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Davis

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[54] **METHOD FOR INSTALLING FURNACE LININGS**

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[52] **U.S. Cl.** ..... **29/407**; 29/423; 29/455; 29/526; 52/249; 52/512; 110/1 A

[51] **Int. Cl.**..... **B23q 37/00**

[58] **Field of Search** ..... 29/423, 407, 455, 526; 220/63; 110/1 A; 52/506, 512, 249

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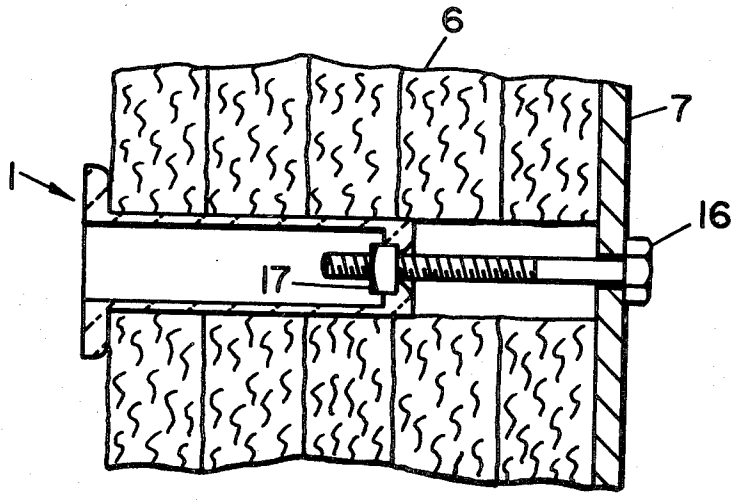
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[57] **ABSTRACT**

A method is taught for the installation of insulating lining materials in furnaces, kilns, and the like. The method of this invention comprises applying a flexible ceramic insulation blanket to a surface by impaling said blanket on temporary locating pin means attached to said surface, forming apertures in said blanket at points located by said temporary pin means, removing said temporary pin means, and attaching a ceramic retainer is said aperture to permanently affix said blanket to the surface.

5 Claims, 5 Drawing Figures



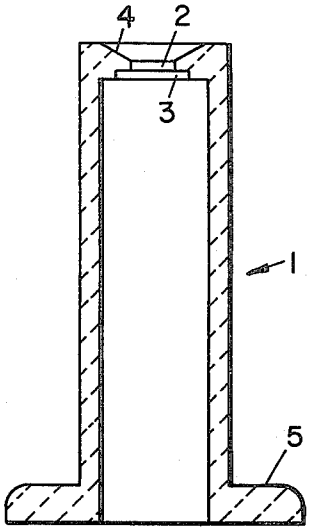


FIG. 1

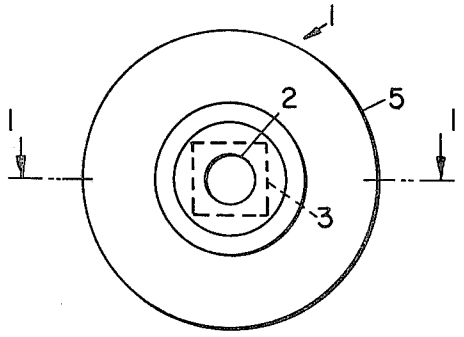


FIG. 2

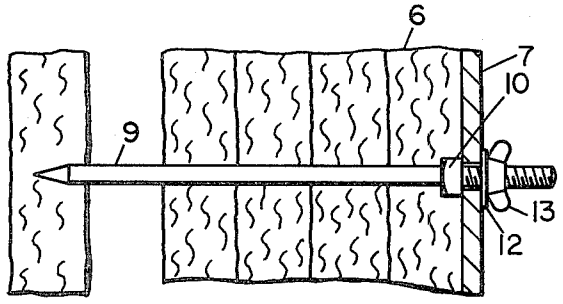


FIG. 3

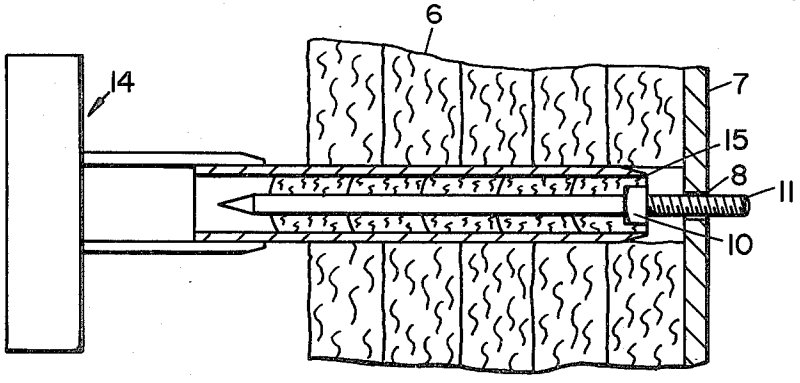


FIG. 4

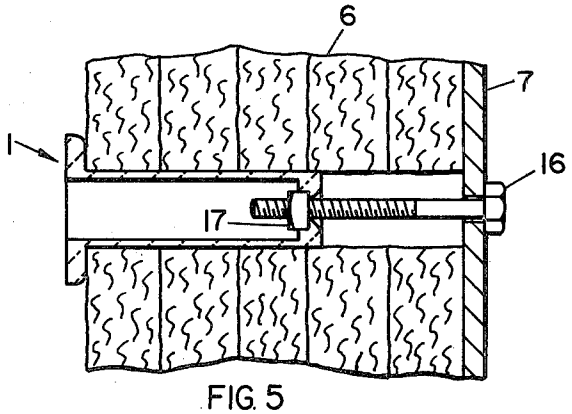


FIG. 5

METHOD FOR INSTALLING FURNACE LININGS

BACKGROUND OF THE INVENTION

This invention relates to the installation of lining material in furnaces, kilns, and the like, particularly ceramic fiber furnace linings where it is desirable to use a ceramic (or refractory) anchoring system.

Use of multi-layer ceramic fiber linings for furnaces or kilns is presently increasing due to decreased bulk as compared with brick linings, and more efficient operating capabilities, such as shorter heating and cooling cycles, decreased down time and longer life expectancy. Furthermore, weight of the fibrous lining is only a small fraction of an equivalent brick lining and therefore the construction of the furnace shell using fibrous lining may be of lighter strength than previously required with brick furnaces and kilns.

Several systems of anchoring the lining to the furnace shell have been developed, but these incorporate heat resisting metal anchors. These are positioned (usually by welding) on the inside of the furnace shell and several layers of ceramic fiber are transfixed over these anchors. The top layer of fiber is ultimately held in place by some locking device (e.g. a washer and locknut). Heat resisting metal anchoring systems have temperature limitations to a maximum of about **1200°C**. Above these temperatures it is necessary to use ceramic anchoring systems if fibrous lining is used, and the furnace lining fixing is to have a reasonable life.

SUMMARY OF THE INVENTION

There is provided according to the present invention a method for installing fibrous heat insulating lining in a furnace or kiln, said furnace or kiln having an outer shell comprised at least of walls and a ceiling having spaced apertures therein distributed over the surface area of said shell. The method comprises applying and temporarily fixing a layer, or layers, of heat insulating material to at least a portion of the interior walls of the shell by securement to pin means inserted through said apertures into the lining and adapted to project into the interior of the shell through the insulating material, forming apertures in the material at points located by said pin means suitable to accommodate a retainer of heat resistant material, and fixing said retainer to the shell in the aperture formed in the insulating material to secure said insulating material to the shell.

In one aspect, this invention provides a temporary anchoring system installed in the shell by fitting a series of spikes (or pins) through the shell apertures. The temporary locking of these spikes is carried out quickly and conveniently, preferably by means of a wing nut on the outside of the shell.

The method further provides the steps of applying a layer or layers of heat insulating material to at least a portion of the interior walls of the shell, temporarily fixing the lining to the shell over temporary pin systems, forming apertures at points located by said pin means suitable to accommodate a retainer of heat resistant material, and fixing said retainer to the shell in the aperture formed in the insulating material to secure said insulating material to the shell. To convert from the temporary to the permanent anchor, a hole preferably of the same diameter as the outside diameter of the ceramic anchor is cut with a hollow cutting tool, through the multi-layer fibrous lining, right through to the shell. This hole is centered over the temporary

spike. The wing nut holding the spike in place is then released and the fiber and spike are easily withdrawn together when the tool is withdrawn from the hole.

Conveniently the refractory or ceramic retainer includes a captive nut for easy fixing onto a threaded bolt shank projecting through the shell aperture. The bolt shank may be varied in length to suit various lining thickness selected for desired furnace performanc. Consequently only one length of ceramic retaining anchor is required for any variation in lining thickness.

In a further aspect of the present invention there is provided a retainer of heat insulating material for fixing lining material to a furnace or kiln shell comprising a hollow body member having a narrow aperture at one end and an external flange at the other end, said body being adapted to extend at least part way through the lining thickness towards said shell and be removably fixed to said shell, preferably by bolt and nut securing means in the apertured end.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a sectional view of the refractory anchor or retainer, taken through line **1—1** of FIG. **2.**

FIG. **2** is an end view of the refractory retainer.

FIG. **3** illustrates, in section, insulating material held in place by a temporary anchor assembly.

FIG. **4** illustrates, in section, removal of the temporary anchor and formation of an aperture for the refractory retainer.

FIG. **5** illustrates, in section, a retainer means affixing insulating material to a surface.

DESCRIPTION OF PREFERRED EMBODIMENTS

The method of the present invention preferably incorporates a refractory or ceramic retainer or anchor such as illustrated in FIGS. **1** and **2,** wherein **1** represents a hollow flanged body of heat resistant ceramic material, having at one end an aperture **2** for locating a holding means, such as a bolt. The internal end surface of the retainer is recessed at **3,** adjacent to aperture **2,** so as to provide holding means for a nut or bolt head. Alternatively, the aperture **2** may be threaded to accept and hold a standard bolt. However, it is preferred that a recess be provided wherein a nut may be held captive. The outside end surface is formed conically at **4** so as to assist in guiding a bolt shank into aperture **2** during installation of the retainer in a furnace shell.

The flanged portion **5** of the retainer is of a suitable dimension to engage and retain the insulating lining against the furnace or kiln shell. The diameter of the flange should be such as to provide a substantial surface area of contact with the fiber blanket, to ensure that the anchor itself does not cut the blanket.

Referring now to FIGS. **3** and **4,** a temporary means for fixing the insulating blanket to a wall is demonstrated. As illustrated, a furnace wall or shell, **7,** having an aperture **8** therein of sufficient diameter to accept a metal pin or spike, **9,** is insulated by ceramic fiber blankets, **6,** impaled over the spike. The method of the present invention envisions the formation of a series of apertures throughout the surface area of the outer supporting shell of the furnace or kiln. Spikes, **9,** are inserted through these apertures into the shell, and fixed to the shell by such means as nuts or, preferably, wing nuts. The spikes may be of any suitable metal, such as steel, and of a diameter such as to provide sufficient

strength to support the insulation, while not too large to allow the insulation to be easily impaled thereupon. To facilitate the mounting and positioning of the insulating body by means of impalement upon the spike, or stud, **9**, the terminal end of the stud is preferably formed into a point.

The refractory lining materials may be suitably of any high temperature refractory fiber blanket or felt, such as alumina-silicate fibers. A particularly suitable material is Fiberfrax refractory fiber insulation available from The Carborundum Company. The refractory fiber blanket or felt is pressed into position and impaled upon the spikes, thus protecting the inner surface, or hot side of the furnace shell. As previously indicated, the spikes are held in position by wing nuts, **13**, which engage a threaded portion of the spike, **11**. The nut **10** functions to limit the travel of the spike, and is located inside the shell wall. A suitable flat washer, **12**, may be employed with the wing nut to evenly distribute loading forces. It may thus be seen that the spikes, having the insulation material impaled thereupon, serve a double function. That is, they temporarily fix the lining, and also locate the position of the shell apertures, **8**, for workmen inside the furnace.

A hole is then bored, centered upon each spike, and having a diameter similar to the outside diameter of the hollow body of the ceramic retainer or anchor. Each spike can be removed as the hole is drilled, as demonstrated in FIG. **4**. A cutting tool, **14**, having sharply ground cutting edge **15**, is centered over each spike, and rotated, with pressure, to cut through the fibrous ceramic blanket to the surface of the shell. This creates a plug or core of fibrous material which may be removed. Prior to removal of this core, however, the wing nut **13** and flat washer **12** are removed from the exterior portion of the spike, thus allowing the spike to be withdrawn at the same time. Upon removal of this fibrous core and enclosed spike, a hole in the fibrous material results, directly centered over the aperture **8** in the furnace wall. As illustrated in FIG. **5**, a flanged retainer **1**, having a nut, **17**, positioned in recess **3** may then be placed in this hole centered over the aperture in the wall. A bolt, **16**, may then be placed through the aperture in the wall, and engaged with the captive nut. Clearly, a bolt may be held captive in the retainer, rather than a nut, and threaded through the shell aperture by the workmen inside the furnace. However, it has been found more convenient to thread the bolt from outside the shell. The conical lead-in section on the end of the anchor allows the bolt to find the nut very easily and readily. The actual tightening of the anchor is done most conveniently from outside the shell. The nut has a firm location inside the anchor, and if necessary may be held in position quite easily by means of a piece of wooden dowling or other appropriate means.

After fixing of the retainer in position, the hollow body thereof may simply be filled with heat resistant fibrous material, thus protecting the metallic bolt at the bottom of the retainer. For example, bulk fiber or blanket trim may be pressed into the cavity. Alternatively, a refractory cement may be placed in the cavity, which will harden upon heating. In the preferred embodiment, the bolt is proportion such that the end thereof does not extend far beyond the nut, **17**, and is completely confined within the body of the ceramic retainer. If the bolt extends beyond the shoulders **5** of the retainer, it may be cut off, by torching for example, to insure insulating of all metallic components of the assembly.

Various high temperature resistant materials are suitable for the practice of this invention. The ceramic anchor is suitably made from refractory materials such as mullite, aluminum silicate refractories, Alfrax fused aluminum refractory or Mulfrax, a furnace mullite refractory available from The Carborundum Company. The ease of the installation system of this invention, as compared to construction systems of the prior art is illustrated by the following specific example.

A metal furnace wall was lined with fibrous insulating material. The composition of the lining was **1** inch of Fiberfrax felt, backed by **2** inches of **6** poung Lo Con Felt, backed by an additional **2** inches of **4** pound Lo Con felt, these materials each being available from The Carborundum Company of Niagara Falls, New York. The metal anchors were installed by drilling ¼ inch diameter holes in the metal wall, and inserting temporary spikes as shown in FIGS. **3** and **4**. The use of wing nuts outside the wall made fixing of these items very quick and easy. It was found that it is possible for two men to position at least **150** spikes per hour. The complete fiber blanket lining was then impaled upon these anchors without any difficulty.

A cutting tool, such as shown in FIG. **4**, was made up and used to cut a cylindrical hole through the fibrous blanket around each temporary anchor. The wing nut outside each anchor was removed as the cylindrical hole was cut, and it was found that the blanket and temporary anchor could be withdrawn as a single unit. The permanent ceramic anchor was then inserted into each of these cylindrical holes, and bolted into position by inserting a bolt of the proper length through the hole in the furnace wall. The total lining time necessary to reline the furnace was approximately **2** and ½ days, compared to a period of **8** days which would have been required for a complete re-bricking.

A number of advantages are seen in the ceramic system of the present invention over conventional metal anchoring systems. First, it must be noted that ceramic systems are suitable for temperatures up to **1400**°C, or higher, whereas metal systems are unable to withstand temperatures in excess of **1200**°C. Secondly, the method of the present invention requires only one size of ceramic anchor, and utilizes easily available standard nuts and bolts. The length of the bolt used is selected in accordance with the thickness of fiber blanket employed. Also, a ceramic system gives better thermal equilibrium through the lining, by obviating local high thermal conductivity transfer points. It is noted that it is difficult to replace welded metal anchors without removing part of the lining right back to the metal shell. However, the ceramic anchors employed in the present method may be replaced without in any way disturbing the lining, by simply unbolting the individual anchor, from the outside of the shell, and replacing it in position with a new anchor.

The assembly of the present invention has been described in respect to its use for securing refractory linings to the walls of furnaces and the like. However, it is anticipated that the assembly may have many other uses in environments other than refractory furnaces. Additionally, while the invention has been described in respect to particular embodiments thereof as shown in the drawings, no limitation is thereby intended, but in-

stead, the scope of the invention is to be interpreted in view of the appended claims.

I claim:

1. A method for affixing insulation to a surface comprising the steps of:

a. forming apertures in the surface;

b. inserting a temporary anchoring device through each aperture;

c. securing each said anchoring device to said surface;

d. applying insulating material over the temporary anchoring devices;

e. forming apertures in said blanket at points located by said anchoring devices;

f. removing said temporary anchoring devices from said surface;

g. inserting a permanent retainer into said aperture in said blanket; and

h. affixing said permanent retainer to said surface by retaining means inserted through said aperture in said surface.

2. A method as set forth in claim **1**, wherein said temporary anchoring device comprises a metal pin.

3. A method as set forth in claim **2**, wherein said permanent retainer comprises a refractory material.

4. A method as set forth in claim **3**, wherein said retaining means comprises a bolt threaded into the base of said permanent retainer.

5. A method for the installation of insulating lining materials which comprises applying a flexible ceramic insulation blanket to a surface by impaling said blanket on temporary locating pin means attached to said surface, forming apertures in said blanket at points located by said temporary pin means, removing said temporary pin means, and attaching ceramic retainers in said apertures and to said surface to permanently affix said blanket to the surface.

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