

April 6, 1965

A. DAVIES ETAL

3,176,433

FURNACE WALL CONSTRUCTION

Filed Dec. 27, 1960

Fig. 1.

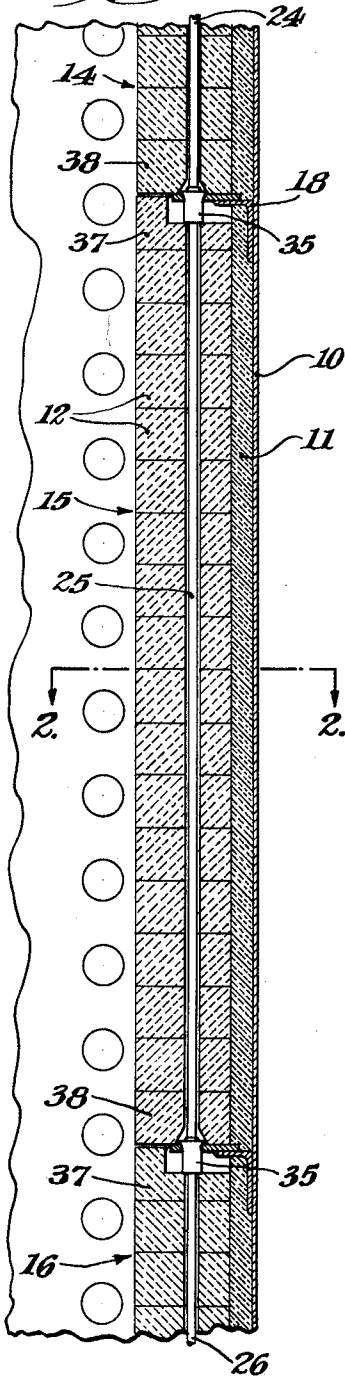


Fig. 2.

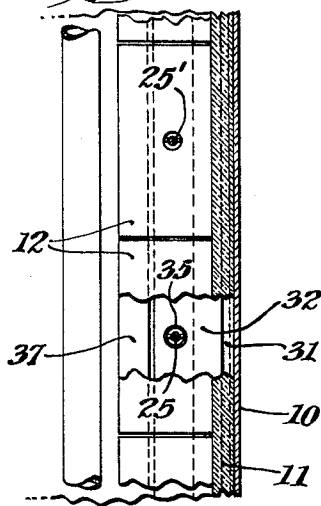
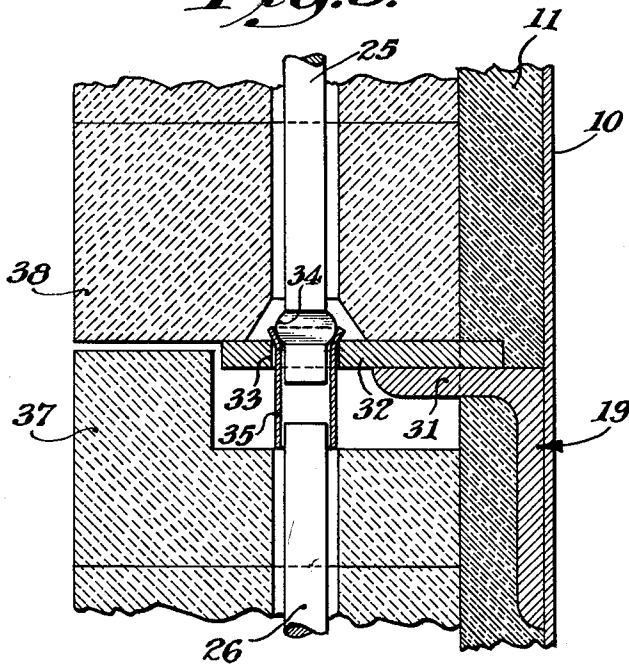


Fig. 3.



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1

2

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**FURNACE WALL CONSTRUCTION**

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Filed Dec. 27, 1960, Ser. No. 78,777

9 Claims. (Cl. 50-404)

This invention relates to an improved furnace construction and particularly to the construction of a heat resistant wall therefor having at least a layer thereof comprising a plurality of stacked heat resistant bricks secured and aligned at the wall by anchoring rods held at their opposite ends.

Furnace walls utilizing a plurality of stacked heat resistant or refractory bricks have been known heretofore and various arrangements for securing the bricks in their stacked relationship to define the inwardly exposed surface of the furnace have been used. In known structures, certain problems have arisen presenting inconvenience and expense not only with respect to the furnace wall structures themselves but also as to techniques and number of technicians required for assembly, repair and maintenance of such structures. Prior structures requiring technicians on both sides of the wall for assembly and/or repair have disadvantages not only because of labor costs, but also because optimum use of space at the outside of the furnace cannot be had.

Inasmuch as the wall structures may be subjected to extraordinarily high temperatures, either continuously or intermittently, there may exist substantial undesirable and perhaps differential expansion of the component parts, due to their temperature coefficients of expansion, which require that not only the bricks but also the structure supporting them be such as to avoid any tendency of the wall to warp or the portions thereof to be subjected to high stresses occasioned by changes in temperature of the wall parts. Prior structures using aligned rods to secure the bricks have accommodated expansion of the rods by providing independent supports for each end of each rod with the ends maintained spaced from each other.

Prior structures have also required special securing devices necessitating the use of special tools during assembly. A structure of this type appears in Patent 2,144,597 in which eye-bolts are used to anchor one end of each rod, the eye-bolts having nuts threaded thereon by a technician at the outside of the wall during the assembly operation.

Among the objects of the present invention are to provide a furnace structure having an improved heat resistant wall, particularly a vertically extending wall, which is very easily assembled, and to achieve such a structure which is inexpensive and dependable.

Another object of the present invention is to provide an improved furnace structure having a heat resistant wall portion of sectionally arranged refractory elements or bricks in which the bricks may be readily removed or reassembled, replaced or repaired without interfering with the bricks of other similar adjacent or remote wall section.

Still another object of the present invention is to provide an improved furnace wall construction which is easier to assemble, particularly in requiring assembly technicians at only one side of the wall structure, preferably within the furnace, whereby the exterior of the furnace wall may be located closely adjacent any other structure without the need for any space for the assembly technicians at the outside of the wall, either for assembly or maintenance.

A still further object of the present invention is to

provide an improved air and gas tight furnace wall which has an interior fire brick lining and which does not depend for its complete gas tightness upon any detachable structure used to secure the bricks to the wall during assembly of the lining at the wall.

A further object of the present invention is to provide an improved furnace wall structure comprising stacks or tiers of fire bricks which stacks or tiers are interconnected by a plurality of rods extending therethrough, which rods need have a unique configuration at only one end whereby the heights of the brick stacks may be varied and the rod length easily shortened to a required length for a particular structure. Such a configuration at one end of the rod is easily formed by subjecting the rod to stacking or the like.

Still another object of this invention is to achieve a structure wherein all detachable parts used to secure the bricks in position are held in place by gravity and may be assembled without need for tools.

The improved furnace wall construction according to the present invention for achieving the aforementioned and other objects may comprise a stationary sealed wall panel, preferably an air-tight sheet metal panel having on its interior surface a layer of insulating block, and a plurality of inwardly projecting shelf-like flanges spaced parallel to each other from top to bottom of the furnace. These flanges are perforated vertically at regular intervals along their horizontal extent. The lower flange of any two flange levels supports refractory structures from below, for example, vertically aligned stacks of heat resistant bricks, and along with the flange above anchors the upper and lower ends of the vertical rods extending through the stacks of bricks. The rods are thus anchored at least against horizontal movement to hold the bricks against the insulating block that lines the interior of the adjacent panel. In this manner, stacks of bricks may be arranged side by side and in a plurality of tiers to cover the inner face of the furnace wall.

More particularly, the rods which position the bricks are preferably constructed for support at their lower ends by the rims defining the apertures in respective flanges so that the rods are prevented from dropping vertically through the flanges from their final assembled positions. The upper ends of each rod in its assembled position terminates close to, but beneath, the adjacent upper flange but is connected and held thereto by a separate member insertable into the aperture in the upper flange in vertical alignment with the aperture in the lower flange. The separate member may also position the lower end of another rod thereabove to the upper flange and prevent said rod from passing through the aperture in the latter flange. This separate interconnecting member is preferably a sleeve which can be inserted into a flange aperture, but which is incapable of passing therethrough, and which, when inserted, is also capable of receiving and positioning adjacent ends of two generally vertically aligned rods somewhat apart from each other on opposite sides of the flange. To facilitate the assembly of the rods into the flanges and through the flange apertures, the apertures may be of sufficient size that the rods pass therethrough in the absence of the aforementioned sleeve in the aperture. The sleeve, in effect, provides for a telescopic interconnection of the adjacent ends of the vertically aligned rods at the same time permitting vertically adjacent rods to be spaced sufficiently from each other to accommodate changes in length due to expansion and contraction during use of the furnace.

The foregoing and other objects of the invention will be made apparent not only by this brief description of the invention but also by the following detailed description of a preferred embodiment which is given merely

by way of example, and not as limiting of the possible modifications obvious in view of this specification and falling within the scope of the appended claims, the details of the preferred embodiment being described in connection with the accompanying drawings, in which

FIGURE 1 is a partial vertical section of a furnace wall structure having a plurality of tiers of stacked fire brick wall sections.

FIGURE 2 is a partial horizontal section taken along line 2—2 of FIGURE 1 and illustrating a plurality of horizontally adjacent stacks of bricks in one tier of the wall structure, and

FIGURE 3 is an enlarged vertical section illustrating in greater detail the structure for anchoring the stacks of bricks against vertical and horizontal displacement.

Referring now to FIGURES 1 and 2 for a general description of the wall structure, the exterior of the furnace may be defined by a gas-tight heat resistant sheet metal panel 10 having over substantially all of its interior surface an insulating layer 11, consisting of insulating blocks or sheets held against the metal panel 10 in any suitable manner, even possibly by the tiers of stacked fire bricks 12 forming the interior surface of the furnace.

As seen in FIGURE 1, there are a plurality of tiers 14, 15 and 16 of brick stacks separated by metallic anchoring flanges 18 and 19 having portions projecting inwardly of the furnace from the metal panel 10. These flanges are securely affixed to the metal panel in any suitable manner, for example, by welding. The respective tiers 14 and 15 and 16 are positioned against the insulating layer 11 by respective aligning and supporting rods 24, 25 and 26 of a suitable heat resistant metal alloy extending vertically through the stacked bricks of the respective tiers.

In FIGURE 2 there are illustrated a plurality of horizontally adjacent stacks of bricks positioned against the insulating layer 11 of the outer wall structure by vertical rods 25 and 25'. Of these horizontally adjacent stacks some of which are shown in partial horizontal section viewed from above in FIGURE 2, all are vertically aligned by means of rods connecting the flanges at the top and bottom of each stack. As indicated in the drawings, it is contemplated that except for the topmost and bottom-most flange, each horizontally extending flange shall be positioned above one tier of horizontally adjacent stacks of bricks and below another tier for anchoring the respective rods therethrough.

FIGURE 3 illustrates a clear example of the details for anchoring the lower end of rod 25 and the upper end of rod 26 to the flange 19. The flange 19 may consist of two portions, a first vertically disposed portion having its outer surface secured to the inner surface of metal panel 10 in the plane substantially vertical thereto and a second horizontally disposed portion 31 extending inwardly of the panel carrying welded or otherwise secured to its upper surface a plate portion 32 perforated vertically at intervals along its horizontal extent by apertures in vertical registry or in alignment with the apertures in the brick stacks 15 and 16, through which the rods 25 and 26 extend.

The perforated plate portion 32 of flange 19 preferably extends horizontally a sufficient distance inwardly from the insulating layer 11, beyond the center of gravity of the stacked bricks, so that the bricks may be stacked vertically on the plate and carried thereby during assembly without toppling over before the anchoring rod is inserted through the stack. The configuration of each rod is such that it may be dropped through the aperture 33 in plate portion 32 of flange 19 above the stack and through the horizontally aligned apertures in the bricks, but is prevented from passing through the next lower aperture 33 by means of a tubular metal ferrule or sleeve-like connecting member 35, which is

dropped into the corresponding aperture 33 in the next lower perforated plate 32 prior to stacking of the bricks thereabove. The connecting member 35 includes laterally projecting means, for example, the outwardly flanged upper end thereof, for abutting the plate 32 at the periphery of the aperture to prevent the sleeve 35 from passing vertically downward through aperture 33. This sleeve member 35 serves to reduce the size of the aperture 33 to block downward passage of the rod. The lower end of each rod is provided with a portion 34 having a greater cross-sectional dimension than the diameter of the rod, attained, for example, by stacking or otherwise deforming the rod. This enlarged portion 34 is of such size as to pass through the aperture 33 when the sleeve 35 is not in position therein but is incapable of passing through the interior of the sleeve 35, and accordingly the lower end of the rod may be supported at the plate 32 by the sleeve 35. The enlargement 34 on the rod is preferably spaced from the lower end sufficiently to provide a tip of the rod of normal diameter which may be received within the sleeve member 35 below the level of plate 32.

As is seen clearly in FIGURE 3, the upper end of rod 26, as well as the upper ends of all other similar rod structures, terminates below the apertured plate 32 and is supported against horizontal movement relative to the plate by means of the depending portion of the sleeve 35. The sleeve 35 thus telescopically interconnects the adjacent ends of the rods 25 and 26 as well as locking each of these ends against horizontal displacement relative to the plate 32. The position of the lower end of rod 25 relative to the sleeve 35 and plate 32 remains substantially unchanged during expansion or contraction of the rod since its stacked or enlarged portion abuts the flange of the sleeve, whereas the end of rod 26 is spaced from the adjacent end of rod 25 to permit expansion or contraction of rod 26 within sleeve 35 due to changes in temperature of the rod.

It is desirable that the adjacent ends of rods at each sleeve 35 be retained within the sleeve but out of engagement with each other throughout the entire temperature range to which the component parts of the wall structure may be subjected during operation of the furnace. Thus each rod is free to expand and contract independently of the other and there can be no cumulative effect of expansion or expansion forces of a plurality of telescopically interconnected rods.

All of the bricks 12 except possibly those immediately adjacent the plate 32 and the structure interconnecting the rods may be similar, of any suitable well known construction and preferably of light weight heat resisting material. The top brick 37 of each stack just beneath the plate 32 may be recessed to accommodate at least a portion of the plate 32 and its supporting bracket 31, as well as providing space for reception of the depending portion of sleeve 35. The lower brick 38 of each stack, resting upon the plate 32, may have a slightly enlarged recess around the rod aperture therein to accommodate the outwardly extending flange portion of the sleeve 35.

The adjacent bricks 37 and 38 at opposite sides of the plate 32 may be specially formed expansion joint bricks and the space between them may be filled with any suitable fire and heat resisting material to form a seal closing the gap therebetween exposed to the interior of the furnace.

From the foregoing description it is obvious that no tools are required to assemble the brick stack and secure them by means of the rods. The rods 24, 25 and 26 and the cooperating sleeve members 35 are retained in assembled position by gravity and during assembly are merely manually dropped into their assembled positions.

The feature of the telescopic interconnection of the rods 25 and 26 could likewise be attained without use of the enlargement 34 at the lower end of the rods providing a sleeve 35 is secured as by welding to the upper ends of each rod. In any event, however, the sleeve interconnects

5

the vertically adjacent ends of the rods, limits their horizontal movement and further supports one of the interconnected rods in its assembled position against downward vertical movement.

While we have shown and described one embodiment in accordance with the present invention, it is understood that the same is not limited thereto but is susceptible of many changes and modifications within the spirit and scope of the present invention, and we, therefore, do not wish to be limited to the details shown and described herein, but intend to cover all such changes and modifications as are encompassed by the scope of the appended claims.

We claim:

1. Refractory assembly for a furnace comprising:
  - (a) a support structure;
  - (b) a plurality of parallel flanges each horizontally affixed to said support structure and vertically disposed with respect to each other, each flange having a portion thereof extending from said structure, each of said portions including an aperture vertically aligned with an aperture of another extending portion;
  - (c) refractory means including an aperture and positioned between a pair of said plurality of flanges, said apertures of said pair of flanges and said aperture of said refractory means being in axial alignment with respect to each other.
  - (d) a first retaining means extending through an aperture of one of said pair of flanges and removably supported thereby;
  - (e) a rod member extending through the aperture of said refractory means, said rod member including an enlarged portion having a configuration of smaller size than the aperture of said one flange to pass therethrough and such that said rod member in combination with said first retaining means is supported by said one flange; and
  - (f) a second retaining means removably supported by and extending through an aperture of the other of said pair of flanges and coaxially surrounding a portion of said rod member for restricting horizontal movement of said rod member.
2. Apparatus as defined in claim 1, wherein each of said retaining means is a separate member insertable into an aperture of a flange during assembly of said refractory means, each of said separate members having means for supporting itself in said aperture of said respective flange.
3. Apparatus as defined in claim 1, wherein each of said retaining means is a generally tubular member insertable into an aperture of said flange during assembly of said refractory means, and wherein each of said tubular members has means for supporting itself in said aperture of said respective flange, and wherein said enlarged portion of said rod member is also supported by said supporting means.
4. Refractory assembly for a furnace comprising:
  - (a) a support structure;
  - (b) a plurality of flanges affixed to said support structure and each flange having a portion thereof extending from said structure, each of said portions including an aperture axially aligned with an aperture of another extending portion;
  - (c) refractory means including an aperture and positioned between a pair of said plurality of flanges, said apertures of said pair of flanges and said aperture of said refractory means being in axial alignment with respect to each other.
  - (d) a first retaining means extending through an aperture of one of said pair of flanges and removably supported thereby;
  - (e) a rod member extending through the aperture of said refractory means, said rod member including at one end an enlarged portion having a configuration of smaller size than the aperture of said one flange to pass therethrough and such that said rod member

6

in combination with said first retaining means is supported by said one flange; and

- (f) a second retaining means removably supported by and extending through an aperture of the other of said pair of flanges and coaxially surrounding a portion of said rod member for restricting movement of said rod member, said second retaining means being recessed to receive and support the enlarged portion end of another rod member.
5. Apparatus as defined in claim 4 wherein said first and second retaining means are identical, and comprise a sleeve-like member having an outwardly extending portion larger than the aperture in each of said portions of said flanges.
6. Apparatus as defined in claim 4 wherein said first and second retaining means are identical, and comprise a sleeve-like member having an outwardly extending portion larger than the aperture in each of said portions of said flanges and wherein the enlarged portion of said rod member engages the outwardly extending portion of said sleeve-like member thereby to vertically support said rod member.
7. Refractory assembly for a furnace comprising:
  - (a) a support structure;
  - (b) a plurality of flanges affixed to said support structure, said flanges having a portion thereof extending from said structure, each of said portions including an aperture axially aligned with an aperture of another extending portion;
  - (c) refractory means including an aperture and positioned between a pair of said plurality of flanges, said apertures of said pair of flanges and said apertures of said refractory means being in axial alignment with respect to each other;
  - (d) sleeve-like members extending through the apertures of said flanges and removably supported thereby; and
  - (e) rod means extending through the apertures of said refractory means and into said sleeve-like members, said rod means including an enlarged portion at one end thereof having a size smaller than the apertures of said flanges to pass therethrough, said enlarged portion having a diameter larger than the inside diameter of a portion of said sleeve-like member, said enlarged portion of said rod means being removably seated in said inner portion of said sleeve-like members thereby supporting said rod means extending through said refractory means, the other end of said rod means extending into a sleeve-like member in an adjacent flange to prevent lateral movement of said rod means.
8. Refractory assembly for a furnace comprising:
  - (a) a support structure;
  - (b) a plurality of parallel flanges each horizontally affixed to said support structure and vertically disposed with respect to each other, each flange having a portion thereof extending from said structure, each of said portions including an aperture vertically aligned with an aperture of another extending portion;
  - (c) refractory means including an aperture and positioned between a pair of said plurality of flanges, said apertures of said pair of flanges and said aperture of said refractory means being in axial alignment with respect to each other;
  - (d) sleeve-like members extending through the aperture of said flanges and supported thereby; and
  - (e) rod members including an enlarged portion at one end thereof of a diameter larger than the inside diameter of a portion of said sleeve-like member and smaller than said apertures in said extending portions of said flanges and said refractory means, said rod members extending vertically through the apertures of said refractory means with the enlarged portion extending downwardly and positioned to be remov-

7

ably seated on the inner surface of a sleeve-like member extending into the aperture of the lower flange of said pair of flanges, the other end of said rod members extending into a sleeve-like member extending into the aperture of the upper flange of said pair of flanges thereby preventing horizontal movement of said rod members.

9. Apparatus as defined in claim 8 wherein rod members extending between said plurality of vertically disposed flanges are in vertical alignment and are free to move axially with respect to each other in response to expansion and contraction of the rod members throughout the entire temperature range of the operation of the furnace.

8

sion and contraction of the rod members throughout the entire temperature range of the operation of the furnace.

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