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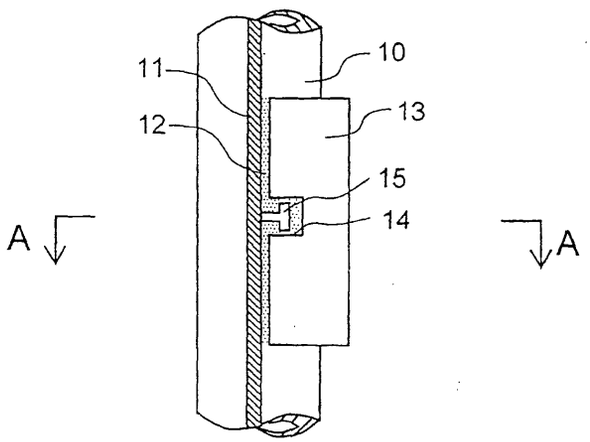
(54) FIXING STRUCTURE OF REFRACTORY TILE FOR PROTECTING WATER TUBE AND REFRACTORY STRUCTURE FOR PROTECTING WATER TUBE

(57) The object of this invention is to provide a fireproof structure for protecting water pipes in boilers and the like using refractory tiles which, even in areas where it would be difficult to slidably join them together, allows said refractory tiles to be easily and securely installed, and be manufactured at a low cost. The support members 15 provided on water pipes 10 have a sectional dimension at the base which is smaller than a sectional dimension at the tip, and the refractory tiles have an indent 14 on an engagement side facing the support member, the indent is wider than the tip of the support member to allow the indent to be freely inserted in the fore-aft direction onto the support members. Further, in this invention, the sectional dimension of the support member is stepped up from the base toward the tip, or smoothly tapered to the larger dimension.

FIG. 1(A)



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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a fireproof structure for protecting water pipe walls used for cooling and heat exchange in incinerators, boilers and the like from the high temperature gas environment, in particular, it relates to an installation structure of refractory tiles for protecting water pipes having complex shapes such as bends around openings and the like, wherein the installation structure allows the refractory tiles to be installed in such areas where it is not possible to slide the tiles into place along the outside surface of the water pipes for installing the tiles.

TECHNICAL BACKGROUND

[0002] Water pipe walls are installed inside of trash incinerators, boilers, etc. for the purpose of cooling or heat exchange in the high temperature environment, however, such water pipe walls in an incinerator, for example, would be exposed to abrasion from flying ash, and corrosion in addition to the high temperature gas environment, and for that reason, a fireproof structure consisting of refractory tiles or refractory castable must be installed around inner walls of the furnace.

[0003] As is shown in Figures 9(A), 9(B) for a fireproof structure of the prior art, adjacent water pipes 10 are connected by connecting fins 11 and are studded with L-shaped hooks 18 on the high temperature gas side. On the other hand, refractory tiles 13, shaped to conform to the curve of the water pipes, contain indent 19 which can engage with the L-shaped hook on the foregoing fins 11. The foregoing L-shaped hook 18 and indent 19 are slidably engaged, and refractory tiles 13 are held in place by the force of gravity maintaining the engagement of said tiles 13. Further, in the space between the foregoing refractory tiles 13 and fins 11, and between the foregoing L-shaped hook 18 and indent 19 is filled with mortar 12 to strengthen the engagement through the adhesion of said mortar.

[0004] Japanese Patent Publication 2000-213703 proposes the fireproof structure for protecting water pipes shown in Figure 9(C), wherein the shape of the supporting arms 17, which protrude toward refractory tiles 13 from the flat surfaced ribs (fins) 11 of water pipes 10, is such that the cross section of support arms progressively increases in the direction toward the foregoing refractory tile 13 side, and the indent 19 in refractory tiles 13 into which said support arms 17 fit is also shaped correspondingly, to increase the cross section as the indent deepens, and mortar 12 is filled up in the space between them.

[0005] Thus, the above described L-shaped hooks 18 and support arms 17 are supporting members which slidably engage in indent 19 in the foregoing refractory tiles 13. This installation structure of the refractory tiles prevents the support members from becoming exposed to the combustion side of the tiles and prevents their corrosion by combustion gases to thereby also prevent the refractory tiles from falling off or becoming damaged.

[0006] Further, PCT/JP98/04832 proposes attaching a refractory sleeve, made from the same material as the refractory tiles, such as SiC, to the indent of the foregoing refractory tile, i.e. the engagement area for the supporting member. The foregoing support member then slides and is inserted into an opening provided in the lower side of said refractory sleeve to complete the engagement.

[0007] The interposition of the foregoing refractory sleeves prevents gap between the refractory tiles and the support members, and assures positive engagement.

[0008] However, for cases where water pipes are installed in stoker type incinerators, there are a large number of areas such as around the air supply ducts, openings for installation of monitoring equipment, openings for the egress of workers such as manholes, and a clinker chill area, where the water pipes must be bent in complex shapes around these openings. In such cases, the sliding installation of refractory tiles structured as described above would be very difficult.

[0009] Further, when the foregoing refractory sleeves are attached to the support members, not only due to the refractory sleeves having a complex shape, but also due to a high degree of precision being required in their manufacture, the manufacturing costs are high and their use detracts from the ease of installation.

[0010] Also, in cases where the spaces between the refractory tiles and the surface of the water pipes, and the spaces between the fins and support members are filled with and adhesive agent such as mortar, any air bubbles existing in the mortar used to fill the foregoing spaces decrease the bonding surface area between the refractory tiles and the outside surfaces of the water pipes, which results in diminished adhesive strength that could very well lead to the refractory tiles falling away from the water pipes.

[0011] Another issue is that when the refractory tiles and water pipes are viewed from the outside, it is impossible to confirm that the mortar has completely filled the spaces or that there are no air bubbles. Since neither the refractory tiles nor the water pipes can be examined visibly, it is not possible to visually examine the space between the refractory tiles and water pipes. Although the use of X-rays to perform this function would be plausible as a non-visual means to check the filling state of the foregoing mortar, the cost of the X-ray equipment and the process for making the measurements would drive up the manufacturing cost for the fireproof structure for protecting the water pipes.

SUMMARY OF THE INVENTION

[0012] The present invention was developed after re-

flection upon the problems in the prior art. The object of this invention is to provide a fireproof structure for protecting water pipes in boilers and the like using refractory tiles which, even in areas where it would be difficult to slidably join them together, allows said refractory tiles to be easily and securely installed, and be manufactured at a low cost.

[0013] The present invention, to achieve these objectives, provides a tile installation structure for installing refractory tiles in areas where it would be difficult to slide the refractory tiles along the outside surface of water pipes to engage with support members, said tile installing structure being provided in a fireproof structure for protecting the water pipes installed in boilers and the like in which the refractory tiles are installed upon the support members protruding from the water pipe side with an adhesive such as mortar disposed between the refractory tiles and the support members, wherein the support members have a sectional dimension at the base which is smaller than a sectional dimension at the tip, and the refractory tiles have an indent on an engagement side facing the support member, the indent is wider than the tip of the support member to allow the indent to be freely inserted in the fore-aft direction onto the support members, to thereby allow the tile installation by pressing the refractory tiles toward the water pipes to engage, with the adhesive such as mortar.

[0014] According to this invention, the refractory tiles are not installed by sliding the indent on the refractory tiles along support members projecting from the water pipes, but rather, the refractory tiles are set directly upon the water pipes using an insertion type of engagement to facilitate the placement of refractory tiles in areas where the water pipes assume complex shapes such as bends or openings where the sliding installation is not possible, and since this structure does not require the use of fireproof sleeves, it is less costly and facilitates installation.

[0015] Further, the foregoing support members and the refractory tiles are affixed together using an adhesive such as mortar, which in addition to the adhesive strength provided by the adhesive, firmly affixes the support members in place once the adhesive has dried and been fired. In other words, the strength developed after drying and firing the adhesive that attaches the foregoing refractory tiles to the water pipes, and such installations can prevent the refractory tiles from falling off not only in the perpendicular direction, but even when they are installed on ceilings.

[0016] Further, the present invention provides that the tip of the support member is thicker than the base, being roughly circular in cross section, the cross-sectional shape with respect to the axis of the support member is approximately circular, which prevents the occurrence of cracks either in the foregoing adhesive or foregoing refractory tiles due to the differences in their heat expansion properties.

[0017] Further, in this invention, the sectional dimension of the support member is stepped up from the base toward the tip, or smoothly tapered to the larger dimension, which improves the effectiveness of the attachment between the foregoing support members and the adhesive, to create a strong junction.

[0018] Also in this invention, the outside surface area of the support members is greater than it would be if the support members shaped a cylinder or a rectangular parallel piped, which increases the contact surface area between the support members and the adhesive and improves the effectiveness of the attachment between the foregoing support members and the adhesive, to create a strong junction.

[0019] Furthermore, an opening of the indent on the refractory tiles is wider than the tip of the support member to allow the indent to be freely inserted in the fore-aft direction onto the support members, and the indent widens in the depth direction towards the bottom of the indent.

[0020] According to this invention, since the surface area on the inside surface of the foregoing indent is greater than it would be for the case where the width between the walls was the same at the top and bottom of the indent, there is an increased contact surface area between the foregoing refractory tiles and the adhesive. Since the refractory tiles are pressed in place toward the water pipes with mortar or other adhesive disposed between the support members and the tiles, the surface area under the compression is increased to improve the holding effect between the mortar and said refractory tiles, to create a strong junction. As a result, a refractory tile structure firmly affixes the tiles and prevents them from falling off from not just the vertical walls, but the ceiling areas as well.

[0021] Further, the invention is characterized by establishing a through hole that passes through the indent to the opposite side of the tiles.

[0022] According to this invention, the mortar or other adhesive disposed between the foregoing refractory tiles and the water pipes can be extruded out through the holes, to enable visual confirmation that the spaces have been completely filled without air bubbles to thereby assure the sound installation and the filling of the voids between the refractory tiles and water pipes.

[0023] Further, the present invention provides a fireproof structure in stoker type incinerators where the gas retention time is about 2 seconds or more from the secondary air duct, and the incinerator outlet temperature to an upper limit of the fireproof installation reaches about 900 °C to 1200 °C, said fireproof structure provided with an installation structure for refractory tiles to be installed around air supply ducts that supply combustion air, openings for the insertion of monitoring equipment, openings such as manholes for worker egress, and around clinker chill area, where the water pipes are bent into complex shapes, said installation structure to be provided on vertical walls and on ceilings, wherein the installing structure comprises:

support members having a sectional dimension at the base which is smaller than a sectional dimension at the tip; and refractory tiles having an indent on an engagement side facing said support member, the indent being wider than the tip of the support member to allow the indent to be freely inserted in the fore-aft direction onto the support members, to thereby allow the tile installation by pressing the refractory tiles toward the water pipes to engage, with the adhesive such as mortar.

[0024] According to this invention, it is possible to easily install a fireproof structure to protect water pipes in the commonly used stoker type incinerators that operate at exceptionally high temperatures, whereby, instead of using an amorphous fireproof material such as the refractory castable that was used in the prior art in the areas where water pipes are bent into complex shapes around openings, refractory tiles having better longevity in these high temperature gas environments can be installed through the application of this invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025]

Figure 1(A) shows a sectional view of a support member for an embodiment of the fireproof structure for protecting water pipes according to this invention, and Figure 1(B) shows a sectional view along line A-A of Figure 1(A).
Figure 2(A) shows a perspective view and Figure 2 (B) shows a sectional view of the first embodiment.
Figure 3(A) shows a perspective view and Figure 3 (B) shows a sectional view of the second embodiment.
Figure 4(A) shows a perspective view, and Figure 4(B) shows a sectional view of the third embodiment.
Figure 5 shows a cross sectional view of a support member of the fourth embodiment.
Figure 6 shows a cross sectional view of a support member of the fifth embodiment.
Figure 7 shows a rough sketch of the installed fireproof structure for protecting water pipe according to an embodiment of this invention.
Figure 8 shows another rough sketch of the installed fireproof structure for protecting water pipe according to an embodiment of this invention.
Figure 9(A) shows a side cross sectional view of a fireproof structure for protecting water pipe according to a prior art, Figure 9(B) shows a cross sectional view along line B-B of Figure 9(A), and Figure 9 (C) shows a cross sectional view of another fireproof structure for protecting water pipe according to another prior art.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0026] In this section we shall explain several preferred embodiments of this invention with reference to the appended drawings. Whenever the size, materials, shapes, relative positions and other aspects of the parts described in the embodiments are not clearly defined, the scope of the invention is not limited only to the parts shown, which are meant merely for the purpose of illustration.

[0027] Figure 1(A) shows a sectional view of a support member for an embodiment of the fireproof structure for protecting water pipes according to this invention, and Figure 1(B) shows a sectional view along line A-A of Figure 1(A).

[0028] As an example, this embodiment of a fireproof structure for protecting water pipes is installed in a stoker type incinerator. Further, the assumed outlet temperature for this stoker type incinerator is very high, approximately 900 to 1200°C, which would mean that the incinerator walls could reach temperatures as high as 800°C.

[0029] In Figure 1 (A), Figure 1(B), 10 represents the water pipes through which the coolant water flows; reinforcing fins 11 are formed on the water pipe walls in the horizontal or perpendicular direction to link adjacent water pipes 10 to each other. 13 represents the refractory tiles which contain SiC as their primary component. Materials that can be used to manufacture refractory tiles 13 in addition to SiC include SK, Si_3N_4 and other materials that may be used to enhance longevity or corrosion resistance, however there is no particular limitation upon such other materials.

[0030] Said refractory tiles 13 are manufactured in a factory, etc., off-site by molding the materials under pressure, sintering or other means of forming. During the manufacturing process for the foregoing refractory tiles 13, an indent 14 is formed in the tile on the side that faces water pipes 10. In this case, it is not necessary to precisely form the indent for engagement with the below described support members 15, such as was the case for the L-shaped indents used in the prior art, and moreover, since the side of the tile facing the fins 11 has an open shape, demolding the tiles is easy, and production costs can be kept low because it is possible to produce the tiles by press forming.

[0031] The support members 15, which are made of a stainless steel metal material, are studded upon the foregoing fins 11 to face inward toward inside the furnace. These support members 15 are joined into the foregoing indents 14 using mortar 12. Since an inorganic adhesive, is used as the mortar 12, such as SiC mortar, Aron Ceramic (trade name) etc., it does not lose its adhesive properties even at high temperatures of 250°C or greater nor does its bond strength become degraded by heat.

[0032] It is optimal to use one set of the foregoing in-

dent 14 and support member 15 on said fin 11 per each two runs of water pipe 10, but it is also possible to use one set per more than two runs.

[0033] As shown in Figures 2 through 4, the shape of support members 15 may be selected based upon manufacturing considerations and the place where they are to be used.

[0034] Figures 2(A) 3(A) and 4(A) show perspective views and Figures 2(B) 3(B) and 4(B) show sectional views of the first through third embodiments.

[0035] In the first embodiment shown in Figures 2 (A) and 2 (B), support member 15A comprises a T-shaped hook, the tip area 15Aa has a larger sectional shape than the base area 15Ab; with the vertical dimension of tip 15Aa being approximately the same length as the base 15Ab, which is attached to the foregoing water pipes 10. Thus the support member has a tip 15Aa that is stepped up from the base 15Ab dimension to improve the ability to be held in place by the foregoing mortar 12, to strongly attach refractory tiles 13 to the foregoing water pipes.

[0036] In support member 15B according to the second embodiment shown in Figures 3(A) and 3(B), the tip 15Ba is disc shaped with a larger sectional shape than base area 15Bb. The rod shaped bases 15Bb are attached to the foregoing water pipes 10. Thus, since the foregoing tip 15Ba is disc shaped, it eliminates the problem of heat expansion during installation causing local stress in the foregoing mortar 12, making mortar 12 less prone to cracking. Also, since there is a step up in size as there was in the first embodiment, the engagement between the foregoing mortar 12 and said support members 15B is thereby improved.

[0037] It is also possible to use bolts having the above-described shape as support members.

[0038] Figures 4(A) and 4(B) show the support member 15C according to a third embodiment in which the tip 15Ca of the support members is circular, having a larger sectional shape than the base 15Cb, wherein the base 15Cb tapers down, in a truncated conical shape, from said tip 15Ca to the base 15Cb where it is attached to the foregoing water pipe 10.

[0039] This shape is smooth without sharp angles, making it even more effective than the foregoing second embodiment in preventing cracks from developing due to heat expansion differentials.

[0040] The support members used in this invention are not confined to those in the foregoing embodiments, any shape may be used so long as the base of the support member is smaller than the tip in at least one of its sectional dimensions.

[0041] Figures 5 and 6 show the cross sectional views of fireproof structures for protecting water pipes employing a fourth and fifth embodiment of the support hardware (support members).

[0042] With regard to the fourth embodiment shown in Figure 5, the space between the walls of the indent at the top of the indent 14a in the foregoing refractory tiles 13 is wider than the tip surface 15Aa of the foregoing support members, and moreover, this space between the walls at the top 14a of said indent widens in the depth direction toward the bottom side (base of the indent 14b), compared with the non-widening shape shown in Figure 1(B). In other words, the width of the gap at the top 14a of the indent in the refractory tiles is greater than the widest part of the support member 15 (the tip of the support member 15Aa), and moreover, said indent becomes even wider in the depth direction at its base 14b, so that the structure of the indent is such that it narrows from the side nearest refractory tiles 13 toward the side of fins 11 on water pipes 10. When the support member 15A shown in Figure 2 is used, the width of the top opening 14a of the indent is wider than the width of the tip 15Aa of the support member, and further the width at the bottom 14b of the indent is greater than width at the top 14a of the indent. The height of the support members 15A is uniform from the base to the tip, and the depth of the indents is greater than the height of support members 15A, and is constant.

[0043] The shape of support member 15 in this embodiment may be any of the shapes shown in Figures 2 (A), 2(B) for the first embodiment, Figures 3(A), 3(B) for the second embodiment, Figures 4(A), 4(B) for the third embodiment, or other shape. For example, using support members 15B such as shown in Figures 3(A), 3(B) with the opening 14a of the indent having a circular opening, the diameter of said opening is made to be greater than the outside diameter of tip 15Ba of the support member, and the diameter of the base of the indent is larger than the opening. Even in the case of a support member 15C shown in Figure 4, the opening of indent 14a may be a circular opening, with the diameter of that opening being greater than the outside diameter of tip 15Ca of the support member, and with the diameter at the base area being even greater than the diameter of the opening to the indent.

[0044] As described above, the structure of the refractory tiles is such that the width of the opening, or the opening diameter, in the indent in the refractory tile, is greater than the maximum width or maximum diameter of the tip of the support member, and moreover, in the depth direction of the indent, the width or the diameter becomes smaller, in the direction from the refractory tile side to the water pipe side. Accordingly, said refractory tiles are not slid into place along the outside surface of the water pipes, but rather, they are pressed in place over mortar toward the fins to engage the tiles 13 in a free-fit engagements over the water pipes by pressing them into place. Furthermore, compared to the case where the widths at the opening 14a and at the base 14b of the indent are identical, the contact surface area with mortar 12 and refractory tiles 13 can be increased to thereby improve the holding effect of said refractory tiles 13 and mortar 12 to achieve a stronger junction. As a result, the fireproof structure provided by the present invention can be securely installed not just upon the ver-

tical walls, but upon ceilings as well.

[0045] In addition, Figure 6 shows the basic structure of a fifth embodiment where a confirmation hole 20 has been placed in the indent 14 of refractory tile 13, which passes through to the surface on the water pipe side of the tile. The structure of this embodiment is the same as shown in Figure 1(B) with the exception of the confirmation hole 20 in refractory tiles 13. In this embodiment, when mortar is pressure injected in the axial direction of water pipes 10 to fill the spaces between refractory tiles 13 and water pipes 10, refractory tiles 13 and fins 11, and refractory tiles 13 and support members 15, the exuding of mortar from the foregoing confirmation holes 20 following the injection process allows visual confirmation that saidmortar has filled said spaces without leaving any air bubbles.

[0046] Another method involves the pre-coating of the outside surface of the foregoing water pipes 10, fins 11 and support members 15 with mortar and then pressing refractory tiles 13 into place over the mortar-coated surface. Then, if the mortar has filled all of the spaces, the excess exudes through the confirmation holes 20 to provide visual confirmation that the mortar has filled the spaces without leaving any air bubbles. Thus, the refractory tiles can be installed over the outside surface of the water pipes securely and inexpensively.

[0047] The embodiment shown in Figure 6 features the confirmation hole 20 located opposite the support member 15, but the position, number, shape and dimensions of the confirmation holes may be selected as appropriate for the shape of refractory tiles 13. Further, the shape of the support member 15 shown in this embodiment may be that shown for the first embodiment in Figures 2(A) and 2(B), the second embodiment in Figures 3(A) and 3(B), the third embodiment shown in Figures 4(A) and 4(B), or other shape.

[0048] Figures 7 and 8 are diagrams showing the installed configuration of the fireproof structure for protecting water pipes according to this invention.

[0049] The foregoing installation structure for refractory tiles, for example, can be provided over a wall of water pipes such as shown in Figure 7 and Figure 8. Figure 7 shows refractory tiles 13a located at a boundary area with refractory castable 16. Here, the refractory castable 16 has been installed above the refractory tile installation, in a position where it would be difficult to slide the refractory tiles 13a into place from above. Refractory tiles 13a are installed onto a vertical wall in the perpendicular direction by inserting the indents 14 over the support members 15, which project from fins 11 to install the tiles.

[0050] Thus, the structure described in the present embodiments does not require that the fireproof structure be slidably engaged, the structure can be used to easily and securely install tiles when there is no room above, or in any other direction, to slide the refractory tiles in place. Further, as shown in Figure 8, in areas around openings such as air supply ducts, openings for installation of monitoring equipment, manholes for worker egress, and a clinker chill area in incinerators where the water pipes are bent into complex configurations, the foregoing refractory tiles 13 can be installed in such places where a slidable installation would be difficult. Tiles manufactured to conform to the foregoing bends, are installed by inserting them in the perpendicular direction to the installation place in a manner such that the support member 15 engages with the indent 14 (not shown) of refractory tiles 13. Thus, it is possible to easily and securely install refractory tiles 13 over the entire surface inside a high temperature furnace, even in places where the water pipes assume complex configurations.

EFFECTS OF THE INENTION

[0051] According to the present invention, as described above, because the indent established in the refractory tiles can be fitted over the support member without sliding, not only is it possible to easily affix the tiles in areas around openings where the water pipes bend into complex shapes, but the installation is inexpensive because it does not require the use of fireproof sleeves, and it is easily installed by the efficient installation.

[0052] Also, since the foregoing support members and refractory tiles affixed together using an adhesive such as mortar, in addition to the adhesion provided by the adhesive, once dried, the tips of the foregoing support members are solidly embedded in the dried mortar. To wit, once the mortar has been dried and fired, the foregoing refractory tiles are solidly affixed to the water pipes in the fireproof structure provided by this invention, which makes it possible to install the refractory tiles not just upon the vertical walls, but upon the ceiling areas as well, securely, and in a manner that precludes their falling off.

[0053] Further, making the sectional shape of the foregoing support members approximately circular, can prevent the cracking of the adhesive or the refractory tiles due to a different rate of heat expansion by said support members.

[0054] Further still, since the structure of the foregoing support members employs a step or a taper between the base and the tip, the bonding effect of the support members is thereby improved by the engagement of the support members in the adhesive.

[0055] Additionally, it is possible to increase the contact surface area between said refractory tiles and the adhesive by widening the internal surface area of the indent in the refractory tiles, which serves to improve the engagement between said refractory tiles and said adhesive to make a stronger bond. This makes it possible to provide a fireproof structure which can be securely affixed to ceiling areas as well as vertical walls without the danger of it falling off.

[0056] Also, by providing a through hole from the water pipe side of said refractory tiles to the other side, adhesive injected between said refractory tiles and said

water pipes exudes through the holes to provide visual confirmation of the complete filling of the spaces by the adhesive without air bubbles, thereby providing a sure and inexpensive means for confirming the secure installation of said refractory tiles.

[0057] In addition, since it is possible to perform the installation over the entire water pipe wall, even in areas where the water pipes bend around openings and assume complex shapes, the fireproof structure provided by this invention provides assured protection for water pipes subjected to high temperature environments.

Claims

1. A tile installation structure for installing refractory tiles in areas where it would be difficult to slide the refractory tiles along the outside surface of water pipes to engage with support members, said tile installing structure being provided in a fireproof structure for protecting the water pipes installed in boilers and the like in which the refractory tiles are installed upon the support members protruding from the water pipe side with an adhesive such as mortar disposed between the refractory tiles and the support members,

   wherein said support members have a sectional dimension at the base which is smaller than a sectional dimension at the tip, and said refractory tiles have an indent on an engagement side facing said support member, said indent is wider than the tip of said support member to allow said indent to be freely inserted in the fore-aft direction onto said support members, to thereby allow the tile installation by pressing said refractory tiles toward the water pipes to engage, with the adhesive such as mortar.

2. A tile installation structure for installing refractory tiles according to claim 1, wherein said tip of said support member is thicker than said base, being roughly circular in cross section.

3. A tile installation structure for installing refractory tiles according to claim 1, wherein said sectional dimension of said support member is stepped up from said base toward said tip.

4. A tile installation structure for installing refractory tiles according to claim 1, wherein said sectional dimension of said support member is smoothly tapered to the larger dimension from said base toward said tip.

5. A tile installation structure for installing refractory tiles according to claim 1, wherein an opening of said indent on said refractory tiles is wider than the tip of said support member to allow said indent to be freely inserted in the fore-aft direction onto said support members, and said indent widens in the depth direction towards the bottom of said indent.

6. A tile installation structure for installing refractory tiles according to claim 1, wherein said indent on said refractory tiles is provided with a through hole that passes through said indent to the opposite side of said tiles.

7. A fireproof structure in stoker type incinerators where the gas retention time is 2 seconds or more from the secondary air duct, and the incinerator outlet temperature to an upper limit of the fireproof installation reaches about 900 °C to 1200 °C, said fireproof structure provided with an installation structure for refractory tiles to be installed around air supply ducts that supply combustion air, openings for the insertion of monitoring equipment, openings such as manholes for worker egress, and around clinker chill where the water pipes are bent into complex shapes, said installation structure to be provided on vertical walls and on ceilings, wherein said installing structure comprises:

   support members having a sectional dimension at the base which is smaller than a sectional dimension at the tip; and
   refractory tiles having an indent on an engagement side facing said support member, said indent being wider than the tip of said support member to allow said indent to be freely inserted in the fore-aft direction onto said support members, to thereby allow the tile installation by pressing said refractory tiles toward the water pipes to engage, with the adhesive such as mortar.

FIG. 1(A)

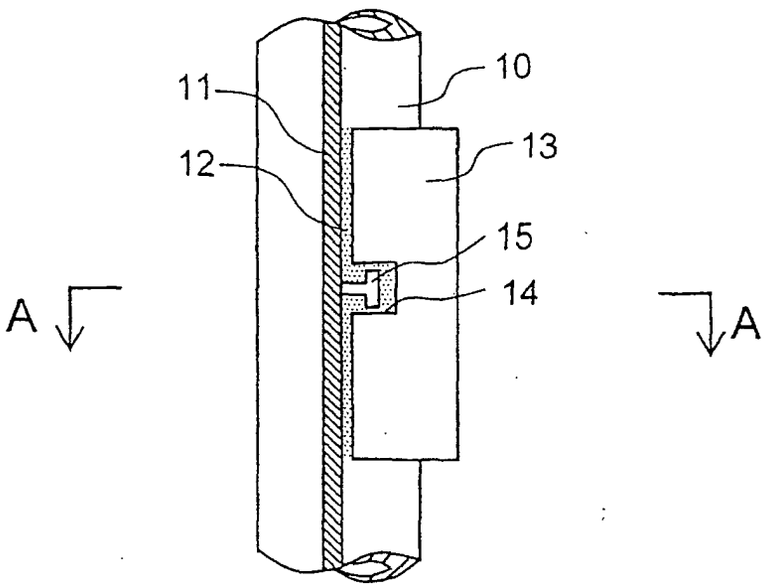


FIG. 1(B)

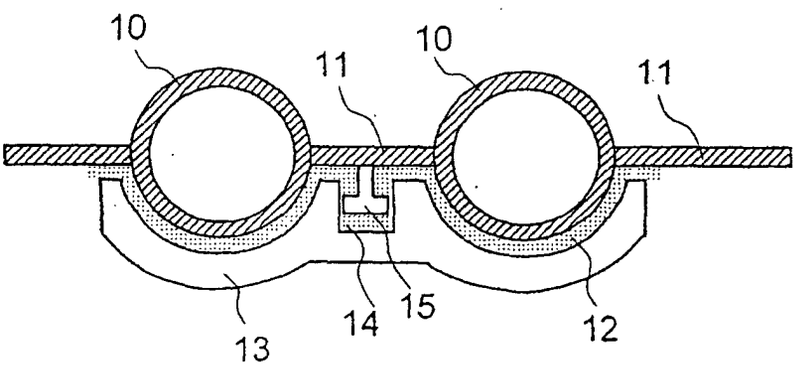


FIG. 2(A)

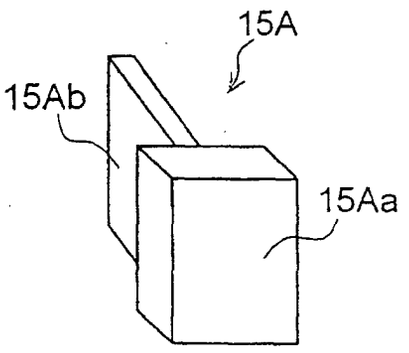


FIG. 2(B)

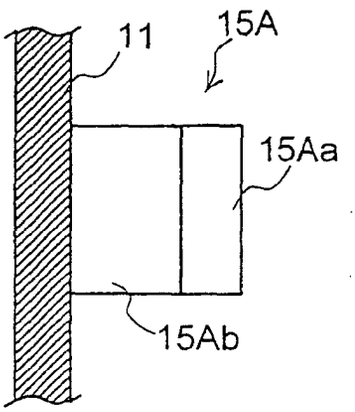


FIG. 3(A)

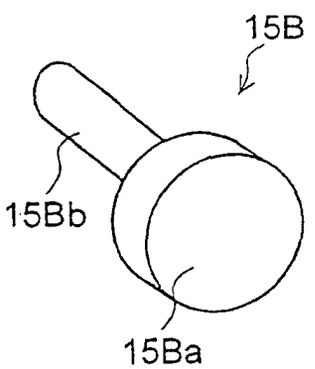


FIG. 3(B)

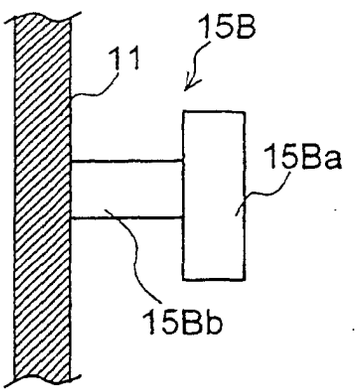


FIG. 4(A)

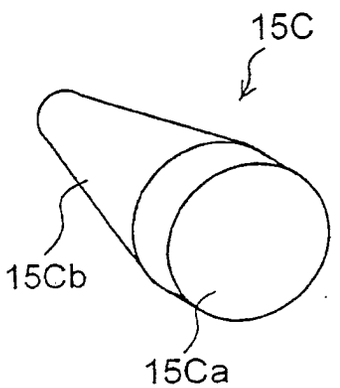


FIG. 4(B)

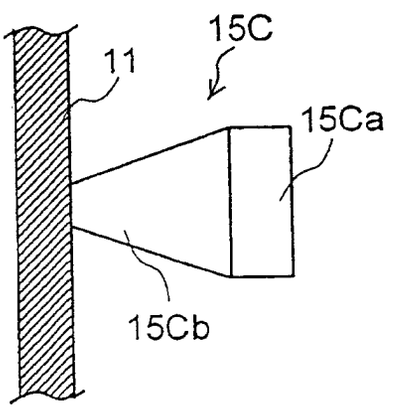


FIG. 5

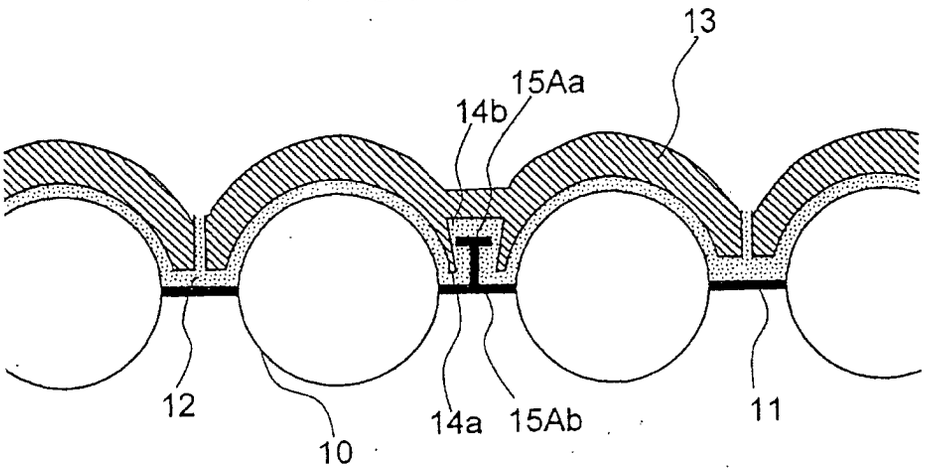


FIG. 6

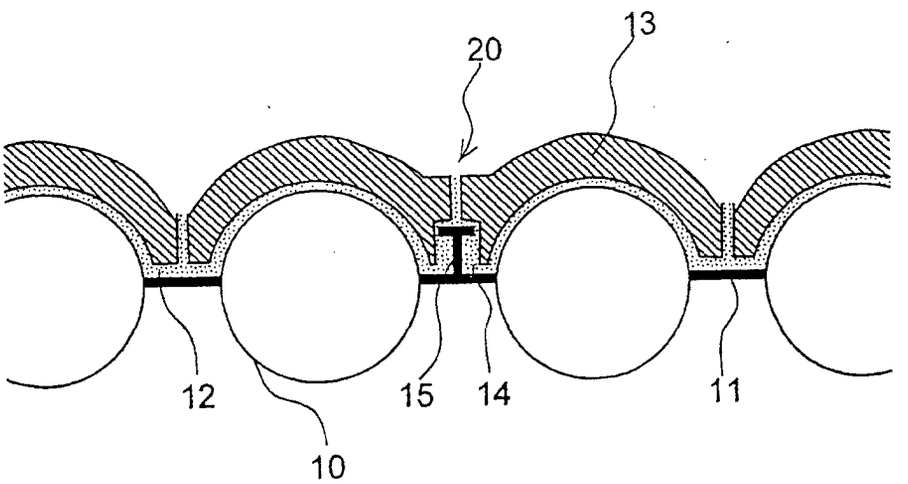


FIG. 7

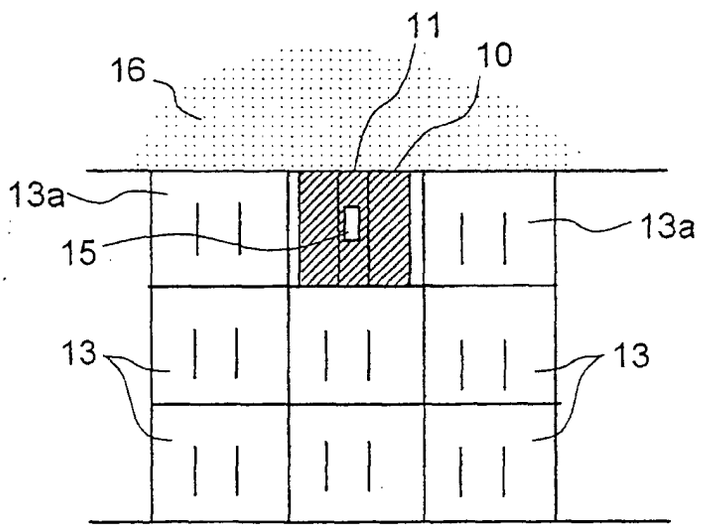


FIG. 8

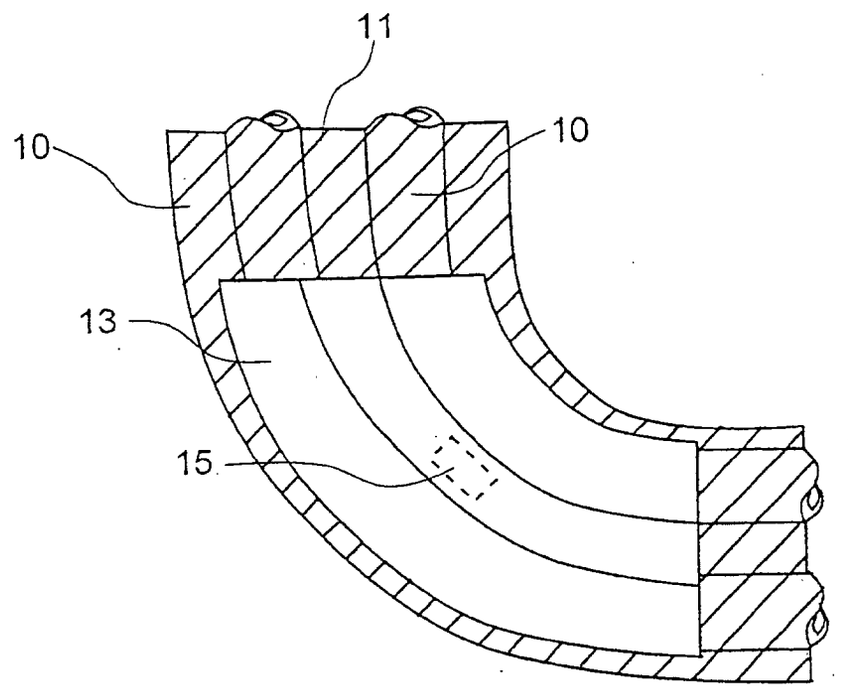


FIG. 9(A)

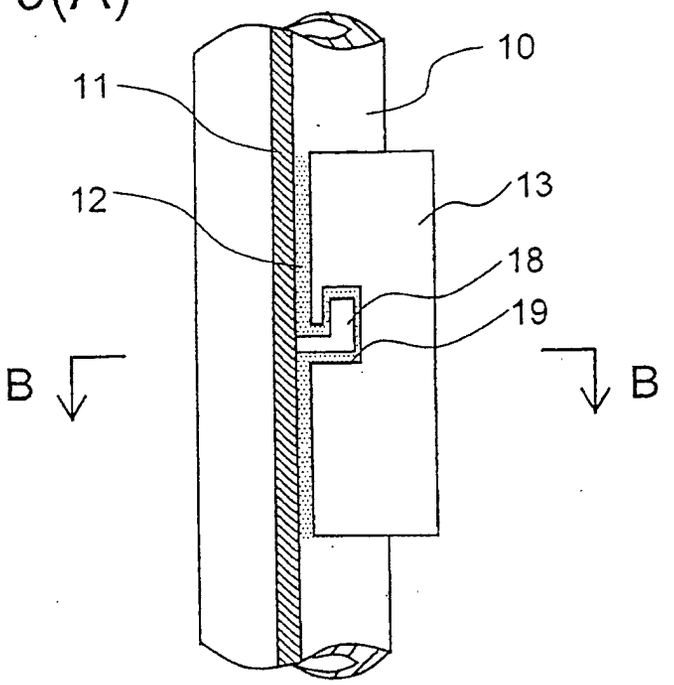


FIG. 9(B)

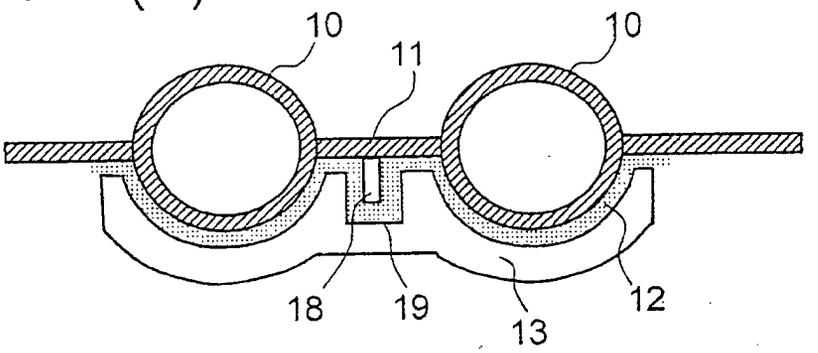
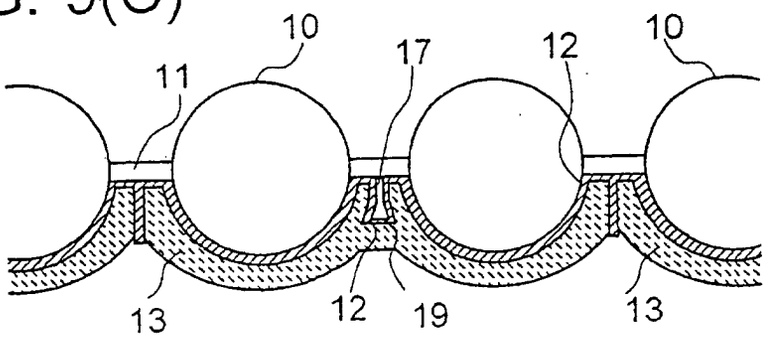


FIG. 9(C)



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP02/11558

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] F22B37/10, F23G5/44

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl[7] F22B37/10, F23G5/44, F23M5/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho	1926-1996	Toroku Jitsuyo Shinan Koho	1994-2002
Kokai Jitsuyo Shinan Koho	1971-2002	Jitsuyo Shinan Toroku Koho	1996-2002

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 199436/1987 (Laid-open No. 106706/1989) (Mitsubishi Heavy Industries, Ltd.), 18 July, 1989 (18.07.89), Full text; Figs. 3, 4 (Family: none)	1-6 7
Y A	JP 62-155406 A (Nippon Drive Iit Kabushiki Kaisha), 10 July, 1987 (10.07.87), Full text; Fig. 2 (Family: none)	1-6 7
A	JP 58-224224 A (Asahi Glass Co., Ltd.), 26 December, 1983 (26.12.83), Page 4, lower left column, lines 3 to 10; Fig. 7 (Family: none)	4,5

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
06 December, 2002 (06.12.02)	17 December, 2002 (17.12.02)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP02/11558

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 57-204723 A (Takuma Co., Ltd.), 15 December, 1982 (15.12.82), Full text; Fig. 1 (Family: none)	7

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