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(54) **IMPROVED INSULATION FOR RADIANT BURNER**

VERBESSERTE ISOLIERUNG FÜR STRAHLUNGSBRENNER

Isolation améliorée pour brûleur à radiation

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Description

Technical Field

[0001] The present invention relates to radiant burners comprising a radiant plate and a screen.

Background Art

[0002] Radiant burners comprising a radiant plate and a screen are known e.g. from US4799879 or EP0539279. The screen together with the radiant burner plate provides the radiative output of the burner, which amounts up to about 50% efficiency. In the past the radiative output of the burners has been increased by modification of the radiant burner plate as described in e.g. US 4,569,657 or US4,799,879. This or similar modifications of the radiant burner plate increased the temperature level and consequently also the radiative output of the burner. Another way to increase the radiative output of the burners was proposed by using two layers of screens as e.g. in US 3,847,536. Here the radiant screens are kept in place by metal means. These metal connections cause thermal bridges and thermal losses, causing thermal stresses and thereby early emitter A radiant burner according to the preamble of claim 1 is disclosed in US 4,799,879.

Disclosure of Invention

[0003] The object of the present invention is to provide a new radiant burner which combines the advantage of using two layers of radiant screens with limiting the lateral heat losses through the thermal bridges, thereby providing a radiant burner wherein the thermal energy is concentrated on the inside of the combustion chamber which results in a greater amount of energy radiated at the front of the radiant burner.

[0004] An aspect of the claimed invention provides a radiant burner according to claim 1. This provides an insulation which enables the different screenlayers to expand freely in the radiant burner and at the same time provides the fact that the insulation is a multipiece, multilayered structure, and preferably that each layer is insulating one screenlayer, that the different levels can expand freely with respect to one another as the different levels are subjected to different expansions due to their distance to the radiant burner surface of the radiant burner plate. A further advantage of this multilayer insulation is an easier assembly of the radiant burner, a simplified production. Moreover, if one layer of the insulation is broken, other insulation layers will keep the broken part in place and the radiant burner can stay in operation.

[0005] Preferably, the insulation is made of ceramic, e.g. cordierite or zirconia; partially stabilised zirconia (PSZ), alumina, silicon carbides or other high level technical ceramics. The ceramic insulation layer is obtained by extruding ceramic material, it is preferable to mold them when aiming at more complex ceramic insulation layers.

[0006] The insulation has an equal thickness in the complete depth of the radiant burner. In an alternative embodiment, the insulation is thicker at the level of the radiant burner plate(s) and obliquely narrows down to smaller thickness. In another alternative embodiment, the insulation narrows gradually from the radiant burner plate(s) upto the upper flange of the peripheral band. These alternative embodiments provide as an extra advantage that a better insulation is obtained on the closer to the radiant burner plate lying screenlayers which are also at higher temperatures and require a thicker insulation. At the same time is this narrowing insulation (away from the radiant burner plate(s)) also provides more free radiant surface to the outside.

[0007] The different layers of the insulation all have the same depth. In an alternative embodiment, the different layers of the insulation have a gradually or obliquely lowering depth from the radiant burner plate upto the upper flange of the peripheral band. In another alternative embodiment, insulation layers with same depth are combined with insulation layers with differing depth.

[0008] In another preferred embodiment, the insulation is also enclosing the radiant burner plate(s).

[0009] In a preferred embodiment, the surfaces of the insulation layers wich are in contact with the other layers of the insulation (which will be called further on "contacting surfaces") are very smooth. Allowing a tension free movement of the contacting surfaces with respect to one another. In another preferred embodiment, each insulating layer comprises one smooth contacting surface and one profiled contacting surface. This provides as further advantage that the contact surface of these contacting surfaces is lowered to the surface of these profiles. Whereas the smooth and flat surface of the neighbouring insulation layer still provides a tension free movement of the contacting surfaces with respect to one another. Preferably, the profiles on one of the contacting surfaces of the insulation layer are ribs. More preferably, these profiles ribs are parallel to the peripheral band, in an alternative preferable embodiment, these ribs are in zig-zag or sinuous form and parallel to the peripheral band.

[0010] It is self evident that the succession of profiled surface and flat, smooth surface can also be used in one insulation layer wherein this insulation layer is construed of multiple building blocks.

[0011] Preferably, the radiant screens are produced from highly heat resistant materials such as ceramics, especially aluminium or zirconium oxide, aluminium titanate, silicon oxide, corundum or mullite, silicon carbide, silicon nitride or metal infiltrated ceramics, such as silicon-infiltrated silicon carbide. Alternatively, the radiant screens can also be fabricated from heat-resistant materials of other nature such as e.g. materials which contain more than 50% by weight of a metal silicide, such as molybdenum disilicide ($MoSi_2$) or tungsten disilicide (WSi_2). Alternatively the radiant screens are fabricated from highly heat resistant steel grades, such as high level

stainless steel grades like Kanthal APM or APMT, different grades of FeCrAl alloy designed for high temperature corrosion, Chrome/Nickel steel grades like Avesta 253 MA, 153 MA, Inconel 601, Incoloy 800HT, Incoloy MA956.

[0012] In a preferred embodiment, at least one of the screenlayers is a metal grid, preferably woven. In an alternative preferred embodiment, at least one of the screenlayers is made of an arrangement of parallel spaced round rods or square bars. In a further preferred embodiment, the different screenlayers are arranged in the same direction and parallel with respect to one another. In an alternative preferred embodiment, the different screenlayers are arranged in shifted angles, but parallel, with respect to one another. More preferably, the first and second radiant screens are at a 90° angle.

[0013] The radiant burner plate is preferably made of a ceramic material with high temperature resistance, and excellent mechanical and thermodynamic properties such as e.g. cordierite or zirconia; partially stabilised zirconia (PSZ), alumina, silicon carbides or other high level technical ceramics.

Brief Description of Figures in the Drawings

[0014] Example embodiments of the invention are described hereinafter with reference to the accompanying drawings in which

Figure 1 shows a cross section through an example radiant burner which comprises 2 screenlayers.

Figure 2 shows a cross section through an alternative example radiant burner which comprises 2 screenlayers.

Figure 3 shows a cross sectional view of another embodiment of insulation of the present invention.

Figure 4 shows a cross sectional view of another embodiment of insulation of the present invention.

Figure 5 shows a cross sectional view of another embodiment of insulation of the present invention.

Figures 6 and 7 show a cross sectional view of further alternative embodiments of insulation layer of the present invention.

Figures 8 to 10 show cross sectional views of differing embodiments of insulation layer of the present invention.

Figures 11 shows a perspective view of an exemplary preferred embodiment of insulation layer of the present invention.

Figure 12 shows a cross sectional view of a stack of two insulating layers according to a preferred embodiment.

Figures 13 and 14 show perspective views of further alternative embodiments of insulation layer of the present invention.

Mode(s) for Carrying Out the Invention

[0015] As shown in Figure 1 the radiant burner 1 according to the invention comprises at least one radiant burner plate 2 and, in this example, two layers of radiant screens 3 enclosed by a peripheral band 4 associated with a body 6 defining a premixing chamber for said burner. The peripheral band comprises an upper flange 5. The radiant burner further comprises an insulation 7 lying under and extending downwardly from said upper flange 5 of said peripheral band 4. The insulation 7 has an internal peripheral structure permitting limited movement of the layers of screens 3. The insulation 7 is a multilayer structure wherein each layer engages and supports at least one screenlayer. This provides an insulation 7 which enables the different screenlayers 3 to expand freely in the radiant burner and at the same time provides the fact that the insulation is a multipiece, multilayered structure, and preferably that each layer is insulating one screenlayers, that the different levels can expand freely with respect to one another as the different levels are subjected to different expansions due to their distance to the radiant burner surface of the radiant burner plate. In this example, the insulation has an equal thickness over the complete depth of the combustion chamber. The depth of both insulation layers are equal although the distribution of the internal peripheral structure permitting movement of the screenlayers varies, in this example the upper screenlayer, being a metal mesh, is placed in the middle of the upper insulation layer, whereas the lower screenlayer, being round rods, is placed in the upper part of the insulation layer.

[0016] The illustrated example of figure 2 comprises an alternative insulation according to the present invention. In this example the insulation has an obliquely increasing thickness starting under said upper flange and extending downwardly to said radiant burner plate(s). In figure 3 the insulation has a gradually increasing thickness. The screenlayers in the exemplary embodiment of figure 2 are both arrangements of parallel spaced round rods which are arranged parallel to one another, but are shifted in a 90° angle with respect to one another.

[0017] Figures 4 and 5 show some examples of insulation layer stacks according to the present invention. Figure 4 shows an insulation stack wherein the different insulation layers have the same depth. Figure 5 shows an insulation stack wherein the different insulation layers have the same and differing depths.

[0018] Figures 6 and 7 show some examples of alternative insulation layers which are mainly used on the top of such an insulation stack.

[0019] Figures 8, 9 and 10 show alternative embodiments of insulation layers in cross section.

[0020] Figures 11 shows a perspective view of a exemplary preferred embodiment of insulation layer of the present invention. The insulation layer of Figure 11 has ribs protruding the upper contacting surface of the insulation layer, these ribs are parallel to the peripheral band.

[0021] Figure 12 shows a cross sectional view of a stack of two insulating layers according to a preferred embodiment, wherein the lower insulation layer is according to figure 11.

[0022] Figures 13 and 14 show perspective views of further alternative embodiments of insulation layer of the present invention. The insulation layer of figure 13 has zig-zag patterned ribs protruding one contact surface. In figure 14 the ribs are in sinuous form and substantially parallel to the peripheral band.

[0023] Thus there has been described a radiant burner which comprises at least one radiant burner plate and at least two layers of radiant screens enclosed by a peripheral band associated with a body defining a premixing chamber for said burner. The peripheral band comprises an upper flange. The radiant burner further comprises an insulation lying under and extending downwardly from said upper flange of said peripheral band. The insulation has an internal peripheral structure permitting limited movement of the layers of screens. The insulation is a multilayer structure wherein each insulation layer engages and supports at least one screen layer.

Claims

1. A radiant burner (1) comprising at least one radiant burner plate (2) and a screen (3) enclosed by a peripheral band (4) associated with a body (6) defining a premixing chamber for said burner, said peripheral band comprising an upper flange (5), said burner further comprising an insulation (7) lying under and extending downwardly from said upper flange of said peripheral band, said insulation (7) having an internal peripheral structure permitting limited movement of said radiant screens (3), **characterised in that** said screen (3) comprises at least two screen layers (3) and **in that** said insulation (7) is a multilayer insulation structure comprising more than one insulation layer, each insulation layer engaging and supporting at least one screenlayer (3).

2. A radiant burner according to claim 1, wherein said insulation (7) has an increasing thickness starting under said upper flange (5) and extending downwardly to said radiant burner plate(s) (2).

3. A radiant burner according to claims 1 or 2, wherein said insulation layer having at least two contacting surfaces which could provide contact with a neighbouring insulation layer, **characterised in that** one contacting surface has at least one flat surface and at least another profiled contacting surface.

4. A radiant burner according to any of the preceding claims, wherein at least one of said radiant screenlayers is a metal grid.

5. A radiant burner according to any of the preceding claims, wherein at least one of said radiant screenlayers is an arrangement of parallel spaced round rods or square bars.

6. A radiant burner according to any of the preceding claims, wherein at least two of said radiant screenlayers are an arrangement of parallel spaced round rods or square bars.

7. A radiant burner according to claim 6, wherein said radiant screenlayers, which are an arrangement of parallel spaced round rods or square bars are in parallel directions.

8. A radiant burner according to claim 6, wherein said radiant screenlayers, which are an arrangement of parallel spaced round rods or square bars are in crossing directions, preferably at 90°.

9. A radiant burner according to any of the preceding claims, wherein said multilayer insulation structure is made of ceramic material.

Patentansprüche

1. Strahlungsbrenner (1), umfassend mindestens eine Strahlungsbrennerplatte (2) und einen Schirm (3), der durch ein peripheres Band (4) umschlossen ist, welches mit einem Körper (6) verbunden ist, der eine Vormischkammer für den Brenner definiert, wobei das periphere Band einen oberen Flansch (5) umfasst, der Brenner ferner eine Isolierung (7) umfasst, die unter dem oberen Flansch des peripheren Bands liegt und sich von diesem nach unten erstreckt, wobei die Isolierung (7) eine innere periphere Struktur aufweist, die begrenzte Bewegung der Strahlungsschirme (3) zulässt, **dadurch gekennzeichnet, dass** der Schirm (3) mindestens zwei Schirmschichten (3) umfasst, und dass die Isolierung (7) eine Mehrschichtisolierstruktur ist, die mehr als eine Isolierschicht umfasst, wobei jede Isolierschicht in Eingriff mit mindestens einer Schirmschicht (3) ist und diese trägt.

2. Strahlungsbrenner nach Anspruch 1, wobei die Isolierung (7) eine zunehmende Dicke aufweist, die unter dem oberen Flansch (5) beginnt und sich nach unten zu dem/den Strahlungsbrennerplatte(n) (2) erstreckt.

3. Strahlungsbrenner nach Anspruch 1 oder 2, wobei die Isolierschicht mindestens zwei Kontaktflächen aufweist, die Kontakt mit einer benachbarten Isolierschicht bereitstellen könnten, **dadurch gekennzeichnet, dass** eine Kontaktfläche mindestens eine ebene Fläche und mindestens eine andere eine pro-

filierte Kontaktfläche aufweist.

4. Strahlungsbrenner nach einem der vorhergehenden Ansprüche, wobei mindestens eine der Strahlungsschirmschichten ein Metallgitter ist.

5. Strahlungsbrenner nach einem der vorhergehenden Ansprüche, wobei mindestens eine der Strahlungsschirmschichten eine Anordnung von parallel beabstandeten Rundstäben oder Vierkantstangen ist.

6. Strahlungsbrenner nach einem der vorhergehenden Ansprüche, wobei mindestens zwei der Strahlungsschirmschichten eine Anordnung von parallel beabstandeten Rundstäben oder Vierkantstangen sind.

7. Strahlungsbrenner nach Anspruch 6, wobei die Strahlungsschirmschichten, die eine Anordnung von parallel beabstandeten Rundstäben oder Vierkantstangen sind, in parallelen Richtungen verlaufen.

8. Strahlungsbrenner nach Anspruch 6, wobei die Strahlungsschirmschichten, die eine Anordnung von parallel beabstandeten Rundstäben oder Vierkantstangen sind, in sich kreuzenden Richtungen verlaufen, vorzugsweise in 90°.

9. Strahlungsbrenner nach einem der vorhergehenden Ansprüche, wobei die Mehrschichtisolierstruktur aus Keramikmaterial gefertigt ist.

Revendications

1. Brûleur radiant (1) comprenant au moins une plaque de brûleur radiante (2) et un écran (3) entourés par une bande périphérique (4) associée à un corps (6) définissant une chambre de prémélange pour ledit brûleur, ladite bande périphérique comprenant un rebord supérieur (5), ledit brûleur comprenant en outre une isolation (7) située sous ledit rebord supérieur de ladite bande périphérique et s'étendant vers le bas à partir de celui-ci, ladite isolation (7) comportant une structure périphérique intérieure permettant un mouvement limité desdits écrans radiants (3), **caractérisé en ce que** ledit écran (3) comprend au moins deux couches d'écran (3) et **en ce que** ladite isolation (7) est une structure d'isolation multicouche comprenant plus d'une couche d'isolation, chaque couche d'isolation venant en prise avec au moins une couche d'écran (3) et la supportant.

2. Brûleur radiant selon la revendication 1, dans lequel ladite isolation (7) présente une épaisseur croissante partant du dessous dudit rebord supérieur (5) et s'étendant vers le bas jusqu'à ladite ou auxdites plaques de brûleur radiantes (2).

3. Brûleur radiant selon la revendication 1 ou 2, ladite couche d'isolation comportant au moins deux surfaces de contact qui peuvent assurer un contact avec une couche d'isolation adjacente, **caractérisé en ce qu'**une surface de contact comporte au moins une surface plane et au moins une autre surface de contact profilée.

4. Brûleur radiant selon l'une quelconque des revendications précédentes, dans lequel au moins une desdites couches d'écran radiant est une grille métallique.

5. Brûleur radiant selon l'une quelconque des revendications précédentes, dans lequel au moins une desdites couches d'écran radiant est un agencement de tiges rondes ou de barres carrées parallèles et espacées.

6. Brûleur radiant selon l'une quelconque des revendications précédentes, dans lequel au moins deux desdites couches d'écran radiant sont un agencement de tiges rondes ou de barres carrées parallèles et espacées.

7. Brûleur radiant selon la revendication 6, dans lequel lesdites couches d'écran radiant qui sont un agencement de tiges rondes ou de barres carrées parallèles et espacées sont disposées dans des directions parallèles.

8. Brûleur radiant selon la revendication 6, dans lequel lesdites couches d'écran radiant qui sont un agencement de tiges rondes ou de barres carrées parallèles et espacées sont disposées dans des directions transversales, de préférence à 90°.

9. Brûleur radiant selon l'une quelconque des revendications précédentes, dans lequel ladite structure d'isolation multicouche est constituée d'un matériau de type céramique.

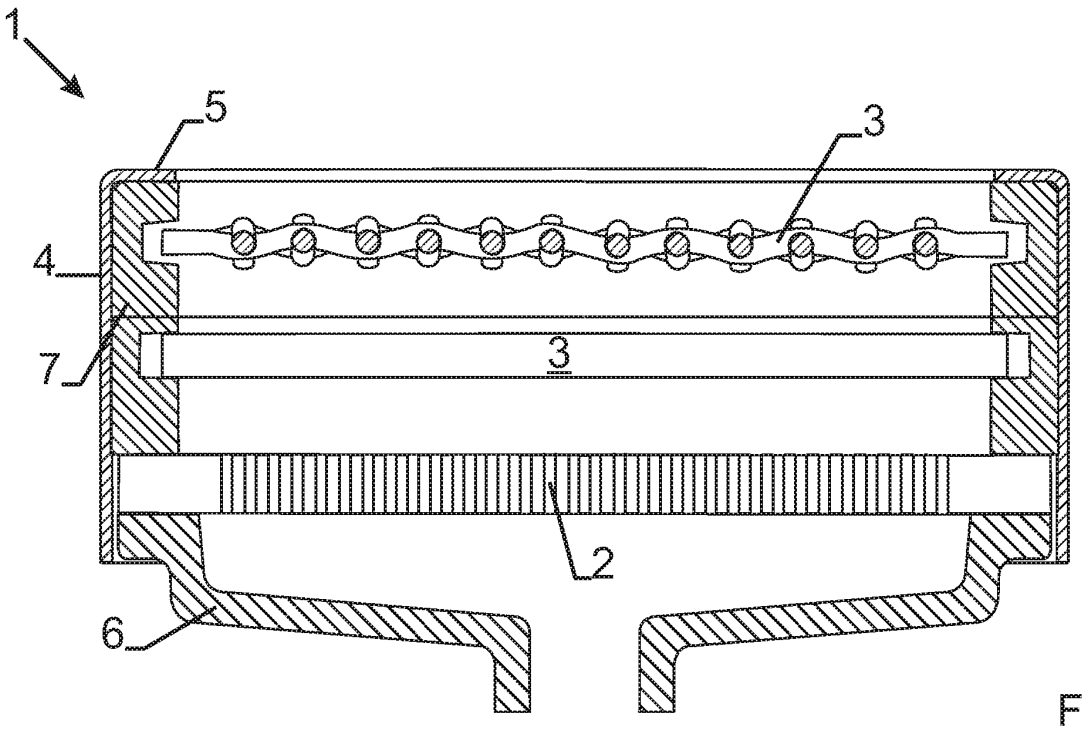

Fig. 1

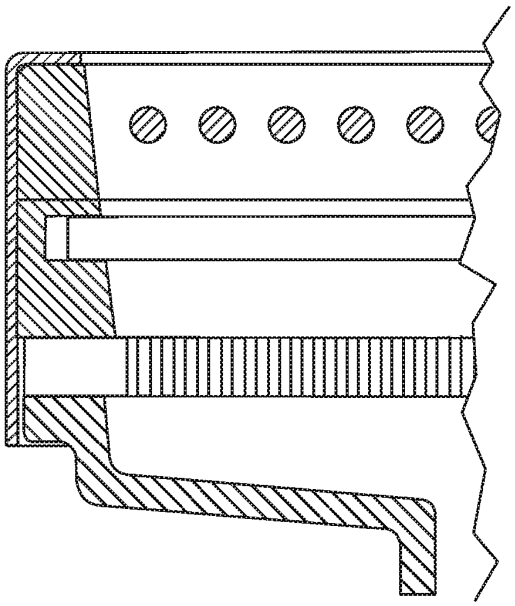

Fig. 2

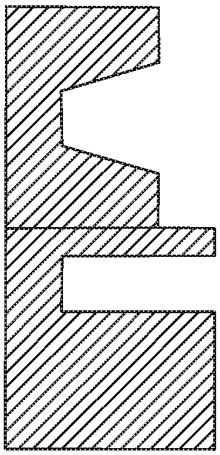

Fig. 3

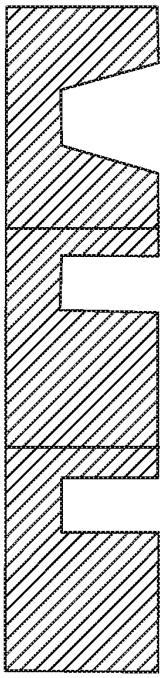

Fig. 4

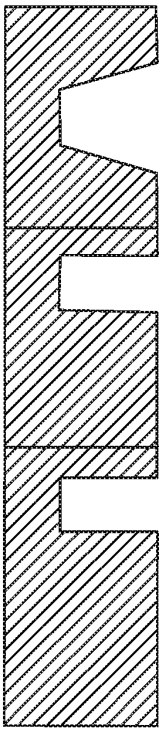

Fig. 5

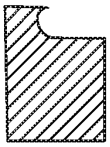

Fig. 6

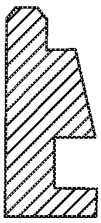

Fig. 7

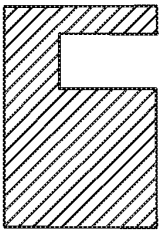

Fig. 8

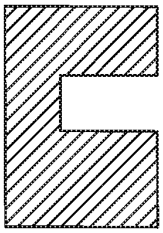

Fig. 9

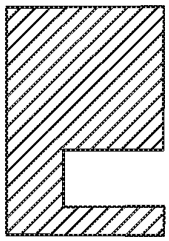

Fig. 10

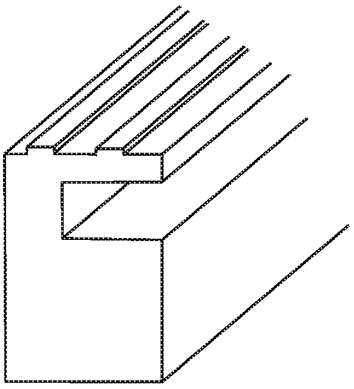

Fig. 11

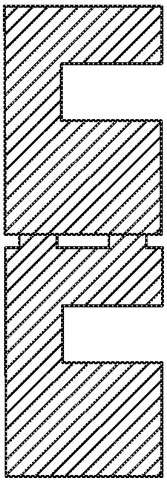

Fig. 12

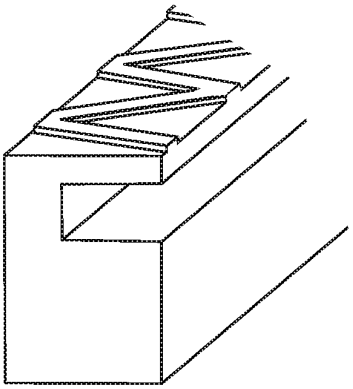

Fig. 13

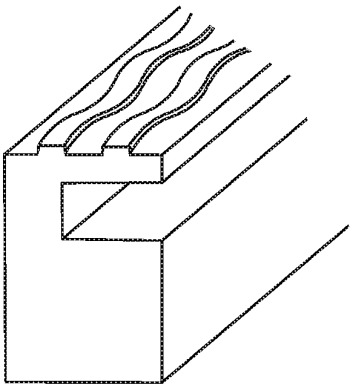

Fig. 14

REFERENCES CITED IN THE DESCRIPTION

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- US 3847536 A **[0002]**