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[73]	Assignee	Peabody Engineering Corporation New York, N.Y.

[56]

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[54] GAS RING FOR FUEL BURNER
6 Claims, 13 Drawing Figs.

[52] **U.S. Cl.**..... **239/567,**
239/601, 431/176
[51] **Int. Cl.**..... **B05b 1/18**
[50] **Field of Search**..... 239/56, 7,
60; 431/175, 176 (X)

ABSTRACT: A gas ring for fuel burners having a burner throat, the ring having an inside diameter substantially the same as that of the throat and having a peripherally spaced set of elongated nozzles or fingers extending radially (inward) from the ring. The fingers have discharge openings in at least one side and are oriented to discharge gas well within the air stream in said burner throat at various angular positions to which they may be adjusted. Such fingers may be used alone or in conjunction with conventional gas exit orifices spaced around the inner periphery of the ring.

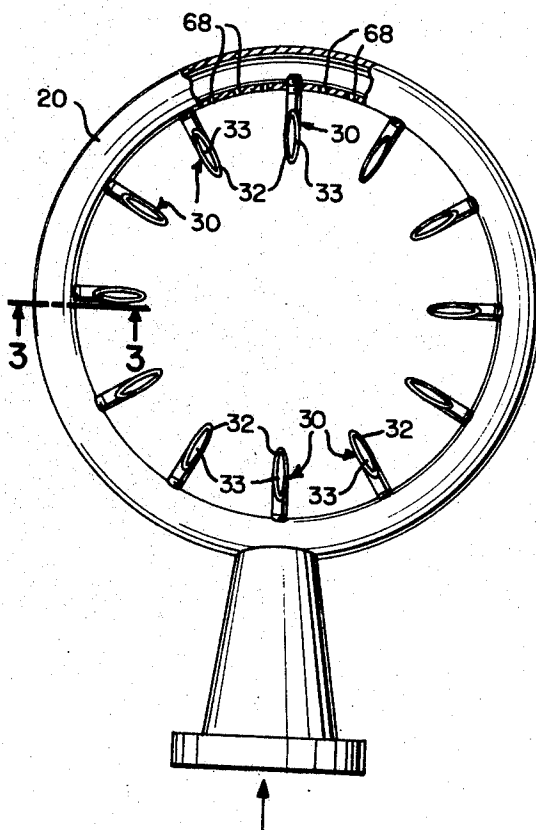


FIG. 1

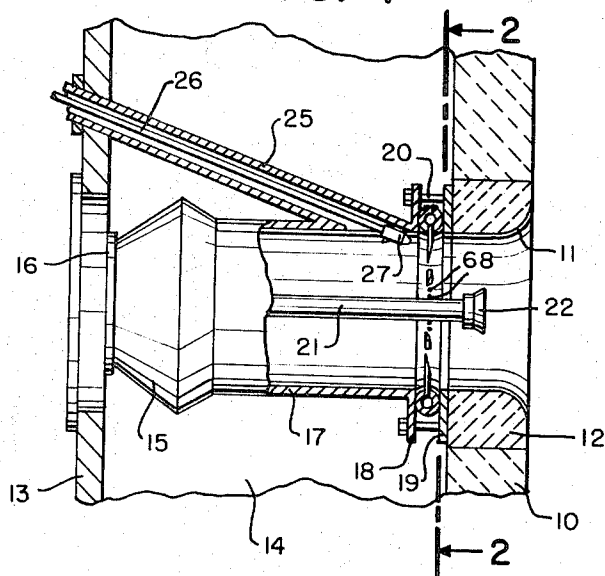


FIG. 2

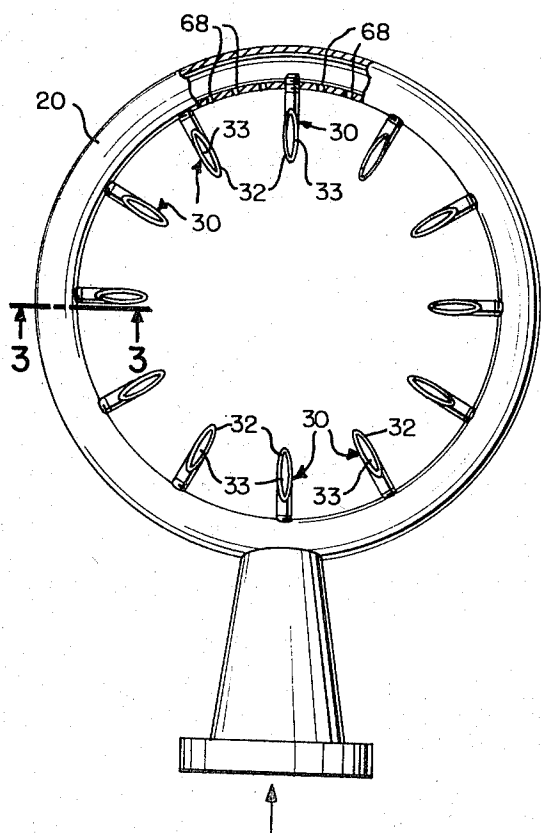


FIG. 3

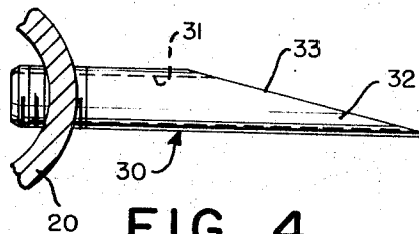


FIG. 4

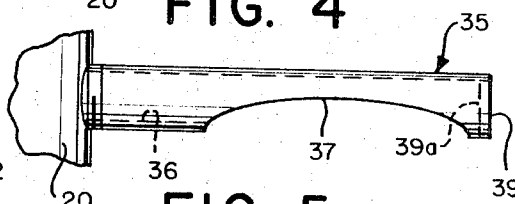


FIG. 5

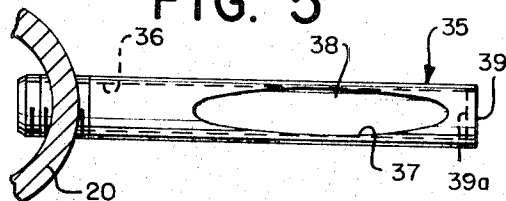


FIG. 6

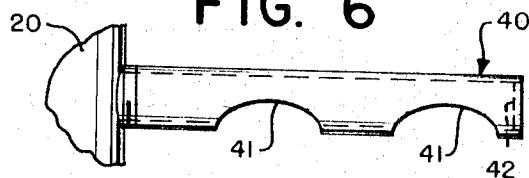


FIG. 7

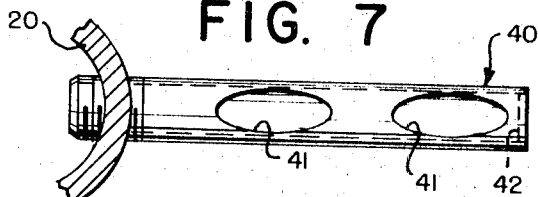
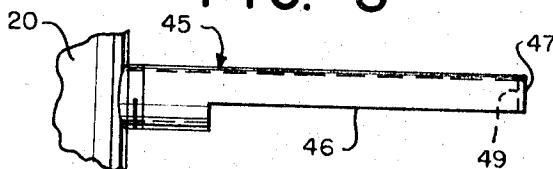


FIG. 8



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FIG. 9

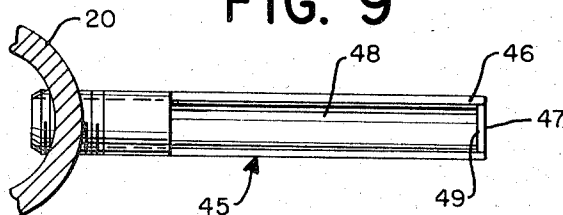


FIG. 10

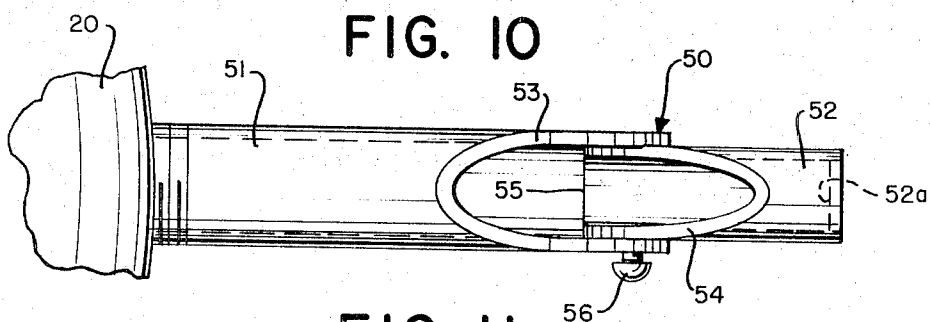


FIG. 11

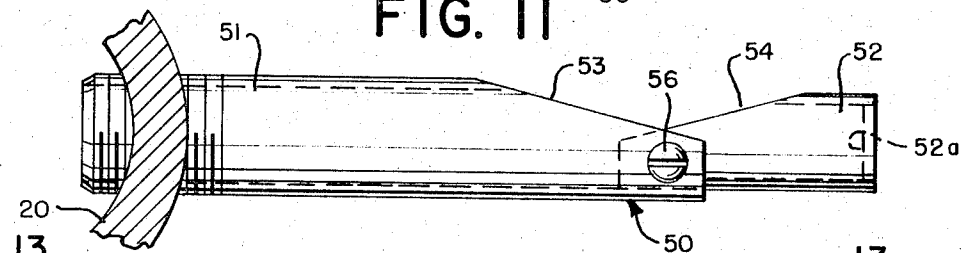


FIG. 12

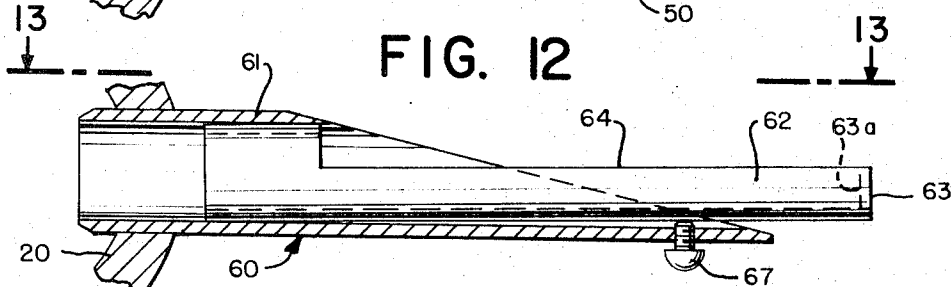
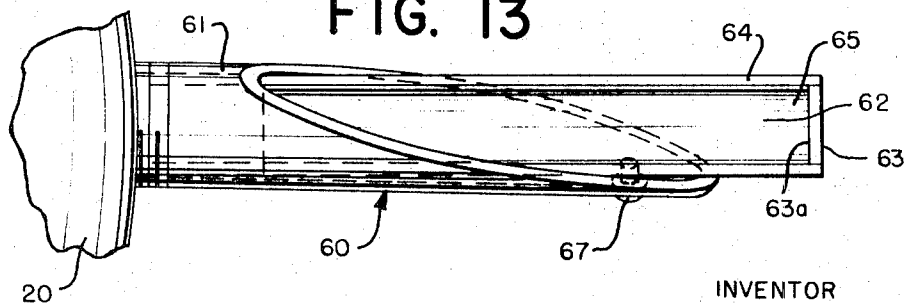


FIG. 13



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GAS RING FOR FUEL BURNER

This invention relates to gas burners and more particularly to gas rings of the type used in connection with industrial burners, said burners having a burner throat coaxial with the principal axis of said ring.

An object is to provide a gas ring of the above type having novel and improved gas discharge elements adapted to provide an improved gas air mixture and stable operation under varying loads and varying conditions of flow of combustion air even with low gas pressure in said ring.

Another object is to provide a gas ring of the above type which permits on-the-job variation of the gas supply to different parts of a burner throat.

Another object is to provide a burner of the above type having novel and improved details of construction and features of operation.

Various other objects and advantages will be apparent as the nature of the invention is more fully disclosed.

The present invention is designed to overcome certain disadvantages of the conventional ring-type gas burner when operating at a low gas pressure (which is nearly always the case when the burner is operating at the lower end of a load range) especially when the inside diameter of the gas ring and burner throat are substantial; for example, 1.5 to 3 ft. or more.

The conventional gas ring of such a burner may comprise a casting or a tube, usually of 2 inches or more inside diameter, said tube being bent to form a circular ring having approximately the same inside diameter as the diameter of the throat of the burner of which the ring forms a part, said ring also having a series of comparatively small, usually drilled, exit ports, spaced at intervals around the inner periphery of the gas ring (and hence, essentially, around the periphery of the burner throat) so as to discharge raw gas or a mixture of gas and primary air into the burner throat, for mixture with the combustion air passing through said throat. Each of such ports may be drilled to lie in a plane, passing through the axis of the burner throat (and of said ring) and directed either perpendicular to or inclined to said axis, or each of said ports may be drilled to provide rotation of said exit gas with respect to said burner throat axis.

Regardless of the specific arrangement of the drilled exit ports the conventional ring-type burner, especially of large throat diameter, provides, with low gas pressure in the ring, insufficient ability for the gas jets leaving said exit ports to penetrate the airstream in the burner throat sufficiently to produce a complete mixture of the gas with said air. The net result of such deficiencies often is poor combustion efficiency (i.e., an amount of air required substantially in excess of the theoretical i.e. stoichiometric air requirements for complete combustion) and even with a large amount of such excess air, there may be pulsation, or vibration of the furnace being fired, instability of ignition and sometimes the complete loss thereof.

The present invention can readily be applied to an existing gas ring having the usual drilled exit ports or can be used in new construction with or without any such drilled exit ports in the ring. The invention comprises a series of tubes or fingers mounted at spaced intervals around the inner periphery of the gas ring and threaded or otherwise suitably attached to the inner periphery thereof, and extending a substantial distance, more or less radially, toward the axis of said ring (and burner throat), but with the axis of each finger lying in the most advantageous specific direction with respect to said ring axis. The net result is that, regardless of the specific arrangement of the gas exit port or ports, of each finger, the gas when ejected is much closer to the burner throat axis and farther within the airstream within the burner throat than would have been possible with the conventional drilled hole construction.

Individual fingers may have their form or exit port areas so proportioned as to vary, if desired, the volume of gas injected into various areas of the burner throat cross section or periphery so as to compensate for any unequal distribution of air within said burner throat.

More specifically in accordance with the present invention the gas discharge openings of the gas ring are formed at least in part by a series of elongated nozzles or fingers which extend in general radially inwardly toward the axis of said burner throat from the inner periphery of the gas ring and have gas discharge openings disposed on at least one side of each of said fingers or nozzles.

Each of the discharge openings in a finger is so disposed that the gas is discharged substantially as an elongated sheet in a plane passing through the center of the gas ring tube or at an angle thereto toward the burner throat. The portion of the finger opposite to the opening serves as a shield for the discharged gas and also introduces turbulence into the flow of combustion air to improve the combustion and flame stability of the gaseous fuel, or of the liquid fuel at the burner throat if the latter fuel is being used.

Each of said fingers may lie in a common plane perpendicular to the burner throat axis and passing through the center of the tube forming the gas ring, in which case each finger may either be truly radial or have its axis inclined to a radius.

Similarly each finger may have its axis in a separate radial plane passing through the burner throat axis with the axis of each finger inclined to said throat axis. Also the axis of each finger may be inclined not only to said throat axis but also to a radial plane passing through said axis.

Such fingers, of course, can be used either in connection with an air register having curved vanes causing the air to rotate as it passes through the burner throat or in connection with an air register having radial vanes, which will result in substantially axial flow as the air passes through such throat. They also may be used alone or in conjunction with conventional gas exit orifices formed in said ring itself or with short spuds carried by said ring and spaced around the inner periphery of said ring.

Regardless of the type of air register it should be noted that the gas discharge from each finger, regardless of the specific a type of discharge port, is substantially from the side of each such finger, rather than axially therefrom, so that each finger might be said to discharge a sheet of gas with maximum surface exposure to the air in said throat, rather than a jet of gas with much less exposure. Maximum surface exposure of gas to air tends to promote more thorough mixing of the two.

The distribution of air among a group of burners firing a given furnace and the distribution of air across a given burner throat, both tend to be imperfect in practice and such maldistribution is always difficult and many times impossible to correct. The finger design retains the advantages of the ring-type burner while making it possible by adjusting the position or discharge port area of individual fingers to "put the gas where the air is" to compensate for such maldistribution of air.

In addition to the basic advantages of greater gas penetration into the air in the burner throat and ready change of port conformation on shutdown, a finger with its large flow area is much less susceptible to plugging by any foreign material in the gas being burned than the relatively small drilled exit ports.

Such fingers when suitably used in a combination burner for oil or gas in which the oil is conventionally injected by an atomizer positioned along the burner throat axis as shown in FIG. 1, not only do not interfere with the combustion process when oil rather than gas is being burned, but improve such combustion due to the fact that said fingers act in conjunction with the conventional oil burner diffuser or flame cone to further improve the mixing of the oil spray with the air in the burner throat. This permits operation with a lesser amount of air in excess of theoretical combustion requirements and also assists said diffuser in stabilizing the oil flame under widely varying conditions.

The nature of the invention will be better understood from the following description taken in connection with the accompanying drawings in which certain specific embodiments have been set forth for purposes of illustration.

In the drawings:

FIG. 1 is a longitudinal view partly in section of a fuel burner embodying the invention;

FIG. 2 is a section taken on line 2-2 of FIG. 1 of a portion of the gas ring showing the discharge fingers with a part of the ring broken away for clarity;

FIG. 3 is a section taken on the line 3-3 of FIG. 2;

FIGS. 4 and 5 are views similar to FIGS. 3 and 2 respectively illustrating a finger having a single side opening;

FIGS. 6 and 7 are views similar to FIGS. 3 and 2 respectively illustrating fingers having a pair of side discharge openings;

FIGS. 8 and 9 are views similar to FIGS. 3 and 2 respectively showing fingers having a further form of gas discharge opening;

FIGS. 10 and 11 are views similar to FIGS. 2 and 3 respectively showing a type of adjustable two-piece finger;

FIG. 12 is a view similar to FIG. 3 but in partial section illustrating a further type of adjustable two-piece finger; and

FIG. 13 is a section taken on the line 13-13 of FIG. 12 but showing the parts in a different angular relation.

Referring to the drawings more in detail the invention is shown as applied to a fuel burner firing into the combustion chamber of a furnace having a wall 10 with a burner throat opening 11 formed by a ring of throat tiles 12. A front wall 13 is spaced from the furnace wall 10 to form a plenum chamber 14 therebetween. The burner elements include an air register 15 having a front plate 16 secured to the front wall 13 and registering axially with a burner tube 17 having a rear flange 18 bolted to a plate 19 secured to the wall 10. A gas ring 20 of the usual type for supplying gaseous fuel is secured between the flange 18 and the plate 19 adjacent the throat opening 11. A fuel barrel 21 of the type carrying gaseous liquid or pulverized fuel extends axially through the air register 15 with an atomizing tip 22 disposed axially within the burner throat 11.

An igniter tube 25 extends from the front wall 13 to the burner tube 17 at a point near the rear flange 18 and at an appropriate angle to the axis of the burner throat.

A gas pipe 26 having an igniter 27 at its rearward end extends through the tube 25 and is so arranged that the igniter can be advanced or retracted therein. When in use the igniter 27 is advanced so that the flame therefrom projects into the path of the combustible air and fuel mixture in the zone of the atomizer tip 22 or of the fingers 30.

In FIGS. 2 and 3 the gas ring 20 is shown as having a plurality of discharge fingers or nozzles 30 extending inwardly a substantial distance from its inner periphery toward the axis of the ring and also a series of conventional gas exit orifices 68 located peripherally between adjacent fingers. Each finger 30 comprises a length of pipe which is threaded or otherwise secured in the gas ring with a bore 31 communicating with the interior of the gas ring. The depending end 32 of each finger 30 is chamfered, that is, cut at an angle to the axis of the finger to provide a tapered end opening 33 from which the gas is discharged into the airstream of the burner. In the embodiment shown the opening 33 is directed axially toward the burner throat so that the gas is discharged in a sheet as long as the opening 33 in the direction of the throat. It is to be understood, however, that the opening 33 may be directed in the plane through the center of the gas ring tube or at any desired angle thereto so as to impart rotation to the gas stream as it is discharged and to direct the stream at an angle across the stream of combustion air passing through the burner tube 17 to the throat.

In FIGS. 4 and 5 the elongated nozzles or fingers 35 are secured to the gas ring 20 and extend inwardly therefrom similarly to the fingers 30. Each finger 35 has an axial bore 36 and is formed with an arcuate cut 37 on one side forming an opening 38 for the discharge of gas. The end 39 of each finger 35 may have an end wall 39a to close the end of the finger or the end may be open for the discharge of gas as desired.

As in the case of the fingers 30 above described the opening 38 may be directed toward the burner throat or at any desired angle thereto. The operation is similar to that above described.

In FIGS. 6 and 7 the finger 40 is similar to the finger 35 above described and is similarly disposed in the gas ring. The finger 40 is formed with two or more cut out portions or openings 41 spaced along its length which are shown as formed on the same side of the finger but may however be angularly displaced about the axis of the finger with respect to each other for producing a fan-shaped discharge. The fingers 40 may have an end wall 42 to form a closed end or the end may be open as desired.

In this embodiment the operation is similar to that of FIGS. 4 and 5 except that the gas is discharged over a greater radial distance and may be angularly spread for improving its distribution in the airstream.

In FIGS. 8 and 9 the fingers 45 are similar to the fingers 30 of FIGS. 2 and 3 and are similarly disposed in the gas ring. The fingers 45 are formed with a straight axial cut 46 extending from the inward end 47 of the finger toward the periphery of the gas ring to form an elongated opening 48 for the lateral discharge of gas into the airstream. These fingers have an end wall 49 but this end wall may be omitted if desired to permit gas to be discharged radially as well as laterally. The operation is otherwise similar to that of fingers 30 above described.

In FIGS. 10 and 11 fingers 50 are shown as composed of an outer member 51 secured to the gas ring in the manner above described and an inner sleeve 52 which is slidable within the fixed member 51. The fixed member 51 is formed with a chamfered cut 53 at its inward end and the sleeve 52 is formed with a similar chamfered cut 54 at its outer end 55. The cuts 54 and 53 are so disposed that the effective opening is adjusted by varying the relative angular and axial positions of the sleeve 52 and the member 51. The sleeve 52 may be secured in adjusted position by a setscrew 56 and may have an end wall 52a to form a closed end or the end may be open as desired.

This embodiment provides for adjustment of the axial length as well as the circumferential width of the discharge opening.

In FIGS. 12 and 13 the fingers 60 are formed by an outer fixed member 61 similar to FIG. 3, which is secured in the gas ring as above described and an inner adjustable sleeve 62 similar to FIG. 8, which telescopes within the outer member 61 and projects beyond the inward end thereof. The projecting end 63 of the sleeve 62 if formed with a straight axial cut 64 forming an opening 65. The inward end of sleeve 62 may have an end wall 63a to form a closed end or the end may be open as desired.

The axial length of the exposed portion of the opening 65 may be varied by axial adjustment of the sleeve 62 and the angular position of the discharge opening may be adjusted by varying the rotational position of the sleeve 62 in the outer member 61. The sleeve 62 may be held in adjusted position by a setscrew 67.

FIG. 12 shows the opening 65 extending axially toward the burner throat and FIG. 13 shows the opening as disposed at an angle thereto.

As a specific example the fingers of any type may extend inwardly for a distance corresponding to about a third of the inner radius of the gas ring or in general the fingers may have a length such that a circle concentric with the gas ring and tangent to the inward ends of the fingers has a diameter of from 60 to 80 percent of the diameter of the inner periphery of the gas ring. This distance may however be varied according to the requirements of a particular burner.

While several forms of finger openings have been shown for purposes of disclosure it is obvious that the shape and size of the opening and the relative angular position thereof may be varied according to requirements.

I claim:

1. A fuel burner comprising a burner tube through which a stream of air for combustion flows, a gas ring having its inner periphery disposed in registration with and forming a portion of said burner tube and having peripherally spaced openings communicating with the interior of said burner tube and adapted to introduce fuel gas directly into said airstream in

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said tube, and a set of tubular fingers carried by said gas ring with their outer ends communicating with at least some of said gas ring openings and with their inner ends extending inwardly into the airstream in said burner tube, said fingers having side openings spaced inwardly of said burner tube and disposed to discharge gas from said gas ring directly into the airstream in said tube for mixing therewith, the sides of said tubular fingers opposite said side openings being disposed to form shields to prevent said airstream from interfering with the discharge of gas from said side openings into the airstream.

2. A fuel burner as set forth in claim 1 in which said fingers are in communication with certain of said discharge openings and others of said discharge openings are disposed to introduce gas from said ring directly into said airstream at the inner periphery of said ring.

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3. A fuel burner as set forth in claim 1 in which said fingers each comprise a pair of telescoping members at least one of which has a side opening in a position to be varied in accordance with the telescoping position of said members.

4. A fuel burner as set forth in claim 3 in which side openings are formed in both of said members.

5. A fuel burner as set forth in claim 1 in which said fingers are in communication with each of said discharge openings.

6. A fuel burner as set forth in claim 1 in which a circle tangent to the inward ends of said fingers and concentric with the central opening of said gas ring has a diameter varying between 60 percent and 80 percent of the diameter of said central opening.

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