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Reid et al.

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[54] **ILLUMINATION BURNER**

[75] Inventors: **Jack M. Reid; Sanford A. Weil; David M. Mason; William R. Staats,** all of Chicago, Ill.

[73] Assignee: **The Institute of Gas Technology,** Chicago, Ill.

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

[51] **Int. Cl.** **F23d 13/12**

[58] **Field of Search** 431/328, 329, 100

[56] **References Cited**

UNITED STATES PATENTS

3,170,504	2/1965	Lanning	431/328
3,208,247	9/1965	Weil et al.	431/328
3,216,478	11/1965	Saunders et al.	431/329
3,304,402	2/1967	Thorpe	118/302 X
3,367,149	2/1968	Manske	431/328

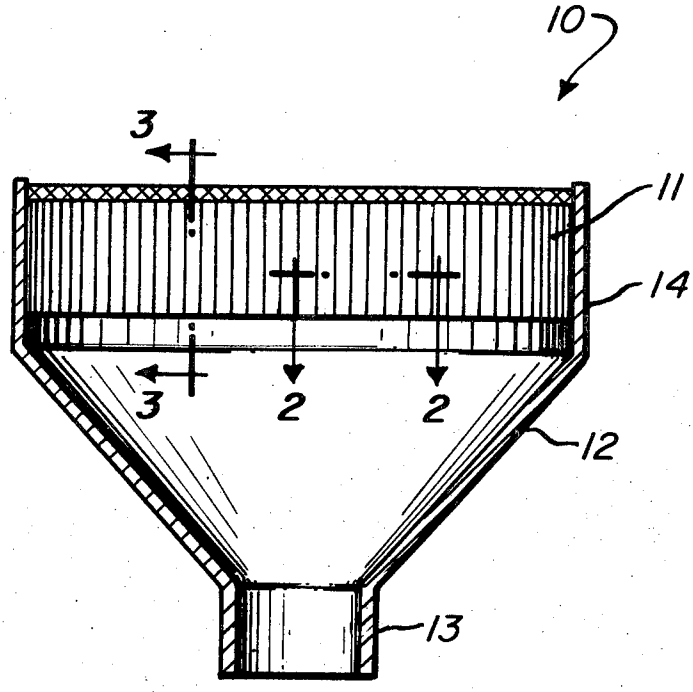
Primary Examiner—Carroll B. Dority, Jr.

Attorney—Dominik, Knechtel & Godula

[57] **ABSTRACT**

A gas illuminating burner in which a gas mixture is delivered through a porous ceramic support and a heat radiating layer of a metal oxide to a layer which is a mixture of thorium and cerium oxides. The gas mixture burns in an improved manner at the upper surface of the layer of oxides.

1 Claim, 3 Drawing Figures



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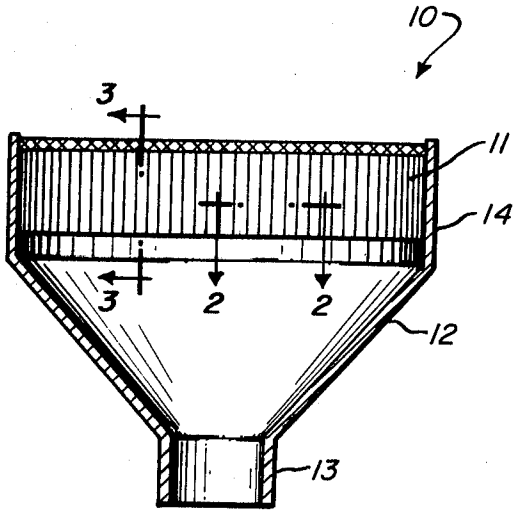


FIG. 1

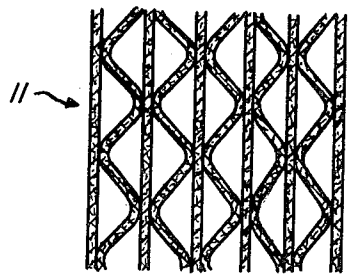


FIG. 2

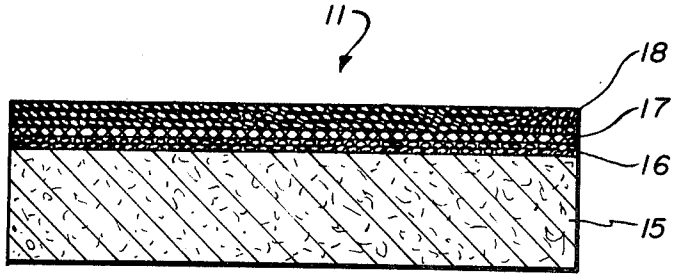


FIG. 3

INVENTORS
Jack M. Reid
Sanford A. Weil
David M. Mason
BY William R. Staats
Dominik, Knechtel & Godula
ATTYS.

ILLUMINATION BURNER

This invention relates to a burner for producing illumination by gas combustion and more particularly to the production of efficient illumination by the combustion of conventional fuel gas.

In U. S. Pat. No. 3,208,247, there is disclosed a burner for producing illumination by gas which is formed of a relatively thick plate or sheet of porous ceramic, preferably thorium oxide, having a thin layer at its outer surface formed by a mixture of thorium oxide and cerium oxide. The gaseous fuel coupled to the burner flows from and burns on the outer surface of the plate or sheet of porous ceramic.

The burner of this subject patent has demonstrated that the fragile properties of the conventional mantle can be overcome, while still retaining the very critical thermal characteristics of a mantle-flame system. The burner, however, does suffer several disadvantages which render it less than satisfactory, or at least economically feasible. For example, one problem with the burner is that it is extremely difficult to establish or maintain a stable flame so that the thorium oxide and cerium oxide layer is maintained at a high temperature so as to produce or provide the maximum light output.

Another disadvantage of the subject burner is that the plate or sheet of porous ceramic is composed entirely of thorium oxide, and this material is relatively costly. Also, it is very difficult to manufacture the thorium oxide with the desired physical properties because of the refractoriness of thorium oxide. In order to retain the necessary thermal properties, the effective material thickness of the bubbles or cells, or the diameter of the fibers, must be kept below 0.005 inches. At the same time, the material must be well sintered in order to develop the desired mechanical strength of the plate or sheet. The fact that the melting point of thorium oxide is substantially higher than any other refractory material (5,486° F), however, makes it extremely difficult to obtain a satisfactory degree of sintering, without destroying the very thin plate or sheet of porous ceramic. The end result is that the extreme care required to achieve the precise results desired, together with the relatively large quantity of thorium oxide required compared to the amount actually contributing to emission of light, result in a relatively costly burner.

Accordingly, it is an object of the present invention to provide an improved burner and method for making the same.

Another object is to provide an improved burner fabricated in a fashion such that the desired structural and thermal properties are easily and economically achieved.

Still another object is to provide an improved burner for efficiently producing light by combustion of fuel gas which employs a minimum amount of thorium oxide.

A still further object is to provide an improved burner having a porous burner structure which has radiation properties superior to those that can be achieved in presently available sintered, porous thorium oxide sheet type burners.

A still further object is to provide an improved burner constructed in a fashion such as to permit or provide better control of the flame zone so that the burner surface is maintained at a high temperature.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the features of construction, combination of elements, and arrangement of parts which will be exemplified in the construction hereinafter set forth, and the scope of the invention will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawings in which:

FIG. 1 is a sectional view of a gas burner exemplary of the invention;

FIG. 2 is a sectional view taken along lines 2—2 of FIG. 1; and

FIG. 3 is an enlarged view of the burner plate of the gas burner.

Similar reference characters refer to similar parts throughout the several views of the drawings.

Referring now to the drawing, in FIG. 1 there is illustrated a gas burner **10** exemplary of the invention including a burner plate **11** in the form of a relatively thick flat plate which may be circular, or of other desired configuration. The burner plate **11** is supported in a cup-shaped housing **12** having a connection **13** at one end for admission of combustible gas and air mixture. Preferably the cup-shaped body is provided with an annular outer flange **14** encircling the outer edge of the burner plate **11** to prevent gas from flowing through the sides of the burner plate.

The burner plate **11**, as can be best seen in FIGS. **2** and **3**, is formed of a lower layer or body **15** of any suitable porous ceramic material, preferably one having a number of parallel passages similar to a honeycomb in nature, as illustrated in FIG. **3**, through which the combustible gas mixture can flow. Advantageously, the ceramic material is one having good thermal and mechanical shock resistance. Also, its ease of fabrication and cost should be considered. A suitable material which can be used is "THERMACOMB," manufactured by the Minnesota Mining and Manufacturing Company. This layer or body **15** should be approximately ¼ inch in thickness in order that it will have a relatively high mechanical strength even apart from the insulating factor. By maintaining the inner surface of the body **15** relatively cool, radiation therefrom is minimized so that greater efficiency will result.

A layer **16** of thorium oxide is atop the ceramic body **15**. This layer must be opaque and therefore at least 0.2 mm. in thickness so that it will function as an insulator between the upper combustion area and the body **15**, where radiation would be the major heat transfer mechanism. Again, this is to prevent the body **15** from becoming sufficiently hot to radiate in the IR region. This thorium oxide layer also must be of very small grains or particles, at least 2 microns in diameter, in order to properly insulate the body **15** from the upper combustion area.

The next layer atop the thorium oxide layer **16** is a metal oxide layer **17** having emissivity of the order of 0.5 so that it radiates enough heat to stabilize the combustion process. The metal oxide may be alumina, for example. This metal oxide layer need only be 1 mm. or less in thickness.

Atop the metal oxide layer **17** is a layer **18** of a mixture of thorium oxide and cerium oxide. This layer **18** should contain 0.0002 grams of cerium oxide per square centimeter and be less than 0.5 mm. thick. The

particles in this layer must be at least 0.2 microns more in diameter.

In operation, the combustible gas and air mixture is admitted into the housing **12** through the connection **13** and flows through the burner plate **11.** When ignited, the combustible gas mixture burns at the surface of the thorium oxide and cerium oxide layer **18** and heats the latter to produce radiation of illumination therefrom.

The metal oxide layer **17** overcomes the problem of the gas burner disclosed in the above-mentioned U. S. Pat. No. 3,208,247, of maintaining a stable flame. With the addition of this metal oxide layer, it is found that a more stable flame can be maintained, and the thorium oxide and cerium oxide layer **18** deposited atop of it is maintained at a high temperature so that the maximum radiation of illumination is provided.

The thorium oxide layer **16** and the thorium oxide and cerium oxide layer **18** both preferably and advantageously are deposited by flame spraying, or by plasma spraying them. Alternatively, however, these layers can be formed and deposited in the same manner as described in the above-mentioned U. S. Pat. No. 3,208,247. That is, the thorium oxide layer **16** can be formed by absorbing a solution of a water soluble thorium salt, such as thorium nitrate, in a combustible material having the desired physical structure, such as sponge foam or felt. The material may then be heated to a sufficiently high temperature in a furnace, or the like, to burn out the combustible material and to convert the thorium solution to a residue of thorium oxide with a porous structure conforming to that of the original combustible material. The heating process is preferably carried out at a temperature slightly below the melting point of the thorium oxide so that the residual thorium oxide will sinter to form a body or layer of relatively high strength.

The thorium oxide and cerium oxide layer **18** can be formed by first forming a thorium oxide layer in the manner described above, then, a cerium salt, such as cerium nitrate, is deposited in a thin layer on the surface of the thorium oxide layer as by dipping the surface in a solution of the cerium salt. After dipping, the burner plate is air dried at an elevated temperature of about 1000° F to decompose the cerium salt to cerium oxide and leave the cerium oxide mixed with the thorium oxide.

The metal oxide layer **17** can be deposited in any suitable fashion.

The gas burner **10** has all of the advantages of the gas burner disclosed in the above-mentioned U. S. Pat. No. 3,208,247 and, in addition, has the further advantage of better flame control so that the thorium oxide and cerium oxide layer **18** is maintained at a high temperature so as to provide maximum radiation of illumination therefrom. Furthermore, the gas burner **10** is fabricated in a fashion such that the desired structural and thermal properties are more easily and more economically achieved.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and certain changes may be made in the above construction. Accordingly, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

Now that the invention has been described, what is claimed as new and desired to be secured by Letters Patent is:

1. An illumination burner for producing illumination by gas combustion comprising: a burner plate formed of a porous ceramic material through which the combustible gas mixture can flow, said burner plate having good thermal and mechanical shock resistance and being of a thickness such as to have a high mechanical strength apart from its insulating factor; a layer comprising a mixture of thorium oxide and cerium oxide deposited on said burner plate, said layer being less than 0.5 mm thick; conduit means to conduct a combustible gas mixture to said burner plate, the gas mixture flowing through said burner plate and burning at the upper surface of said mixture of thorium oxide and cerium oxide to thereby heat the latter to produce radiation of illumination therefrom, a layer of insulating material deposited atop said burner plate for insulating said burner plate from the combustion area of said gas mixture to prevent said burner plate from becoming sufficiently hot to radiate in the infrared region, said layer of insulating material being of thorium oxide and at least 0.2 mm in thickness; a layer of heat radiating material deposited atop said layer of insulating material beneath said layer of thorium oxide and cerium oxide, said layer of heat radiating material being a metal oxide having emissivity of the order of 0.5 so as to radiate heat to maintain said mixture of thorium oxide and cerium oxide at a high temperature to provide maximum radiation of illumination therefrom and to stabilize the combustion process.

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