Jan. 20, 1959 A. J. NERAD 2,869,629

BURNER ASSEMBLY

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Fig. 1.

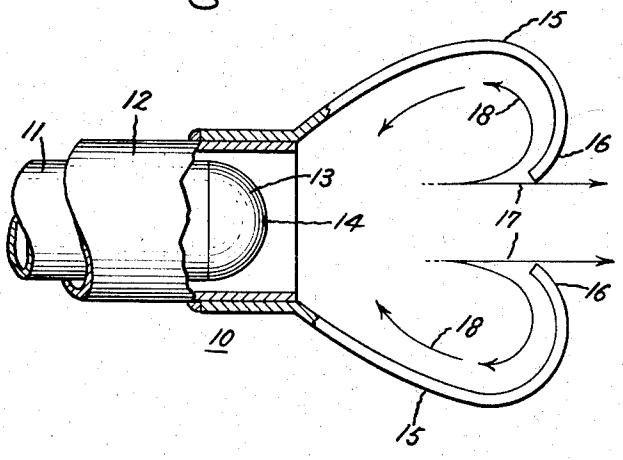


Fig. 2.

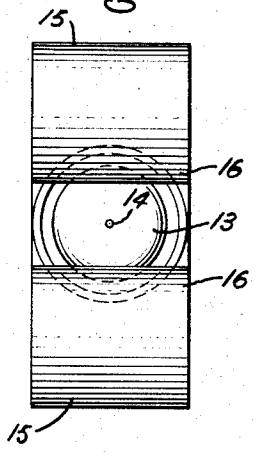
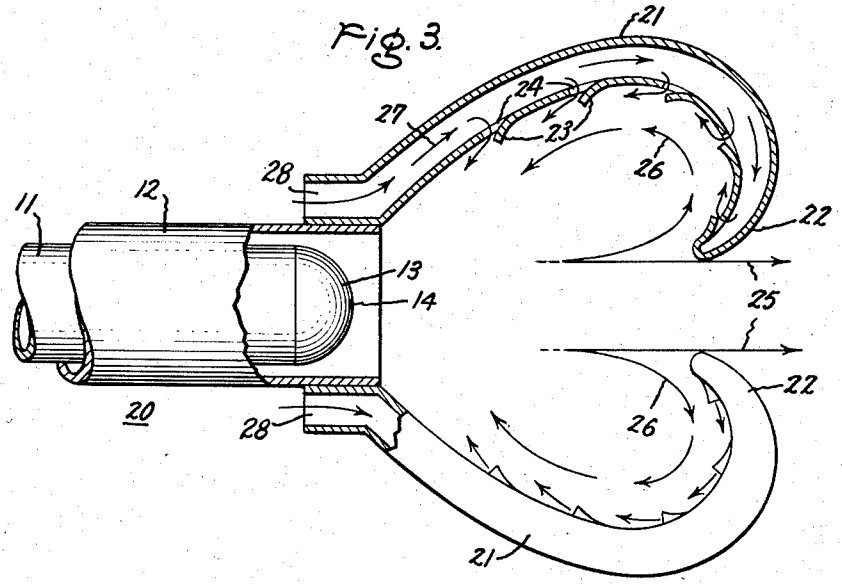


Fig. 3.



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BURNER ASSEMBLY

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3 Claims. (Cl. 158—73)

This invention relates to burner assemblies and more particularly to burner assemblies which are used in gas turbine combustors, ramjets, afterburners, and household oil and gas burners.

Flame extinguishment is a serious problem in gas turbine, jet propulsion, and domestic heating fields. A burner assembly which produces a stable flame is desirable to provide efficient combustion and to prevent flame extinguishment. Some present combustors use a rapidly burning fuel or an increased amount of fuel in the fuel-air mixture to stabilize the flame. However, such additional fuel consumption creates a higher operating cost for the apparatus and requires excessive storage space for the fuel. The invention of the present application provides a burner assembly which has flame stabilization of a high order with normal requirements of a conventional liquid, gas or solid fuel.

Accordingly, it is an object of my invention to provide a new and improved burner assembly.

It is another object of the invention to provide an improved burner assembly which produces a stabilized flame without excessive fuel consumption.

It is another object of the invention to provide an improved burner assembly which can be used in gas turbine combustors, ramjets, afterburners, and household type oil and gas burners.

It is a further object of the invention to provide an improved burner assembly in which a portion of the flame stream is returned mechanically to the flame base to produce stable combustion.

In carrying out my invention in one form, a pair of inwardly curved numbers are positioned adjacent the outlet end of a fuel-air casing to produce a direct mechanical return of a portion of the flame from a zone of combustion to the flame base. Thus, thermal regeneration of a high and controllable value is provided for high space rates of combustion.

These and various other objects, features and advantages of the invention will be better understood from the following description taken in connection with the accompanying drawing in which:

Fig. 1 is a partial sectional view of a burner assembly which embodies my invention;

Fig. 2 is a front elevational view of the burner assembly shown in Fig. 1; and

Fig. 3 is a partial sectional view of a modified burner assembly.

In Figs. 1 and 2 of the drawing, a burner assembly **10** is shown which comprises a fuel tube **11** spaced coaxially within an outer air inlet casing **12**. Tube **11** which is shown in the form of a cylinder has a closed outlet end **13** with a central fuel aperture **14** therethrough. This arrangement is broadly descriptive of various forms of fuel nozzles. Casing **12** projects beyond closed end **13** to provide an air stream for atomization of fuel which is sprayed from aperture **14**. Air and fuel are supplied to their respective casing and tube from any suitable sources (not shown). A pair of radially and axially extending inwardly curved metallic members **15** with inturned lips **16** are positioned on opposite, outer surfaces of casing **12** adjacent the outlet end thereof or alternately may be formed from extensions of end portions of the casing **12**. The "inwardly curving" may be defined in one sense as a hook member or a volute curve which commences in a direction substantially parallel to the longitudinal axis of the casing **12** and progresses in a general radial and axial direction away from the fuel outlet end **13** with the smooth volute curving inwardly toward the longitudinal axis of the casing and terminating in an inturned lip surface facing outlet end **13** to provide a stripping or peeling action of part of the burning stream of fuel air mixture. If it is desired, members **15** may be composed of a suitable refractory material. While a pair of members **15** are shown in Fig. 1 of the drawing, it should be understood that a single member or a plurality of members could be employed, and that such members may be axially extending without having an increase in the radial dimension. These members may be curved flat strips or have inner planar surfaces to peel a portion of the burning mixture and guide or redirect this portion rearwardly to the fuel nozzle outlet end **13**. I have found that a space should be provided between adjacent members for side air flow to support combustion.

In operation of burner assembly **10**, a liquid, gas or solid fuel is provided from a source of supply (not shown) through tube **11** and sprayed from aperture **14** into an air stream which is produced by tube **12**. The atomized fuel-air mixture is ignited within the confines of members **15** in any suitable manner to provide an initial flame stream which extends beyond members **15** as indicated by arrows **17** and engulfs lips **16**. A portion of the flame is peeled off by lips **16** and returned directly to the base of the flame by members **15** as indicated by arrows **18**. This mechanical return of a portion of the flame stream from a zone of hot, rapid combustion to the flame base stabilizes the initial flame stream through a mixing of hot combustion products to provide efficient combustion and to prevent flame extinguishment. I have discovered that a substantial portion of the initial stream can be returned to the flame base with an increased stabilization of high order.

In Fig. 3 of the drawing, a modified burner assembly **20** is shown which comprises a fuel tube **11** spaced coaxially with an outer air inlet casing **12**. Closed outlet end **13** of tube **11** has a central aperture **14** therethrough. A pair of hollow, inwardly curved members **21** with inturned lips **22** are positioned on opposite, outer surfaces of the outlet end of casing **12**. The inner wall of each member **21** has a plurality of louvers **23** with associated apertures **24** which are directed toward the outlet end of casing **12** to provide an additional fluid stream, such as, air for combustion and cooling.

In the operation of burner assembly **20**, the atomized fuel-air mixture from tube **11** and casing **12** is ignited to produce an initial flame stream which extends beyond members **21** as indicated by arrows **25**. A portion of the flame is peeled off by lips **22** and returned to the flame base by members **21** as indicated by arrows **26**. This mechanical return of a portion of the hot burning and burned combustion products to the flame base stabilizes the initial flame stream. An air stream flows through inlet **28** to each member **21** from a source of supply (not shown) as indicated by arrows **27** to cool the member during burner assembly operation. Air is discharged from members **21** through apertures **24** and directed by louvers **23** in a vortical stream toward the casing outlet to provide additional air for mixing with combustion products and the burning reactants.

As will be apparent to those skilled in the art, the

objects of my invention are attained by the use of a pair of inwardly curved members which are positioned adjacent the outlet end of a fuel-air casing to produce a direct mechanical return of a portion of the flame from a zone of combustion to the flame base to provide a highly stabilized flame.

While other modifications of this invention and variations of apparatus which may be employed within the scope of the invention have not been described, the invention is intended to include all such as may be embraced within the following claims.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A burner assembly comprising a hollow, substantially cylindrical casing having an inlet and an outlet, a fuel tube spaced coaxially within said cylindrical casing, a closed outlet end on said tube, said closed end having a central aperture therein and spaced inwardly from the outlet of said cylindrical casing whereby a fuel air stream is ejected from said outlet for ignition thereof, a hollow strip member positioned adjacent the outlet of said cylinder to extend therefrom in a general radial and axial direction and curving inwardly toward the longitudinal axis of said cylindrical casing to form a lip surface facing the outlet of said casing, said lip surface intercepting a portion of the burning fuel air mixture for redirection along the lip surface to the casing outlet, said hollow strip members defining an air passage therein, and a plurality of louvres on the said lip surface to provide a vortical air stream for the redirected portion of the burning fuel air mixture.

2. A burner assembly comprising a hollow, substantially cylindrical casing having an inlet and an outlet, a fuel tube spaced coaxially within said cylindrical casing, a closed outlet end on said tube, said closed end having a central aperture therein and spaced inwardly from the outlet end of said cylindrical casing to provide a fuel air stream ejecting from said outlet for ignition thereof, a plurality of hollow relatively flat strip members adjacent the outlet end on said cylindrical casing and positioned on the periphery thereof in opposite and opposed flat surface relation to each other, the said members extending from the said outlet in a generally radial and axial direction and curving inwardly toward each other and the longitudinal axis of said cylinder to provide a lip surface facing the casing outlet, said lip surface intercepting a portion of the burning fuel air mixture for redirection along the lip surface toward the casing outlet, the said members defining an internal air passage therein, and a plurality of louvres on the said lip surface to provide a vortical air stream for the redirected portion of the burning fuel air mixture.

3. A burner assembly comprising in combination a fuel nozzle to emit a spray of fuel, means supplying combustion air for mixture with the fuel spray for burning thereof, a hollow strip member, means supporting the hollow strip member adjacent the periphery of the nozzle at the outlet thereof, said strip member extending from the outlet of said nozzle in a generally radial and axial direction and curving inwardly toward the longitudinal axis of said nozzle to form a lip surface facing the outlet of said nozzle, said lip surface intercepting a portion of the burning fuel air mixture for redirection along the lip surface to the nozzle outlet, said hollow strip member defining an inner air passage, and a plurality of louvres on said lip surface to provide a vortical air stream for the redirected portion of the burning fuel air mixture.

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