

[54] FURNACE WALL CONSTRUCTION

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122/6 A

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[58] Field of Search 110/1 A; 52/249, 506, 712,
52/714, 378, 443, 444, 700, 701; 122/6 A;
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Primary Examiner—Kenneth W. Sprague

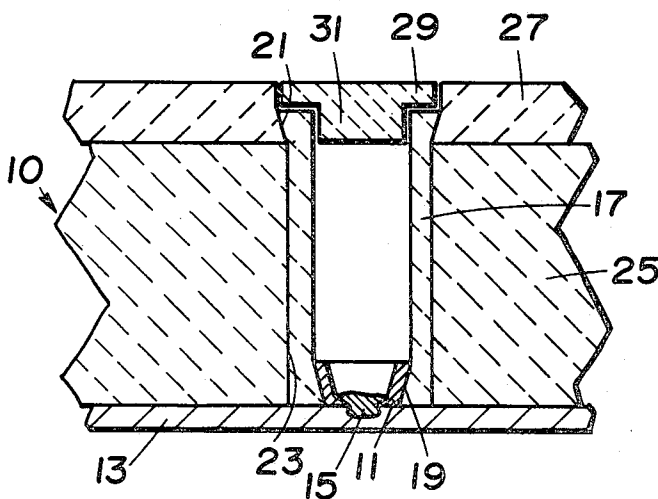
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[57] ABSTRACT

A lining for a furnace having a metal wall is held in place by tubular ceramic anchors and metal bushings fitting therein and secured, by welding or other means, to the metal wall. The ceramic anchors and bushings have interengaging portions holding the anchors on the wall. The anchors, before they are secured to the wall are inserted through a hole in a ceramic insulating and/or refractory body, which may be lamellar, and have such engagement with the body as to support it and hold it in place.

16 Claims, 7 Drawing Figures



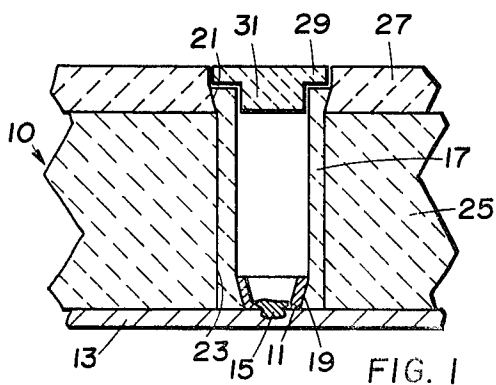


FIG. 1

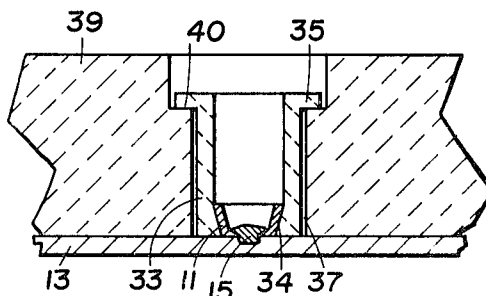


FIG. 2

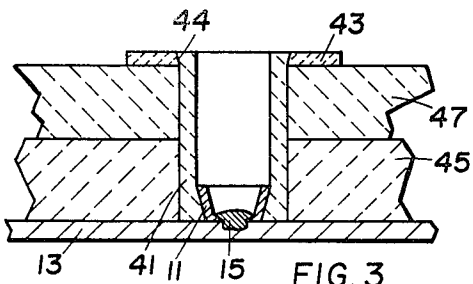


FIG. 3

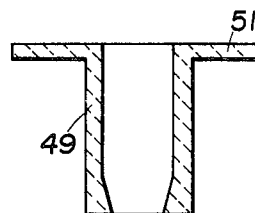


FIG. 4

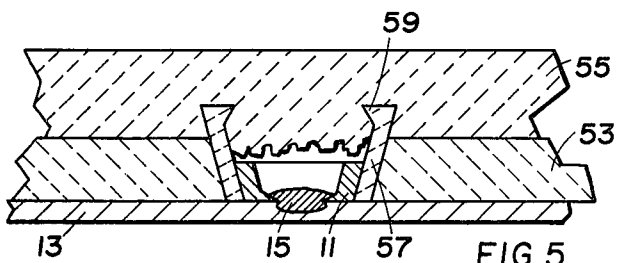


FIG. 5

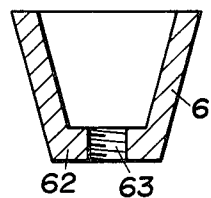


FIG. 6

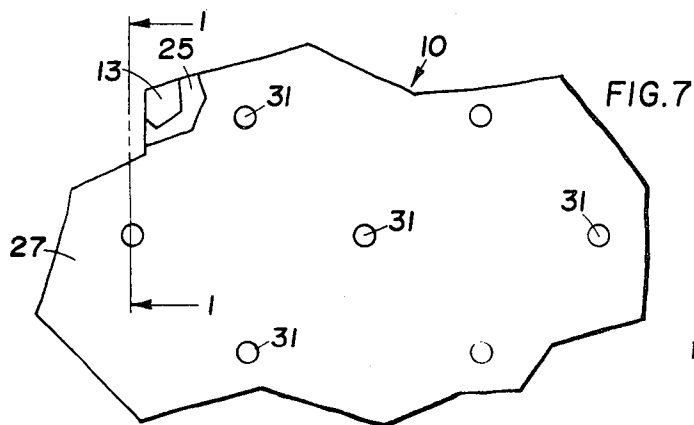


FIG. 7

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FURNACE WALL CONSTRUCTION

BACKGROUND OF THE INVENTION

This invention relates to the construction, especially the lining, of furnace walls and is particularly concerned with installations utilizing blankets, bats, or block of relatively lightweight refractory or heat insulating materials usable at relatively high temperatures.

Many methods and devices have been previously suggested for securing refractory and/or insulating materials as linings to the interior walls of a furnace. In many of such methods or devices the lining is required to have a specific shape or elaborate hardware on the furnace walls is required. In many instances an exorbitant amount of labor is required. Consequently, there has been a demand for a construction which permits the convenient attachment of refractory and/or insulating material in the form of blankets, sheets, bats, or blocks to furnace walls with a minimum of hardware and accessories and without exposing mounting hardware to furnace atmosphere and temperature.

SUMMARY OF THE INVENTION

The furnace wall construction of the present invention provides simple and convenient means for lining the walls by securing blankets, sheets, blocks, or bats of ceramic refractory and/or heat-insulating material on furnace walls either in a single layer or in a plurality of layers. In constructing or installing the lining the securing or mounting means may be easily applied wherever necessary or desired, thus giving a flexibility to furnace wall construction which is absent in many prior systems.

Essentially the mounting or securing devices utilized in the practice of the present invention consist of tubular ceramic retaining members and small metal bushings. Each bushing is adapted to be secured to a metal wall surface and to so engage an associated one of the tubular ceramic retainers as to hold it against the wall surface. More specifically, the metal bushings are placed inside the tubular ceramic members (hereinafter for convenience referred to as "anchors"), the bushings and anchors having interengaging bevelled portions, and secured by suitable means, such as welding, to the metal furnace wall. The anchor is thus supported on the furnace wall, extending outwardly therefrom and having such external configuration as to engage the body of refractory and/or insulating material. The anchors may be installed with any desired spacing between them merely by forming a hole in the refractory and/or insulating material at the desired location, inserting the assembly of anchor and metal bushing therein, and securing the bushing to the wall. The bushing may be protected, if desired, by a covering of a refractory material.

SHORT DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary sectional view, on line 1—1 of FIG. 7, of a furnace wall structure in accordance with the invention in which a body formed of a plurality of layers of insulation and/or refractory material is secured to a metal wall;

FIGS. 2 and 3 are fragmentary sectional views similar to FIG. 1 in which different forms of anchors and different layers of insulating and/or refractory material are shown;

FIG. 4 is a sectional view of still another form of anchor which may be used in carrying out the invention;

FIG. 5 is a fragmentary sectional view similar to FIG. 1 in which the outer layer of insulating and/or refractory material is applied by spraying, troweling, or the like;

FIG. 6 is an enlarged view of a modified form of bushing which may be used in accordance with the invention; and

FIG. 7 is a fragmentary elevation, on a reduced scale, of a furnace wall having a body of refractory and/or insulating material attached thereto by devices according to the present invention.

DESCRIPTION OF THE INVENTION

In FIG. 1 there is depicted in section a portion of a furnace wall, comprehensively designated 10, which includes the underlying metal wall of the furnace and a lining of refractory and/or insulating material that is held in place by devices, according to the invention. As will be seen, the metal bushing 11 is in the shape of an open-bottomed cup, the outer wall of which is outwardly flared, and is secured to the metal furnace wall 13 by a weld bead 15. The tubular anchor 17 of suitable ceramic material is provided at or adjacent the inner end of its inner surface with an inwardly bevelled portion 19, the angle thereof being substantially the same as the outward bevel of the outer wall face of the bushing 11, whereby the two bevelled faces are in substantial contact. The anchor 17 is provided at its outer end with an exterior, outwardly bevelled portion 21.

The anchor 17, as shown in FIG. 1, is inserted in a hole 23 formed in the ceramic body formed of layers 25 and 27 of insulating and/or refractory material and is of sufficient length as to extend through the inner layer 25 and extend a substantial distance into the layer 27 which it engages with the flared or bevelled portion 21 thereof. The hole 23 may be enlarged at its outer end, beyond the outer end of the anchor 17, to permit insertion of a plug 29 of suitable ceramic refractory, a central projection 31 of which preferably fits snugly in the bore of the anchor 17 to retain it in place. Not only does the plug 29 provide a relatively unbroken surface on the outer face of the lining, but it also protects the ceramic anchor 17 from heat shock and shields the metal bushing 11 from the furnace atmosphere and temperature.

In the structure shown in FIG. 1 the layer 25 can be, typically, a blanket or compressible bat of mineral wool or like insulation while, typically, the layer 27 can be a bonded block or sheet of more refractory material adapted to withstand the furnace temperature. Obviously, the block or sheet 27 must have substantial strength and resistance to deformation so that it can be retained by the bevelled surface 21 of the anchor 17. As illustrated in the drawings and hereinafter described, the anchor can take other forms as desired to adapt it to specific insulating and/or refractory products.

In FIG. 2 the tubular ceramic anchor 33 has an internal bevelled portion 34 at or adjacent its inner end for cooperation with the bevelled outer surface of the metal bushing 11 whereby to secure the anchor to the wall 13. At its outer end, the anchor 33 has an integral, outwardly extending, annular flange 35. The hole 37 formed in the refractory block 39 for reception of the

anchor is provided with an outer portion of enlarged diameter to furnish a shoulder 40 engaged by the flange 35, to hold the block in place. A refractory plug (not shown) such as the plug 29 illustrated in FIG. 1 may be used to cover the anchor and present a refractory face at the points where the block 39 is mounted.

FIG. 3 illustrates another form of the invention in which a ceramic anchor 41, essentially like the anchor 17, is used with an annular disc or washer 43 to mount insulating and/or refractory layers 45 and 47 on a metal wall 13. The inner periphery of the washer 43 is provided with a bevelled edge 44 which cooperates with the outer bevelled surface of the anchor 41 to hold the washer in place. The washer 43, which is preferably formed of a heat resistant ceramic material or a suitable, heat resistant metal such as nichrome or stainless steel can, of course, be of any desired diameter. To protect the metal bushing 11 from direct exposure to the furnace atmosphere, the interior of the anchor 41 may be filled, after mounting is completed, with a suitable insulating refractory mix such as one of the commercially available refractory cements. It will be understood that instead of using a preformed ceramic plug in the embodiments illustrated in FIGS. 1 and 2 or similar constructions, the interior of the anchors 17 and 33 may be similarly filled with a suitable insulating refractory mix.

In FIG. 4 there is illustrated a modified form of ceramic anchor 49 which is similar in construction to the forms shown in FIGS. 2 and 3. The outer end of the anchor 49 is provided with a wide, outwardly projecting, integral flange 51 adapted to hold loose bats and blankets of insulating material. The anchor 49 is attached to a metal surface by a metal bushing in the same manner as the anchors 17, 33 and 49. In using such a construction the interior of the tubular anchor may be filled after installation with a suitable insulating refractory mix to protect such bushing. The flange 51 may be of any desired diameter.

In FIG. 5 the layer 53 is a bonded insulating refractory sheet or block and the layer 55 is formed by spraying or troweling thereover a suitable refractory mix such, for example, as known mixtures of ceramic refractory fibers, colloidal silica, and calcium aluminate cement made plastic or sprayable with water. The tubular anchor 57, which is held against the surface of the underlying metal wall 13 by welding the metal bushing 11 thereto, flares outwardly from its base and is provided at its outer end with an inwardly directed shoulder 59. As will be evident, the layer 55 is applied in such a thickness that the anchor 57 is covered and the interior of the anchor is filled with the mix. Thus, when the mix, which is applied in a plastic or moist condition, hardens, the layer 55 is held in place not only by the flaring of the anchors, but also by the plugs formed in the anchors and held therein by the shoulders 59.

FIG. 6 illustrates a modified form of metal bushing 61 adapted for use in carrying out the present invention. The bushing 61 is provided at its smaller end with a wall 61 through which there extends a threaded opening 63. This form of bushing is adapted to be secured to threaded studs which are welded or otherwise mounted at intervals on the underlying surface of the metal furnace wall 13. Otherwise, the bushing 61 functions the same as the bushings 11.

In FIG. 7 there is shown, on a reduced scale, a portion of a furnace wall face after installation of a lining in accordance with the present invention. The supporting anchors may be arranged in regular or symmetrical positions as shown or may be mounted as desired or necessary on the wall 13. As shown, the anchors are covered by plugs 31.

Many different ceramic materials may be employed for the ceramic anchors used in carrying out the present invention. Among the materials which are suitable are porcelain, stealite, mullite, sintered stabilized zirconia, sintered alumina, sintered cordierite, and, in some cases, hard fired clay. The same or similar materials may be used in forming the washers 43 (FIG. 3) when the latter are ceramic. It will be understood that a choice from among the many available materials will be made to ensure that at the temperature and under the other conditions of use the anchors and washers will have sufficient strength and not warp excessively.

Since the metal bushings 11 and 61 are not directly exposed to the furnace atmosphere and temperature, they may conveniently be made of steel although other metals can be used in some instances.

As previously pointed out, the construction of the present invention is adapted for use in lining a furnace wall with a ceramic insulating and/or refractory body comprising one or more layers. It will be understood that in many instances there is little difference between the basic ceramic materials used in refractory compositions and heat-insulating compositions. For example, a dense, bonded alumina body has a fairly good heat conductivity while a bonded body in which the alumina is in the form of hollow bubbles will be a good heat insulator. Accordingly, the distinction between an insulating material or composition and a refractory material or composition as used herein may reside only in the density or form of the material. In general, when a plurality of layers is used, the outer layer is primarily chosen for refractory properties as, for example, the layer 27 in FIG. 1, and a layer such as 25 in FIG. 1 of ceramic material having a lower heat-conductivity is employed for the inner layer. However, in some cases only a single layer of adequately insulating refractory may be used, for example as shown in FIG. 2. In other cases, three or more layers of varying properties may be used if desired. The layers of insulating and/or refractory materials may be provided in a choice of forms such as bats, blanket, sheets, blocks and the like. For primarily insulating purposes blankets, bats, or sheets of mineral wool or other ceramic fiber and sheets or blocks of ceramic-bonded, hollow, ceramic bubbles are among the useful materials. Where a higher refractoriness is wanted denser bodies or layers are used, for example blocks or sheets of bonded aluminasilica ceramic fiber are very satisfactory. If desired, for example to make installation more convenient, a plurality of the layers of insulating and/or refractory material may be secured together by suitable means, such as a silicate cement, or even glue, but this is not essential.

The installation in a furnace of refractory and/or insulating bodies in accordance with the invention is generally described in connection with the description above of FIG. 1 and is essentially the same in all cases.

with respect to preformed layers of refractory and/or insulating material. The holes or openings through the material may be made in any desired and convenient manner using, for example, a suitable drill or coring device. As indicated above, the shapes of the retaining anchors and the metal bushings may vary as desired and the latter may be secured or attached to the underlying furnace wall in any suitable manner.

It will be evident that by the use of the present invention many benefits and advantages are gained. For example, the hot face of a furnace lining may be directly attached to a metal furnace wall in such a way that there is a minimum of heat transfer or loss. This enables a furnace designer to use, under the hot face, one or more layers of insulating and/or refractory material which need not have sufficient strength for independent suspension. Other advantages are that metal is not used in the hot zone of the lining, that the weight of the lining may be greatly reduced, that installation requires no special skills and may be done very rapidly, and that in many cases furnaces lined in accordance with the invention may be used as soon as the installation is completed without a prolonged period of drying out.

I claim:

1. A furnace wall construction comprising an underlying metal surface; a ceramic body superimposed on said underlying surface, said body having an inner face adjacent said underlying surface and an outer face, and having an opening extending from said inner face at least partially through said body; a tubular ceramic anchor extending through at least a portion of said opening; and a metal bushing within said anchor and attached to said underlying surface; said anchor and said bushing having interengaging means holding said anchor against said underlying surface when said bushing is attached to said underlying surface, and said anchor having means engaging said body for retaining it in superimposed position on said underlying surface.

2. A furnace wall construction as set forth in claim 1 in which said bushing is attached to said underlying surface by welding.

3. A furnace wall construction as set forth in claim 1 in which at least a portion of one of the walls of said anchor is bevelled.

4. A furnace wall construction as set forth in claim 1 in which said bushing has a flared outer wall surface which is engaged by an internal bevelled portion of said anchor.

5. A furnace wall construction as set forth in claim 1 in which said means for engaging said body is a bevelled portion of said anchor.

6. A furnace wall construction as set forth in claim 1 in which said anchor has an outwardly projecting portion at or adjacent to its outer end.

7. A furnace wall construction as set forth in claim 6 in which said outwardly extending portion is an annular flange.

8. A furnace wall construction as set forth in claim 1 in which said anchor has flared walls.

9. A furnace wall construction as set forth in claim 1 in which the length of said anchor is less than the thickness of said body.

10. A furnace wall construction as set forth in claim 9 in which a plug is provided in said opening outwardly of said anchor.

11. A furnace wall construction as set forth in claim 1 in which said body comprises a plurality of layers.

12. A furnace wall construction as set forth in claim 11 in which said anchor extends through at least one layer and at least a portion of the outer one of said layers.

13. A furnace wall construction comprising an underlying surface, a multilayer ceramic body superimposed on said underlying surface, said body having an inner face adjacent said underlying surface and an outer face, and having an opening extending from said inner face at least partially into the outer one of said layers; a tubular ceramic anchor in said opening extending from said underlying surface through at least a portion of each of said layers, said anchor having a projecting bevelled portion engaging said body for retaining it in superimposed position on said underlying surface; a metal bushing within said anchor secured to said underlying surface, and ceramic means within said opening outwardly of said bushing whereby to protect said bushing from direct exposure to furnace temperature; said anchor and said bushing having interengaging bevelled portions whereby said anchor is held against said underlying surface when said bushing is attached to said underlying surface.

14. A furnace wall construction as set forth in claim 13 in which said underlying surface is metal and said bushing is welded thereto.

15. A furnace wall construction as set forth in claim 14 in which said ceramic means is a plug.

16. A method of installing a lining on a metal furnace wall which comprises: providing a body of refractory and/or insulating material, said body having an inner face and an outer face; forming an opening through said body; inserting into said opening from the outer face of said body a tubular ceramic anchor having an outer portion engaging a portion of said body, said anchor being of such length as to engage said metal wall at its inner end; inserting a metal bushing into said tubular anchor; and securing said bushing to said metal wall, said bushing and anchor having interengaging means whereby the inner end of said anchor is held against said wall.

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