design of the section supporting members are such that these bricks 19 will be positioned to cover the frame members 11 within the air compartments, thus shielding the steel members from radiant heat projected through the ports.

By virtue of the construction and specialized form of the shoe tile, therefore, the wall refractories are given suitable anchorage such as will prevent inward bulging of the wall from expansion under heat, and all of the refractories are retained in a flexible fashion so that they may adjust themselves individually with reference to their own expansion and pressures transmitted to them upwardly or laterally. This flexibility in the wall structure tends to eliminate spalling of the refractories. As the section supporting members are freely supported on the frame members, they afford a desirable lateral mobility of the respective wall sections. Tile may be removed from any stack by first removing one or more of the unanchored shoe tile, then shifting the anchored shoe tile laterally to disengage them from the retaining members 17, withdrawing them inwardly, and then moving the tile 14 upwardly to disengage them from the flanges 12^a, and appropriate tile may be placed in the wall by a reversal of these operations. By removal of a number of the shoe-tile, an opening is afforded through the refractory wall for inspection of the sheathing wall and the frame members. The disposal of the partition bricks 19 in proximity to the shoe-tile allows for removal of the former through the space afforded by removal of the latter, so that the frame portions may be inspected. Certain features herein disclosed but not claimed are claimed in my co-pending applications identified above.

I claim:

1. In furnace construction, in combination, separately supported groups of wall refractories, anchoring means for respective groups, tile supported on one group and overlapping another group to close the space between the groups, and means removably anchoring said tile to one of the groups independently of the other group, said tile being detachable from their anchoring means to permit their removal from the wall while the group of wall refractories remain in place.

2. In a furnace wall construction, the combination with separately supported wall sections made up of refractories, of tile supported on one section and overlapping another section to close the intervening space, and tile-retaining members removably anchoring the tile to the first mentioned section.

3. In a furnace wall construction, the combination of supporting members, groups of refractories supported independently by the respective supporting members, said refractories having slots affording them anchoring engagement with the supporting members, a removable tile-retaining member engaged in one of said slots, and a tile having anchoring engagement with said tile-retaining member, whereby it is held in alignment with associated refractories.

4. A furnace wall construction comprising, in combination, wall refractories arranged in superposed independently supported sections, tile closing the space between sections, and tile-retaining members anchoring the tile to one section independently of the other sections and retaining said tile in overlapping association with an adjacent section.

5. In a furnace wall construction, the combination of section supporting members, groups of wall refractories independently supported in superposed relationship on respective supporting members, a tile-retaining member engaged with a refractory of one of said groups, and tile for closing the space between superposed groups, said tile having laterally opening slots movable laterally into anchoring engagement with the tile-retaining member to anchor the tile against displacement transversely of the wall.

6. In a furnace wall construction, the combination of a section supporting member, wall refractories supported by and anchored to said supporting member, a tile-retaining member anchored to one of the refractories and a plurality of shoe-tile having anchoring engagement with the tile-retaining member.

7. In a furnace wall construction, the combination of a section supporting member, a plurality of refractories supported on said supporting member as an upright course and having anchoring engagement with the supporting member, a tile-retaining member having anchoring engagement with one of the refractories, and a plurality of shoe tile supported on said refractory and having anchoring engagement with the tile-retaining member, said shoe tile arranged in collateral disposal and having an aggregate width approximately equal to that of the course of refractories.

8. In a furnace wall construction, the combination with a supporting member, of a slotted tile having anchoring engagement

with the supporting member, a shoe tile supported on the slotted tile, and a tile-retaining member seated in the slot of the slotted tile and having anchoring engagement with the shoe tile.

9. In a furnace wall construction, the combination with wall refractories arranged in a stack with their end surfaces in alignment, of shoe tile formed with a bottom surface resting on one of said refractories and a front surface in alignment with the end surfaces of the refractories, and a tile-retaining member having anchoring engagement with the shoe tile and its supporting refractory.

10. A furnace wall portion consisting of a shoe tile having an upright arm and a transverse arm arranged at right angles, the upright arm having a plane front face and a plane rear face parallel thereto, the transverse arm being bevelled at its upper corner portion and being provided in its lower face with a slot for anchoring engagement with a retaining member.

11. A structural element for a furnace wall, consisting of a shoe tile of refractory material, same being of generally L-shape with an upright arm and a transverse arm extending at right angles, the upright arm having a plane front face and a rear face parallel thereto, the transverse arm having a plane lower face and being provided in said lower face with a transverse groove for engagement with a retaining member, whereby the rear face of the upright arm may be retained in association with a wall portion disposed in the reentrant angle between the arms.

12. An element of furnace wall construction, consisting of a plurality of identical shoe tile of refractory material, said shoe tile being of generally L-shape, each having an upright arm and a transverse arm extending at right angles, both said arms having parallel lateral faces, the upright arm having parallel front and rear faces at right angles to said lateral faces, the transverse arm having parallel top and bottom faces extending at right angles to the front face of the upright arm, the last mentioned arm having a top face extending parallel with the bottom face of the transverse arm, the transverse arms of said refractories being provided in their lower faces with grooves opening laterally of the refractories, whereby the several refractories may have anchoring engagement with a retaining member to hold the rear faces of their upright arms in alignment.

13. In a furnace wall construction, the combination of frame members, section supports supported on said frame members, refractory wall sections supported on the section supports, refractory shoe tile removably mounted between sections, a sheathing wall spaced from the refractory wall sections, and partition brick supported on the section supports between the sheathing wall and refractory wall sections, said partition brick covering the inner portions of frame members.

14. In a furnace wall construction, the combination of frame members, section supports mounted on the frame members, refractory wall sections carried by the section supports in association to form a refractory wall, a sheathing wall spaced from the refractory wall to afford an intervening air chamber, and brick carried by the section supports between the sheathing wall and refractory wall in covering relationship to frame members exposed in the air chamber, to shield said exposed members from radiant heat from the refractory wall.

15. In a furnace wall construction, the combination of frame members, section supports mounted thereon, refractory wall sections carried on said supports, a sheathing wall spaced from the refractory wall sections, partition brick disposed in the space between the sheathing wall and refractory wall sections, refractory shoe tile closing the space between superadjacent wall sections, and a tile-retaining member anchoring shoe tile to a wall section in position to form an abutment for partition brick.

16. In a furnace wall construction, the combination of frame members, section supports mounted thereon, refractory wall sections carried by said supports, a sheathing wall spaced from said refractory wall sections, partition brick subdividing the space between the sheathing wall and refractory wall sections, refractory shoe tile disposed in association with said partition brick and closing the space between superadjacent refractory wall sections, and a tile-retaining member anchoring the shoe tile against movement inwardly from the wall sections.

17. In furnace wall construction, in combination, refractories anchored in separately supported superposed wall sections, shoe tile disposed in the wall between the anchored refractories of adjacent sections to form a portion of the wall therebetween, and means anchoring said shoe tile to one section and permitting removal of said shoe tile horizontally from the wall while the anchored refractories remain in place, the removal of said shoe tile affording space for removal of anchored refractories from their anchorage.

18. In furnace wall construction, in combination, relatively movable wall sections disposed in superposed relationship, the respective sections comprising refractories anchored against displacement horizontally but detachable from their anchorages by upward movement, shoe tile inserted in the wall between the anchored refractories of adjacent sections to close the space between the sections, and a tile retaining member anchoring said shoe tile to one of the sections to prevent horizontal displacement of the same transversely of the wall but permitting removal

of the shoe tile while the anchored refractories remain in place.

19. In furnace wall construction, in combination, separately supported wall sections each comprising refractories anchored against horizontal displacement, shoe tile forming the wall portion between adjacent sections, retaining means anchoring said shoe tile to one of the sections independently of the other section, and compressible material between the shoe tile and said other section, the removal of said compressible material affording space for movement of the shoe tile to disengage same from said retaining means.

In testimony whereof I have hereunto subscribed my name.

RAYMOND D. FOLTZ.

CERTIFICATE OF CORRECTION.

Patent No. 1,747,824. Granted February 18, 1930, to

RAYMOND D. FOLTZ.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, line 3, for number "684,689" read "684,698"; page 2, line 79, for "superadjacent" read "superjacent"; page 3, line 68, claim 1, for the word "group" read "groups"; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 15th day of April, A. D. 1930.

M. J. Moore,
Acting Commissioner of Patents.

(Seal)