

[54] **RADIANT BURNER**

[72] Inventor: **Katsushi Mizutani**, Inazawa, Japan

[73] Assignee: **Kabushiki Kaisha Rinnai Seisakusho**, Nagoya-shi, Aichi-ken, Japan

[22] Filed: **Oct. 30, 1970**

[21] Appl. No.: **85,323**

[30] **Foreign Application Priority Data**

Oct. 31, 1969 Japan44/86924

[52] U.S. Cl.431/328

[51] Int. Cl.F23d 13/12

[58] Field of Search.....431/328, 329

[56] **References Cited**

UNITED STATES PATENTS

3,445,175 5/1969 Krieger.....431/328

FOREIGN PATENTS OR APPLICATIONS

893,554 4/1962 Great Britain.....431/329

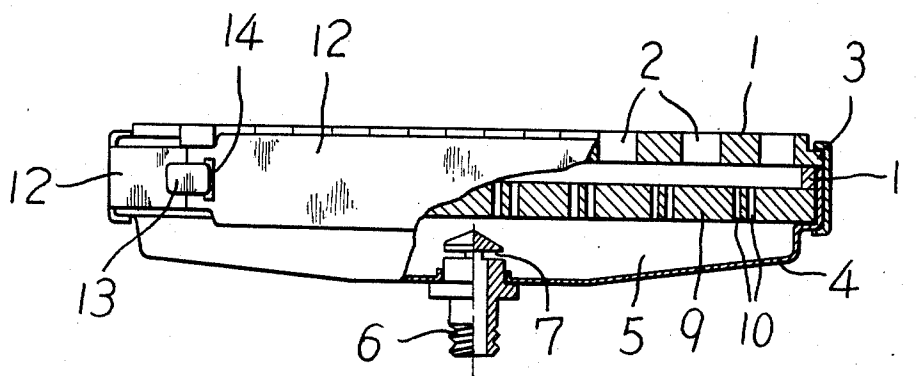
Primary Examiner—Carroll B. Dority, Jr.

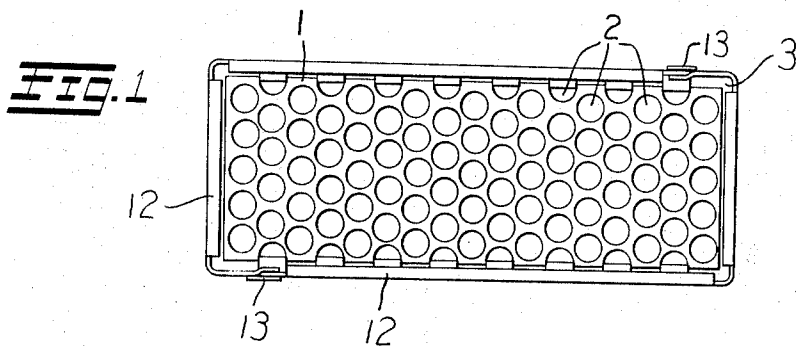
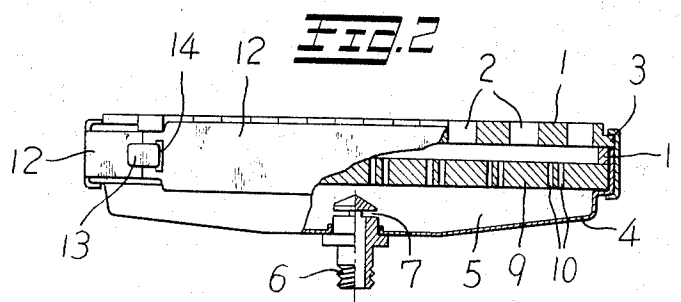
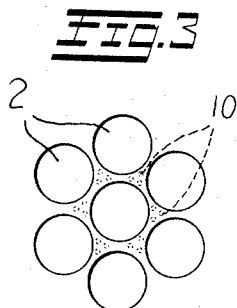
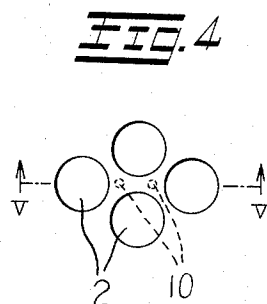
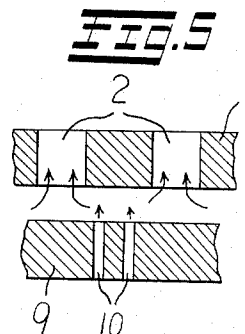
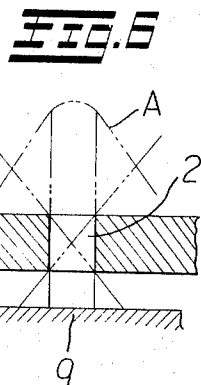
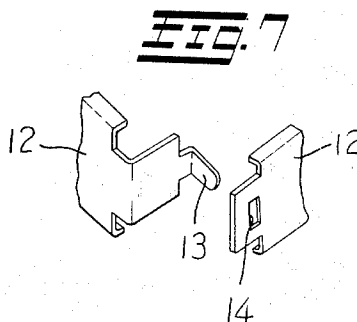
Attorney—Waters, Roditi, Schwartz & Nissen

[57] **ABSTRACT**

A radiant burner comprises a casing with an open chamber supplied with gaseous fuel, and a heating place and burner plate mounted in spaced relation in the casing across the open chamber, the heating plate facing the outside. The heating plate is made of a fire-resisting material and has a large number of circular holes of equal size arranged at equal intervals throughout the entire extent thereof. The burner plate is also made of a fire-resisting material and it has a large number of holes arranged to face the solid portions of the heating plate between the circular holes.

4 Claims, 7 Drawing Figures





INVENTOR

Katsushi Mizutani

RADIANT BURNER

BRIEF SUMMARY OF THE INVENTION

This invention relates to a radiant burner using gas as a fuel in which the whole surface thereof is uniformly heated to a high temperature. The invention contemplates a construction in which any damage to the heat radiant elements due to high temperature is prevented while also the durability is improved.

The invention is characterized in that a heating plate of a fire-resisting material having a large number of circular holes of equal size arranged at equal intervals throughout the entire extent thereof and a burner plate of a fire-resisting material having a large number of discharge holes arranged in facing relation with the solid portions of the heating plate without the circular holes are disposed in opposed relationship, with a space left therebetween and the plates are secured to the inner surface of an open portion of a casing.

A type of radiant burner exceeding 1,000°C in operation temperature has been hitherto known in which a heat-resisting heating portion is mounted such that a gas flame may strike the same. In this type of burner the heating portion has a low thermal capacity in order to improve the heat radiant effect thereof and it is formed into a plurality of pieces in the form of rods or narrow plates so that these pieces face one another in order to jointly promote the heating effect.

This conventional arrangement, however, is deficient in that the heating-resisting material used for making the heating portion is not only fire-resisting but also has a low co-efficient of expansion and low thermal conductivity and also low elasticity, so that when the heating portion is heated by the gas flame, the part thereof against which the flame strikes assumes a high temperature, and the heating portion is easily breakable by stresses arising from temperature differences of that part and the remainder of the heating portion. The breakage can take place due to the application of a slight external force, such as shock or vibration.

This invention seeks to avoid the above drawbacks and provides a burner in which, without lowering the radiant effect, the strength thereof against external forces is increased and the strength thereof against thermal shocks arising from temperature gradients, rapid heating, or the like, is increased while, additionally, the molding, baking or firing operation is simplified.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a top plan view of one embodiment of this invention;

FIG. 2 is a side elevation view thereof, partly broken away and in section;

FIG. 3 is an enlarged top plan view of a part thereof showing the relation of the position between the circular holes of a heating plate and the discharge holes of a burner plate;

FIG. 4 is a top plan view similar to FIG. 3 of a portion of another embodiment of this invention;

FIG. 5 is a section side view taken along line V—V in FIG. 4;

FIG. 6 is a schematic diagram showing the temperature distribution of radiant heat, and

FIG. 7 is a fragmental perspective view of a fastening band.

DETAILED DESCRIPTION

Referring to the drawing, numeral 1 denotes a heating plate of a fire-resisting material in the form of a flat plate and having a large number of circular holes 2 therein extending throughout the entire extent of the plate. As best seen in FIG. 1, the holes 2 are equal in diameter and are disposed close to each other and at equally spaced intervals. The heating plate 1 is attached to an open portion of a casing 4, and a burner plate 9 is mounted in casing 4 parallel to the heating plate 1 beneath the same at a particular spacing therefrom as established by a spacer 11. The plates 1 and 9 have about the same thickness. The spacer 11 is made principally of alumina fiber. As is well known, this fiber may be obtained by heating a raw material chiefly composed of Al_2O_3 (42.5 percent) and SiO_2 (49.9 percent) at a temperature of about 2,000°C in an electric furnace so that the raw material becomes fibrous. Its resistability to heat is above 1,260°C and such a product has an excellent resilient character.

The fire-resisting material of heating plate 1 may be any known furnace material such as a fire brick or the like. It may be obtained by adding oil or water to a raw material chiefly composed of clay and talc and including a very small quantity of additive, then mixing and kneading the mixture, thereafter molding the mixture into desired shape and then baking the molded mixture.

The burner plate 9 is prepared by baking a fire-resisting material chiefly composed of clay and silicic acid to form a fine porous plate-like structure. A large number of discharge holes 10 for a gas are then formed therein. The holes 10 are arranged to face the solid portions of the heating plate 1 between the circular holes 2 as shown in FIGS. 2, 3, 4 and 5. The number of the holes 10 is selected in accordance with the amount of mixing air and the burning speed for the various different fuel gas components. The heating and burner plates 1 and 9 are mounted in the open portion of the casing 4 and are attached thereto by any suitable attaching means. One embodiment of attaching means comprises a band 12 applied to the peripheral surface of casing 4, and both side edges of the band are bent inwards and are respectively engaged with a shoulder 3 on the periphery of the heating plate 1 and with a shoulder on the casing 4. The opposite ends of the band 12 are connected together by inserting a projecting claw 13 at one end of the band 12 in an engaging slot 14 in the other end and then bending claw 13. A gas distribution chamber 5 is formed within the casing 4 and is supplied with gaseous fuel by a connecting tube 6 mounted at the bottom surface of casing 4 and adapted for connection with a gas supply conduit (not shown). The tube 6 has, around its upper portion, a jet opening 7 open into the chamber 5, so that gaseous fuel is supplied uniformly in a horizontal plane into the distribution chamber 5. The burner illustrated is of rectangular form but it could be modified to any desired form.

In the burner, the fuel gas within the gas distribution chamber 5 gushes through the holes 10 of the burner plate 9 to the upper surface thereof and is burned thereat when ignited. The burning flame of the gas causes the lower peripheral edge of each hole 2 of the heating plate 1 to be first heated to a high temperature and then the inner wall thereof is gradually heated. This heat radiates to the front surface of the burner plate 9 and in cooperation thereof with the heating of the

burning flame the said surface becomes red-hot, whereby the burning of the gas is promoted and the heating degree is progressively intensified such that the rear surface of the heating plate 1, against which the burning flame strikes, becomes white-hot. When, thus, the front surface of the burner plate 9 becomes red-hot and the rear surface of the heating plate 1 glows white-hot, the inner walls of the holes 2 of the heating plate 1 also become red-hot, and the radiant heat of those portions radiates forward through the holes 2 of the heating plate 1. As, in this case, each opening 2 is in the form of a cylinder, the radiant heat is defined within an angle projecting from the burner plate 9 to the open area of the holes 2, and thus the radiant heat emitting forward is concentrated and the distribution of temperature substantially conforms to curve A shown in FIG. 6.

According to this invention, the lower surface of the heating plate is subjected, at its solid portions without the holes, to the flames burning on the burner plate so as to be heated to an extremely high temperature and those portions of the heating plate are subjected to thermal expansion. However, due to the fact that the circular holes 2 of equal size are arranged at equal intervals, the thermal expansion is dispersed uniformly to the peripheral wall of each hole and there is established such an equilibrium condition that the circles mutually sustain the tension force. Accordingly, there is not produced any planar distortion caused by the thermal expansion as is often produced in the conventional heating units composed of linear pieces such as rod-like pieces or flat narrow plate pieces. Thus, the strength is maintained, and there is no damage caused by application of external force or by a rapid temperature change or partial temperature difference. Due to the fact that the spacer 11 is chiefly made of alumina fiber, the spacer can withstand a high temperature while also the elasticity of the alumina fiber can absorb any influence of the thermal expansion of the attaching member 12. Thus, any damage can be prevented and a uniform high temperature can be obtained. Additionally, in the manufacture of the heating plate, it is very simple to

form uniformly distributed circular holes in a flat plate and because the circular holes are distributed uniformly throughout the entire extent of the flat plate, even if these holes become redistributed during the heating operation, they are mutually balanced with each other and there is not caused any planar distortion. Thus, the heating of the heating plate becomes reliable.

What is claimed is:

1. A radiant burner comprising a casing having an open chamber for the supply of a gaseous fuel, a heating plate and a burner plate mounted in spaced relation in said open chamber, said heating and burner plates defining therebetween an unimpeded space so that the burner plate can radiate heat toward the heating plate, said plates being constituted of fire resistance material, said heating plate having a plurality of holes of equal size arranged at equal intervals therein throughout the entire extent of the heating plate, said burner plate having a plurality of holes therein facing the solid portions of the heating plates between the holes therein, an annular spacer of fibrous, heat resistant material between said plates, and band means encircling said casing and holding said plates in mounted relation in said casing with said spacer sandwiched therebetween, said band means comprising a band member having opposite ends constructed to be engaged together with the band member surrounding the casing, said band member having inwardly facing edges, said heating plate having a shoulder and said casing having a shoulder which respectively receive the edges of said band member so as to be clamped therebetween, one of said ends of the band including a projection and the other end having a slot for insertion of said projection and engagement of said ends.
2. A radiant burner as claimed in claim 1 comprising distributor means in said chamber of the casing for the horizontal discharge of gaseous fuel into said chamber.
3. A radiant burner as claimed in claim 1 wherein said spacer is fibrous alumina.
4. A radiant burner as claimed in claim 1 wherein said plates have relatively equal thicknesses.

* * * * *