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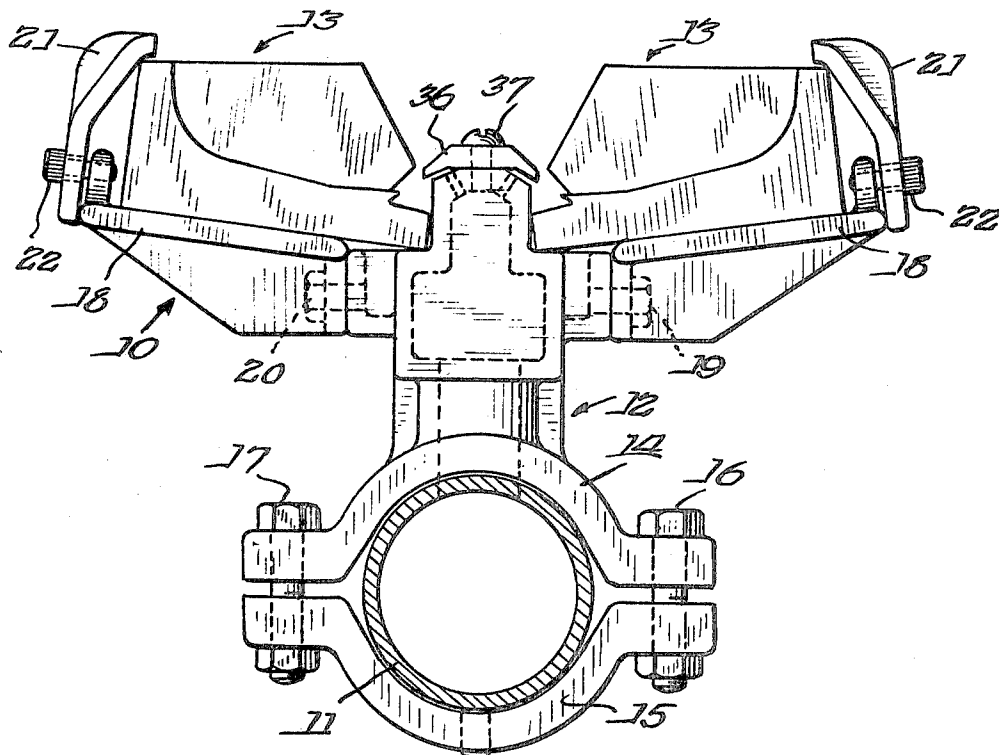
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[54] **RADIANT HEAT GENERATING BURNER**
 7 Claims, 6 Drawing Figs.

[52] U.S. Cl..... 431/348
 [51] Int. Cl..... F23d 13/12
 [50] Field of Search..... 431/347,
 348

ABSTRACT: A new and improved radiant heat generating burner having a fuel discharge assembly equipped with a deflecting plate to downwardly direct a flow of fuel and a radiant heat generating refractory material made up of a curved upper section, which carries a plurality of parallel spaced flanges, and a lower base section terminating in a knifelike edge opposite the downwardly directed flow of fuel, is provided for use in dividing a fuel stream so that the major portion of fuel passes onto the refractory material and the minor portion of fuel recirculates back to the fuel discharge point.



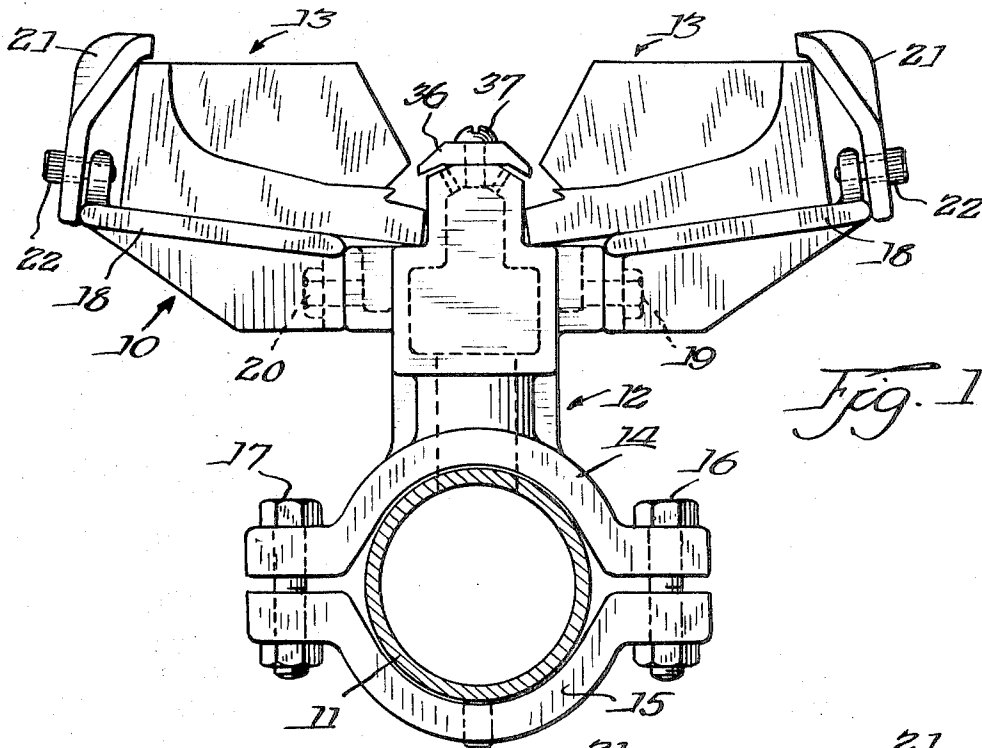


Fig. 1.

Fig. 2.

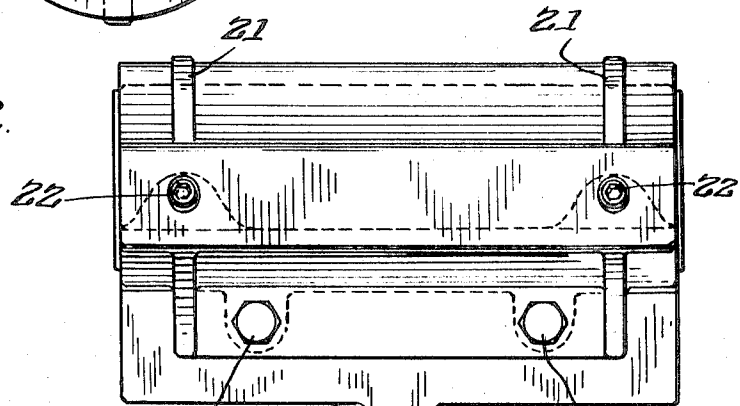
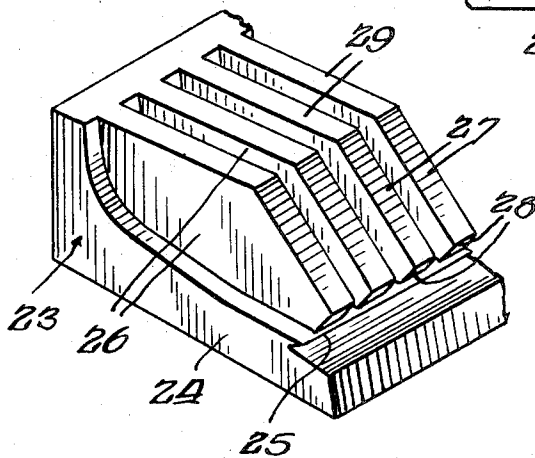


Fig. 3.



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Fig. 4.

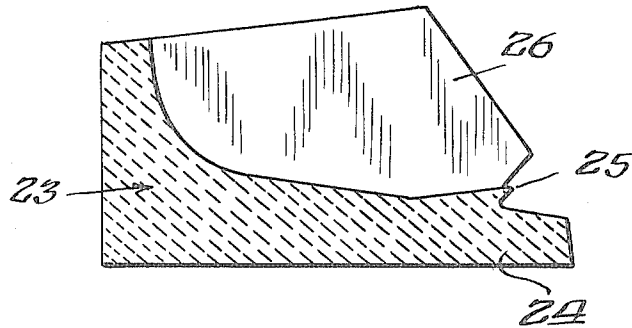


Fig. 5.

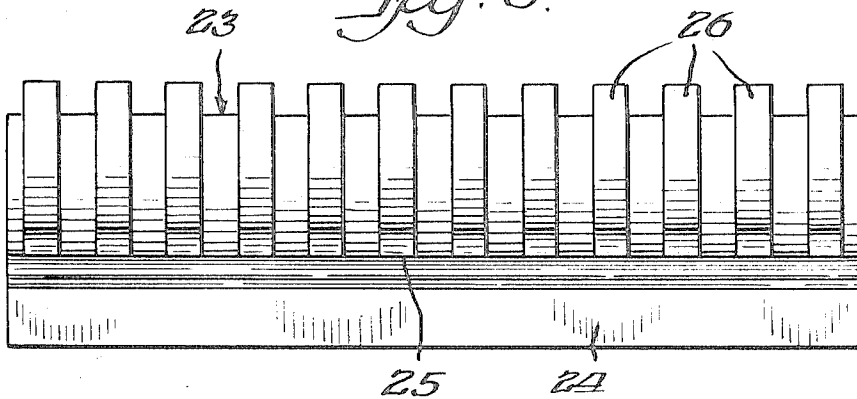
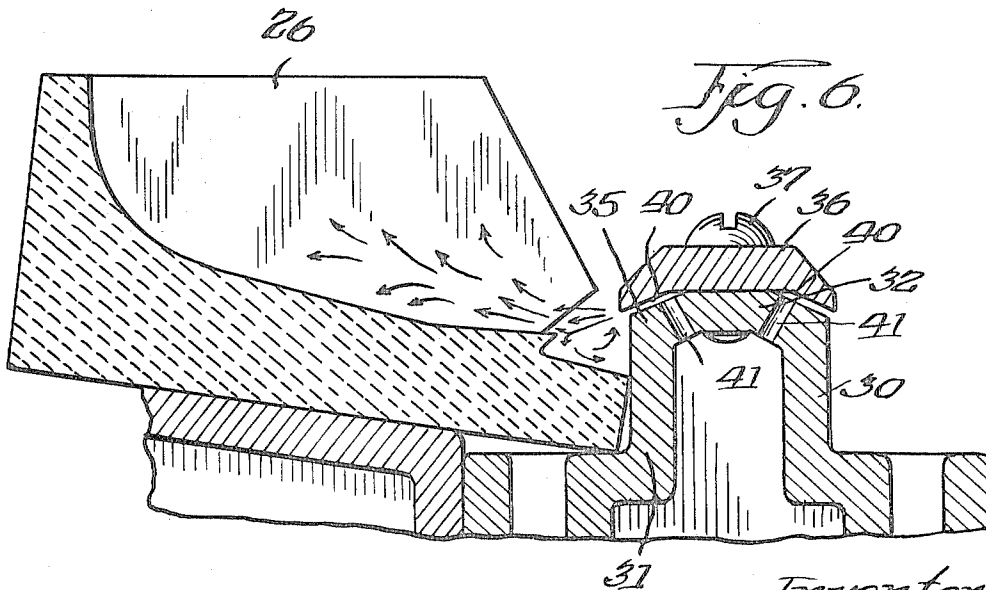


Fig. 6.



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RADIANT HEAT GENERATING BURNER

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to radiant heat generating burners and more particularly to gas-fired burners in which direct streams of combustible gases are made to impinge upon a refractory material in a manner sufficient to convert the refractory material into an excellent source of radiant energy.

2. Discussion of the Prior Art

Gas-fired radiant heat generating burners are known in the art and have been extensively used, for example, in drying paints, curing synthetic resins, heat-treating various metals and for other well known industrial drying and heating operations. Typically, such burners consist of a casing or conduit which serves to transport a supply of natural or other combustible gas to the burner, a mixing chamber in which gas is combined with combustion supporting air to form a combustible fuel, a refractory material disposed in some suitable arrangement alongside the casing and a fuel discharge assembly, which acts to direct combustible gases onto the refractory material. The rapid and continued attainment of elevated temperatures in the refractory material is, of course, necessary to provide a constant source of radiant energy for the burner.

Although numerous radiant heat generating burners are well known in the field, two of the most widely used types of burners are those which employ gas flames to effect temperature elevation in ceramic blocks and those which use heat from burning gases to cause the required temperature elevation in a refractory material. In the first mentioned type of radiant burner, fuel gas is urged under pressure through a highly porous block of ceramic material. Ignition takes place at the surface of the block, and radiation emitted from the gas flame causes a sufficient temperature rise in the ceramic material to allow radiation of heat energy.

The second type of radiant burner utilizes direct heat transfer from combustible gas rather than from a gas flame. For example, one such burner employs a jet of fuel gas directed downwardly along one edge of an annular refractory trough. Heat released by the combustion of gases passing across the surface of the trough causes the requisite elevation in trough temperature. A more recent modification of this latter-type burner provides a ceramic target-type heating unit in which the target is formed by a series of parallel channels suitably arranged to permit the temporary confinement of burning fuel gas within the channels. Typically, these channels are oriented vertically to the direction of gas flow and are slightly curved at their base to permit effective heat transfer as the hot gases move through the relatively narrow channels.

While such recent modifications in burner design have increased overall thermal efficiency, reduced fuel gas consumption, and have provided additional flexibility for most radiant burner applications, such burners still suffer from several significant deficiencies. It has been observed, for example, that the high fuel gas velocities which accompany such burner operations have increased the frequency of burner flameouts. In addition, the rapid movement of combustible gases across the radiation targets coupled with the quick and effective heat release required to elevate target temperatures has placed a premium on burner designs which provide for the preheating of burner fuel gases to temperatures at which complete combustion can take place at very short distances from the emergence point of the fuel gases.

As a consequence of these deficiencies, burner manufacturers have for some time sought to design a burner which would markedly reduce the frequency of burner flameouts and, at the same time, provide a quick and efficient technique for preheating burner fuel gases.

SUMMARY OF THE INVENTION

According to this invention, a new and improved radiant heat generating burner construction has been provided to improve burner flame retention and to permit the preheating of

burner fuel gases to temperatures at which complete combustion and heat release can take place at relatively short distances from the emergence point of the gases. One embodiment of this radiant heat generating burner invention includes:

A radiant heat generating gas burner comprising: means for discharging a directed flow of fuel, and refractory wall members on opposite sides of and adjacent to said fuel discharge means, said refractory wall members having (a) an upper portion extending above said fuel discharge means, and carrying a plurality of parallel spaced flanges projecting toward said fuel discharge means and defining a series of individual passages for gases emitted from said fuel discharge means, and (b) a lower base portion terminating in a knifelike edge and directed at said means for discharging a directed flow of fuel, whereby the major portion of the fuel discharged from said fuel discharge means passes along with said upper portion of the refractory walls and between the parallel spaced flanges and a minor portion of fuel discharge from said fuel discharge means is recirculated back to said fuel discharge means.

Another embodiment of the invention includes the above-described structure, except that a single refractory wall member is disposed adjacent to one side of the discharge means, rather than being disposed on opposite sides of the fuel discharge means.

The prime objective accomplished by means of the combined directed flow of fuel and knifelike edge is that a minor portion of the fuel discharged from the fuel discharge means will be recirculated back to fuel discharge point to insure flame retention and, at the same time, preheat emerging fuel. Of course, the major or remaining portion of the fuel discharged from the fuel discharge means passes along the upper portion of the refractory wall member and is forced between the parallel spaced flanges to effect the rapid attainment of elevated temperatures in the refractory member.

Some of the more apparent advantages flowing from this invention are burner flame retention and the preheating of fuel to temperatures at which complete combustion can take place. In addition, the use of the knifelike edge to effect a controlled splitting of the fuel gas stream vastly improves the overall thermal efficiency of the burner. Firstly, adequate preheating of the combustible fuel gases insures a rapid complete heat release as the gases pass across the refractory material. This in turn reduces the amount of fuel utilized to heat the surrounding air and, as a result, increases the amount of fuel directly used to raise the temperature of the refractory material. Likewise, effective flame retention reduces the overall fuel requirements in the burner operation.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be more readily understood by reference to the following drawings in which:

FIG. 1 is a transverse view of one form of the radiant heat generating burner of this invention showing a complete burner assembly with an attaching clip holding the refractory member and fuel distribution chamber in assembled relationship;

FIG. 2 is a longitudinal view of the assembled burner;

FIG. 3 is a fragmentary detailed perspective view of the refractory wall member showing the plurality of parallel spaced flanges projecting therefrom;

FIG. 4 is a transverse cross-sectional view of the refractory wall member;

FIG. 5 is a front elevational view of the refractory wall member; and

FIG. 6 is an enlarged detail view of the refractory wall member showing the divided flow paths of fuel gas resulting from the positioning of the knifelike edge of the refractory wall in relation to the downwardly directed flow of fuel gas.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

As shown in the drawings, the radiant heat generating burner assembly 10 of this invention basically comprises a casing or conduit supply assembly 11, a fuel distribution chamber

12 secured to and projecting upwardly from the conduit, and a refractory wall member 13, which serves as the source of radiant heat energy for objects being processed in the burner. More specifically, as shown in FIGS. 1 and 2, supply conduit 11, which carries natural gas or some other suitable fuel gas to the burner, is attached to fuel distribution chamber 12 by means of clamps 14 and 15 held together by some suitable fastening means, such as bolts 16 and 17.

Base plates 18, used to support the refractory wall members, are secured to the upper end of the fuel distribution chamber by means of bolts 19 and 20.

As shown in FIG. 1, refractory wall members 13 are symmetrically disposed on opposite sides of distribution chamber 12. Sideplates 21 are extended upwardly from baseplate 18 and are secured to the baseplate by some suitable means, such as bolts 22. Each sideplate 21 engages the upper ends of refractory wall members 13 and holds the refractory members in an angular position in relation to the downwardly directed flow of fuel gases emitted from the distribution chamber.

It should be understood, however, a single refractory wall member 13 can be disposed on one side of distribution chamber 12 only, rather than on opposite sides of chamber 12 as shown in FIG. 1.

Referring now to FIGS. 3 and 4, it can be observed the refractory wall member 13 essentially comprises a curved upper wall section 23 and a lower base section 24, which terminates in a knifelike edge 25 disposed opposite the downwardly directed flow of fuel gases. Spaced along the curved upper wall section 23 of the refractory member are a plurality of parallel flanges 26 which project outwardly from the curved wall section in the direction of distribution chamber 12 and which provide a series of channels for hot fuel gases emerging from the distribution chamber. Although a number of shapes and configurations for flanges 26 are suitable for use in the practice of this invention, the particular shape illustrated in FIGS. 3 and 4 is particularly desirable because it provides a series of radiation surfaces 27, 28, and 29 oriented in such a way as to emit radiation in a variety of directions.

The construction of fuel distribution chamber 12, as shown in FIGS. 1 and 6, is such as to provide a continuous flow of combustible fuel gases to the refractory member. Included in the fuel distribution chamber construction are sidewalls 30 and 31 and upper walls 32. Specifically, this upper wall 32 has a flat horizontal surface 33 and a pair of converging inclined surfaces 34 and 35. A deflector plate 36 is secured to the flat horizontal surface of upper wall 32 by means of a suitable fastening device such as screw 37. The deflector plate is preferably formed with a pair of downwardly extending inclined walls 40 corresponding to the inclined surfaces of upper wall 32 and proportioned to overlap the sidewalls 34 and 35 of the distribution chamber. As fuel gases emerge from ports 41, they are deflected off inclined walls 40 of the deflector plate and thus downwardly directed toward knifelike edge 25 of the refractory member.

During operation of the radiant heat generating burner of this invention, fuel gas and air (air-gas mixtures) enter through supply conduit 11 and pass continuously into chamber 12. As the air-gas fuel emerges through ports 41, it is deflected from plate 36 and directed downwardly so as to impinge upon the knifelike edge 25 of refractory wall member 13. Fuel impinging upon knife edge 25 is divided into major and minor portions as shown in FIG. 6. The major portion of fuel passes over the curved wall section 23 of the refractory wall and is divided into the series of channels defined by flanges 26. During the time at which the fuel gases passes through the channels defined by flanges 26, the heat released by the gases rapidly elevates the temperature of the refractory wall. In particular, surfaces 27, 28, and 29 become sources of radiant energy to surrounding objects being processed in the burner. High terminal efficiency is attained, of course, when the fuel gases passing through the channels have completely undergone the process of combustion.

The minor portion of the combustible air-gas fuel, as shown in FIG. 6, is recirculated back to the gas discharge point from the distribution chamber. This recirculation effect causes the gases emitted from the distribution chamber to reach a sufficiently high temperature to permit rapid combustion of the gas between the discharge point and the refractory material. In addition, the recirculation of the fuel gases by means of knife edge 25 vastly improves the flame retention capability of the burner. It has been observed in the practice of this invention that the orientation of knife edge 25 in relation to the downwardly directed flow of fuel gases is preferably adjusted to allow about 3 to 10 percent by volume of the fuel gases to be recirculated back to the point at which fuel emerges from the distribution chamber. The remaining portion of fuel gases, of course, is utilized in elevating the temperature of refractory wall member 13.

We claim:

1. A radiant heat generating gas burner comprising: means for discharging a directed flow of fuel; and refractory wall members disposed on opposite sides of and adjacent to said fuel discharge means, said refractory wall members having (a) an upper portion extending above said fuel discharge means, and carrying a plurality of parallel-spaced flanges projecting toward said fuel discharge means and defining a series of individual passages for gases emitted from said fuel discharge means, and (b) a lower base portion terminating in a knifelike edge and directed at said means for discharging a directed flow of fuel from fuel discharge means, whereby the major portion of the fuel discharged from said fuel discharge means passes along said upper portion of the refractory walls and between the parallel-spaced flanges and a minor portion of fuel discharged from said fuel discharge means recirculated back to said fuel discharge means.
2. The gas burner apparatus of claim 1 wherein a single refractory wall member is disposed on one side of and adjacent to said fuel discharge means.
3. The gas burner apparatus of claim 1 wherein said fuel discharge means comprises:
 - a fuel supply conduit;
 - a hollow upwardly extending chamber disposed centrally to and projecting from said supply conduit, said upwardly extending chamber being provided with an upper wall having a pair of converging inclined surfaces, each of said surfaces containing a plurality of spaced fuel discharge ports therein; and
 - a deflector plate secured to said upper wall and having a pair of downwardly extending inclined portions corresponding to the inclined surfaces of said upper wall so as to form a downwardly directed fuel discharge passage between said deflector plate and said upper wall, said passage being disposed in direct alignment with the knifelike edge on the lower base portion of said refractory wall.
4. The gas burner of claim 3 wherein said knifelike edge on the base portion of said refractory wall is positioned in relation to the downwardly directed fuel discharge passage so that about 3 to 10 percent by volume of the fuel discharged from said chamber is recirculated back to point at which fuel emerges from said passage.
5. A radiant heat generating gas burner comprising:
 - a fuel discharge means having a fuel supply conduit and a hollow upwardly extending discharge chamber disposed centrally to and projecting from said supply conduit, said upwardly extending chamber being provided with an upper wall having a pair of converging inclined surfaces, each containing a plurality of spaced discharge ports therein;
 - a deflector plate secured to said upper wall and having a pair of downwardly extending inclined portions corresponding to the inclined surfaces of said upper wall so as to form a downwardly directed fuel discharge passage between said deflector plate and said upper wall; and

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refractory wall members disposed on opposite sides of and adjacent to said upwardly extending chamber and having lower base portions terminating in a sharp knifelike edge positioned opposite and directed at the downwardly directed fuel discharge passage, and a curved upper portion extending above said chamber carrying a plurality of parallel-spaced flanges projecting toward said chamber and defining a series of individual passages for gases emitted from said chamber, said knifelike edge being oriented in relation to said discharge passage in a manner sufficient to divide fuel discharging from said chamber into major and minor portions, the major portion of said

fuel passing along the curved upper portion of the refractory wall and between the parallel-spaced flanges and the minor portion of said fuel recirculating back to the fuel discharge point.

5 6. The gas burner of claim 5 wherein said knifelike edge is oriented in relation to said downwardly directed fuel passage to cause about 3 to 10 percent by volume of said fuel to be recirculated back to the fuel discharge point.

10 7. The gas burner apparatus of claim 5 wherein a single refractory wall member is disposed on one side of and adjacent to said upwardly extending chamber.

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