

[54] **FUEL MIXING SHROUD FOR HEATING TORCHES**

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[51] Int. Cl.**F23d 15/00**

[58] Field of Search 60/39.65; 431/351, 431/352; 239/419.5, 424.5

[56] **References Cited**

UNITED STATES PATENTS

2,461,731 2/1949 Guth.....431/352 X

2,105,546 1/1938 McDonald.....431/182
3,643,431 2/1972 Jamieson.....60/39.71

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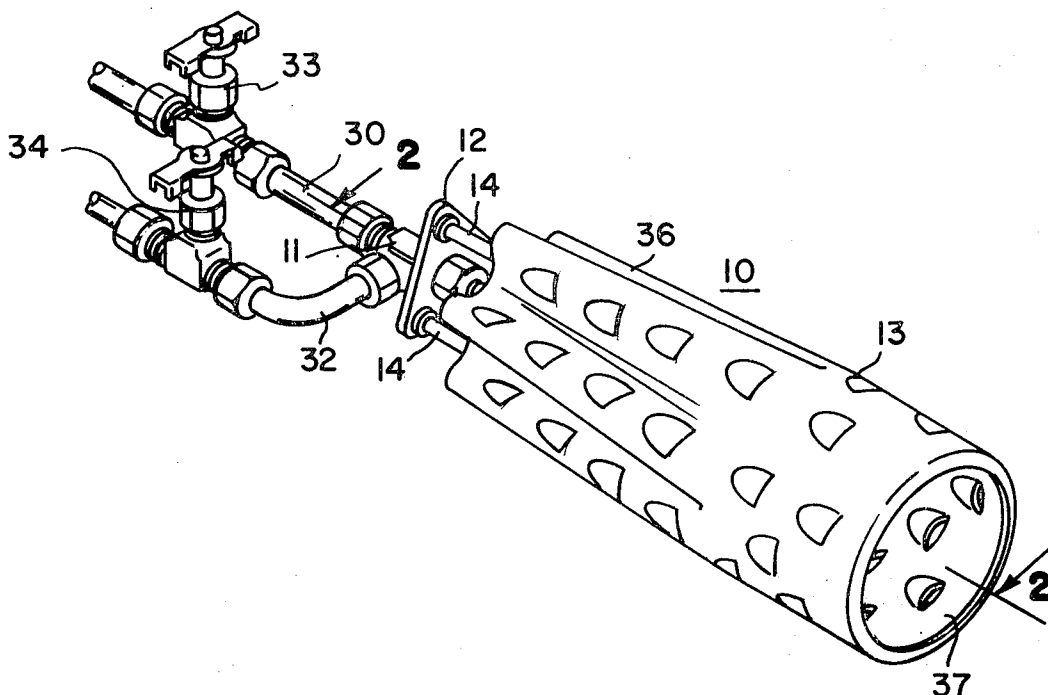
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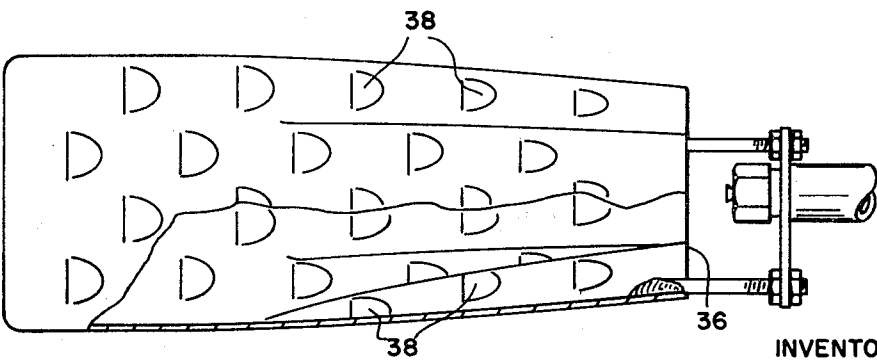
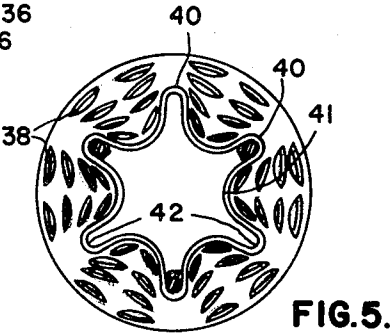
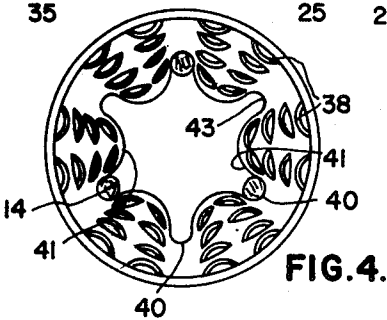
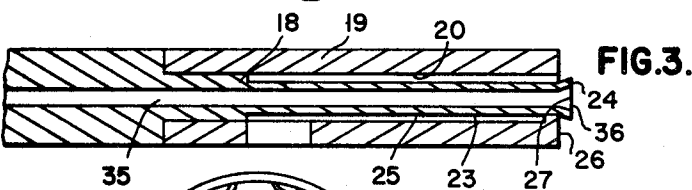
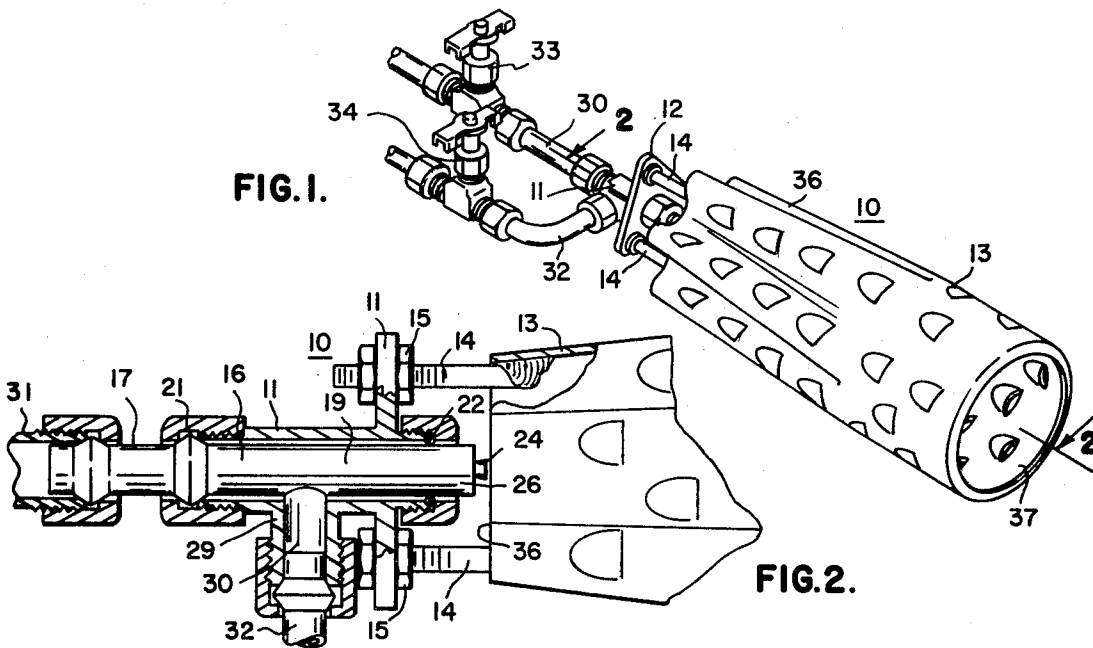
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ABSTRACT

A shroud for a fuel burning torch deformed to form a fluted configuration tapering outwardly from its fuel and air inlets to utilize air aspiration to draw fuel from a nozzle tip and to mix the air with expanding gases or liquids in a highly efficient manner to effect complete combustion.

10 Claims, 10 Drawing Figures





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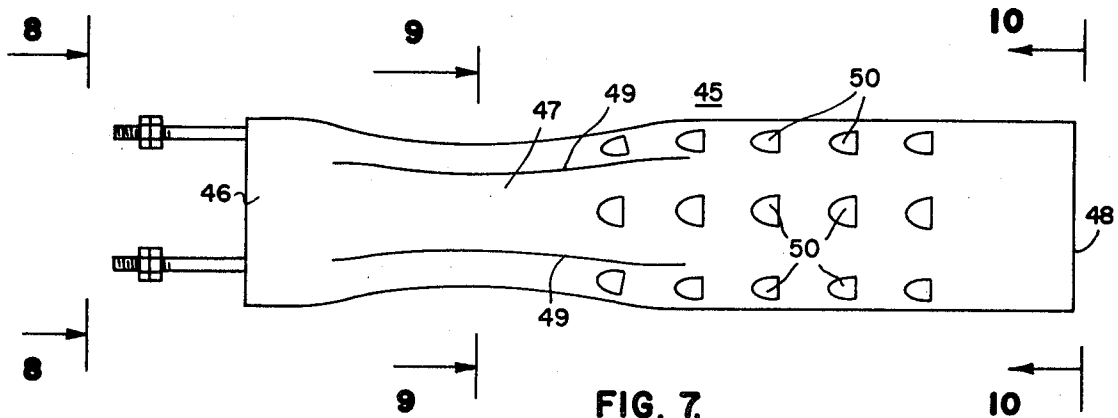


FIG. 7.

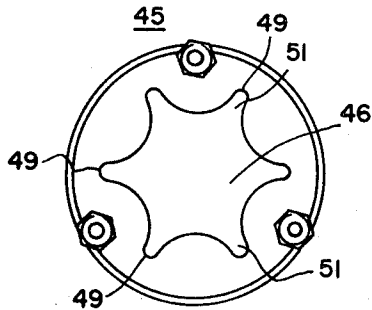


FIG. 8.

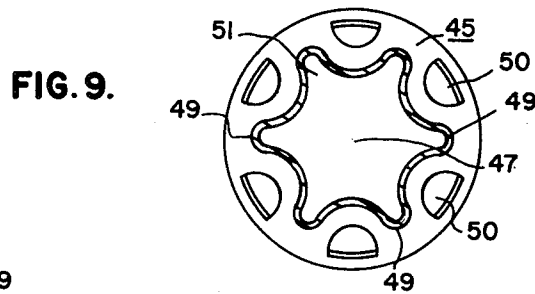


FIG. 9.

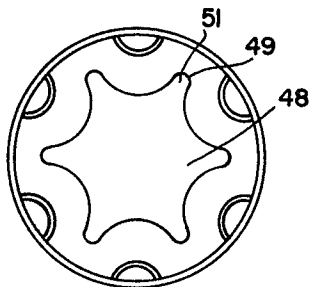


FIG. 10.

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FUEL MIXING SHROUD FOR HEATING TORCHES

BACKGROUND OF THE INVENTION

This invention is directed to fuel burners such as heating torches and is more particularly directed to an improved fuel mixing shroud which is so designed that air aspiration is utilized fully to aid combustion of the expanding fuel gases or liquids jetting into the shroud.

Heretofore, the fuel mixing shrouds were merely designed to provide the necessary space to mix the fuel and compressed air supplied to the burner. This resulted in incomplete combustion or at best erratic flame action.

FIELD OF THE INVENTION

This invention is particularly directed to a burner utilizing an improved fluted tapered shroud which increases air aspiration to more completely burn liquid or gaseous fuels for producing a high temperature flame. The shroud through its design configuration rises to a higher temperature during use than heretofore possible and aids in heating the incoming fuel and air for more effective fuel combustion.

DESCRIPTION OF THE PRIOR ART

At the present time combustion chambers for heating torches and the like have not taken effective advantage of the secondary supply of atmospheric air for aiding in the complete combustion of burning liquids or gases. This has occurred because the shroud heretofore used on heating torches did not mix the air thoroughly with the incoming fuel in the shroud and consequently the flames have not reached the temperatures possible and much of the fuel has been wasted through unburned or not fully consumed gases.

SUMMARY OF THE INVENTION

In accordance with the invention claimed, a new and improved fluted and tapered shroud is provided for a fuel burner which, through its unique configuration, mixes air more thoroughly than heretofore possible through fuel aspiration for obtaining an efficient consumption of the fuel gases.

It is therefore one object of this invention to provide an improved shroud for fuel burners which effectively utilizes a secondary air supply for fuel aspiration and efficient fuel consumption.

Another object of this invention is to provide an improved fluted, apertured shroud for a fuel burner which tapers outwardly from its fuel inlet for effectively utilizing air aspiration for drawing fuel from a nozzle to mix the air with the expanding gases efficiently to effect complete combustion.

A further object of this invention is to provide an improved shroud for a torch which is deformed to a fluted tapered configuration for moving air surrounding the injected fuel into the burning gases for aiding combustion more effectively in the shroud.

A still further object of this invention is to provide an improved shroud which is tapered outwardly to compensate for the expansion of the combustion gases from its inlet and wherein a part of its length is pleated or corrugated to form the tapered configuration.

A still further object of this invention is to provide an improved shroud which reduces the noise of expansion and combustion of the gases while increasing the oper-

ating temperature of the shroud over that heretofore possible.

A still further object of this invention is to provide an improved combustion chamber, the shroud of which controls the shape of the flame outside of the combustion chamber.

A still further object of this invention is to provide an improved combustion chamber, the shroud of which surrounding the burning gases heats the incoming secondary air into the shroud for raising the temperature of the combustion mixture.

Further objects and advantages of this invention will become apparent as the following description proceeds and the features of novelty which characterize this invention will be pointed out with particularity in the claims annexed to and forming part of this specification.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view of a gas burner incorporating the improved shroud and embodying the features of this invention;

FIG. 2 is an enlarged fragmentary sectional view of the burner on the line 2 — 2 of FIG. 1;

FIG. 3 is an enlarged sectional view of the jet element of the nozzle structure of the burner;

FIG. 4 is an enlarged right end view of the shroud shown in FIG. 1;

FIG. 5 is an enlarged left end view of the shroud shown in FIG. 1;

FIG. 6 is an enlarged partially broken away view of the shroud and nozzle structure of the burner;

FIG. 7 is a modification of the shroud and nozzle structure of the burner shown in FIGS. 1 and 4;

FIG. 8 is an enlarged left end view of FIG. 7 taken along the line 8 — 8;

FIG. 9 is an enlarged cross sectional view of FIG. 7 taken along the line 9 — 9; and

FIG. 10 is an enlarged right end view of FIG. 7 taken along the line 10 — 10.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIGS. 1, 2, 3 and 6 illustrate one embodiment of this invention where a gas and liquid fuel burner or heating torch 10 is shown comprising a main support element 11 which may take the form of a conventional pipe Tee having an integral flange 12 to which is secured the burner flame shroud 13 by suitable studs 14 and nuts 15. The stud and nut arrangement make it possible to adjustably position the shroud at predetermined positions with reference to flange 12.

The nozzle element 16 comprises a cylindrical shank portion 17 having a reduced front end diameter 18 upon which is securely fitted an air supply sleeve 19 having an air supply passageway bore 20. The members 17-19 are appropriately secured by suitable seals 21 and 22 in the main support element 11 as best seen in FIG. 2.

The reduced diameter portion 18 has a jet extension tube 23 terminating in a flared bell-shaped flange 24 at its outer end. The air passageway 25 formed by bore 20 surrounding the jet extension tube 23 terminates in the radially outwardly extending surface 26 set back rearwardly from the outer face 27 of the flange lip 24.

Rearwardly of sleeve 19 and adjacent the end of the shank 17 is laterally disposed air inlet port 29 formed

in sleeve 19. This port 29 is aligned with lateral air passageway 30 of main support element 11. Gas or liquid fuel is supplied from pipe 31 while compressed air is provided by pipe 32, each controlled by suitable valves 33 and 34, respectively. As the fuel proceeds through the fuel jet passageway 35 and out its end 36, air flowing out over the flange lip 24 aspirates the fuel laterally to cause it to combine with the air as ignition takes place.

In order to effectively burn the fuel mixture of the compressed gases transmitted to the burner to obtain complete combustion, a shroud must be provided for controlling the mixing gases and a suitable supply of secondary air must be obtained from the atmosphere and directed into and around the fuel mixture in the shroud. Heretofore this has been accomplished without regard to the volume of air needed for complete combustion and controllable flame configuration. The need for a supplementary secondary air supply will be noted when one considers that at atmospheric pressure and 60° Fahrenheit the volume of one pound of acetylene is 14.53 cubic feet and it requires 11.92 volumes of air or 2.5 volumes of oxygen for its complete combustion. It should be noted that other fuels also involve the use of large volumes of air for complete combustion.

The source of air from pipe 32 alone cannot furnish the mixture of air to cause complete combustion of the gases from pipe 31. Accordingly, it has been found that a secondary source of supply of air from the atmosphere must be fed into the shroud 13 forming the combustion chamber of the fuel burner or heating torch 10 to obtain complete combustion, and it must be done in such a manner so as to properly mix with the expanding and burning gases of air and liquid or gaseous fuel under pressure to contain the burning gases in a suitable configuration.

To accomplish this purpose shroud 13 which forms a combustion chamber is arranged to diverge from its entrance 36 immediately adjacent the bell-shaped flange 24 to its outlet 37 spaced therefrom. This shroud is provided with a plurality of air scoop or louvered openings 38 which permit parallel flow of secondary air around the moving and burning gases to further supplement the air supply to aid complete combustion. This secondary air directed around the periphery of the shroud draws air into the burning fuel and keeps the fuel mixture contained within the center of the shroud.

The particular shroud configuration aids air and fuel mixture for more complete combustion within the shroud and immediately outside of its nozzle end by providing a housing formed of a metallic cylindrical member which is tapered from its inlet end to its outlet end by deforming the shroud in a pleated or corrugating manner. This type of pleating action makes it possible to start with a cylinder having the same diameter throughout its length and end up with a tapered nozzle-like structure which diverges from its inlet end to its outlet end without cutting away any of its metal.

The corrugated shroud 13 provides a plurality of equally spaced wrinkles or ridges 40 and grooves 41 on its outside surface which taper outwardly from the inlet end 36 to outlet end 37. The inside or crests 42 of these grooves 41 provide not only a means for receiving the ends of studs 14 but more particularly provide air passageways for primary air from the inlet 36 of the shroud along the length of the shroud. These passageways in the grooves 41 taper outwardly as the shroud tapers

outwardly and provide a means for furnishing air to the fuel injected into the shroud along its longitudinal axis. Since these passageways taper into the main bore of the shroud the air from these passageways eventually is directed into the combustion area or flame of the burning gases to aid in thoroughly mixing with the gases for complete combustion. Since more complete combustion occurs than heretofore possible, the shroud heats up to a higher temperature.

One of the particular benefits of the claimed structure is that the heat of the shroud heats the secondary air entering from the inlet end of the shroud as well as through louvered openings 38 so that when the secondary air mixes with the burning gases it has been raised to substantially the combustion temperature of the burning gases. Heretofore the secondary air was of a lower temperature and when mixed with the burning gases cooled them down, causing a portion of the gases to remain unburned as they were jetted into the atmosphere.

By directing the secondary air around the inside surface of the shroud and through the openings 38 inwardly of the shroud, the air is heated by convection, conduction, radiation, refraction and by diffusion, thereby substantially raising or maintaining the temperature of the burning gases. This action greatly increases the efficiency of the burner since it aids complete fuel combustion. It should be noted that openings 38 are louvered so as to direct the incoming secondary air through the openings in a direction substantially parallel to the jetting combustion mixture to reduce and control turbulence as well as noise of the mixing and burning gases. Further, the louvers forming openings 38 are so arranged along the sides of ridges 40 to uniformly furnish the secondary air along the passageways formed by crests 42. This aids in drawing air into the shroud through air aspiration functions.

To supplement the burning gases with the necessary supply of secondary air, the inlet 36 of the shroud is open so that the expanding compressed gases or liquids from sources 31 and 32 jetting into the shroud 13 may draw by suction (air aspiration) enough additional oxygen and other gases of the atmospheric air to completely burn, thereby increasing the temperature of the flame.

By properly introducing this secondary air into a shroud of the configuration disclosed, the noise of combustion or mixing of the burning fuel may be greatly reduced. In addition the temperature of the burning fuel is increased without increasing fuel consumption, thereby increasing the efficiency of the burner or torch.

It should be recognized that the tapered combustion chamber compensates for the fuel expansion of the gases during their burning cycle in the combustion chamber, resulting in complete fuel consumption of the burner. The tapered shroud as well as the force of the secondary air on the combustion gases controls the configuration of the flame outside of the shroud.

Although the shroud may be formed of special tubing, it can be formed readily of stock tubing, providing a venturi throat configuration. Heretofore, shrouds have been formed by spinning or casting.

As noted from FIGS. 1, 2 and 6, the nozzle 24 may be adjustably positioned by varying the stud and nut arrangement 14 and 15 to center the jetting gases into the center of shroud 13 so that the gases may be properly mixed and the secondary air properly heated before

mixing with the burning fuels. If the mixed gases are not centrally or axially positioned in the shroud the resulting flame may not issue axially of the shroud and accordingly may not burn completely to its full heat potential.

FIGS. 7-10 disclose a modification of shroud 13 of the burner or heating torch 10 shown in FIGS. 1-6 wherein shroud 45 forms a combustion chamber arranged to converge from adjacent its entrance 46 to a point 47 between its entrance 46 and its outlet 48 and then diverge from point 47 to its outlet 48. This type of structure forms a venturi action wherein the velocity of the air and gaseous fuel flowing through the constructed part of the shroud increases as the pressure decreases. This venturi form of shroud produces a suction type of action for aiding the aspiration ability of the burner.

The shroud 45 is tapered to form the constructed zone by deforming the shroud in a pleated or corrugating manner as set forth in the discussion of FIGS. 1-6. This type of pleating action makes possible the use of a cylindrical member of the same diameter throughout its length which is then deformed to provide the venturi configuration. As noted from FIG. 7 the plurality of equally spaced wrinkles or ridges 49 on the outside surface of the shroud taper inwardly from the inlet or entrance 46 to point 47 and then taper outwardly to the outlet 48.

As in the shroud of FIGS. 1-6, a part or all of the shroud may be provided with louvered openings 50 so that when the secondary air from the passageways 51 formed by the grooves shaped by ridges 49 mix with burning gases the mixture is further supplemented by the air drawn in through louvers 50 to aid complete combustion.

Since the louvers 50 are downstream from the venturi portion of the shroud the increased velocity of the gases created by the venturi effect aids in drawing air into the burning gases through louvers 50.

Although but two embodiments of the invention have been illustrated and described, it will be obvious to one skilled in the art that various changes and modifications may be made without departing from the spirit of the invention and scope of the appended claims.

What is claimed is:

1. A fuel burner comprising:

a main support element,

a nozzle element on the main support element, said nozzle element being connected to an air gas supply and a fuel gas supply,

a burner flame shroud mounted on said support element a predetermined distance therefrom for receiving air and gas from said nozzle element, said shroud comprising a fluted surface along a part only of its length and defining an inlet adjacent said support element diverging outwardly and terminating in an outlet, said fluted surface defining a plurality of U-shaped grooves on the inside of said shroud which form air passageways extending along the surface of the fluted portion of said

shroud, said passageways exposing air passing therethrough to the temperature of the surface of the shroud before injecting it into the zone of fuel combustion in said shroud,

a plurality of air scoop openings arranged along the fluted surface of said shroud, said air scoop openings defining secondary air passageways into said chamber for mixing with air and fuel gases in said shroud to aid combustion of said gases.

2. The fuel burner set forth in claim 1 wherein said air scoop openings form louvers directing the secondary air laterally into said shroud.

3. The fuel burner set forth in claim 1 wherein said shroud is formed of a continuous cylindrical configuration fluted at one end to form a tapered combustion chamber.

4. The fuel burner set forth in claim 1 wherein said air scoop openings are positioned along the surfaces of said grooves.

5. The fuel burner set forth in claim 4 wherein said air scoop openings are arranged to draw atmospheric air into said shroud by the effects of aspirating of the air passing through said passageways.

6. The fuel burner set forth in claim 4 wherein said air scoop openings are symmetrically arranged around and along the length of said shroud.

7. A fuel burner comprising:

a main support element,

a nozzle element on the main support element, said nozzle element being connected to an air gas supply and a fuel gas supply,

a burner flame shroud mounted on said support element a predetermined distance therefrom for receiving air and gas from said nozzle element, said shroud comprising a fluted surface along a part only of its length and defining a venturi tube between its inlet and outlet, said fluted surface defining a plurality of U-shaped grooves on the inside of the fluted portion of said shroud which form air passageways exposing air passing therethrough to the temperature of the surface of the shroud before injecting it into the zone of fuel combustion in said shroud.

8. The fuel burner set forth in claim 7 wherein said shroud is provided with a plurality of air scoop openings arranged along at least a part of the fluted surface of said shroud, said air scoop openings defining secondary air passageways into said chamber for mixing with air and fuel gases in said shroud to aid combustion of said gases.

9. The fuel burner set forth in claim 8 wherein said air scoop openings are positioned in said shroud downstream from said venturi tube.

10. The fuel burner set forth in claim 8 wherein said air scoop openings are arranged symmetrically around and along said shroud to draw atmospheric air into said shroud by the aspirating effects of the air passing through said venturi tube.

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