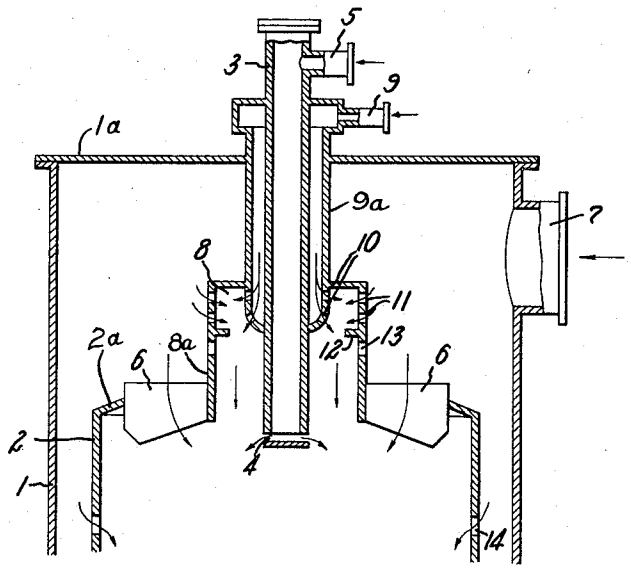
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GAS BURNER

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GAS BURNER

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1 Claim. (Cl. 60—39.74)

The invention relates to a gas burner adapted for use in the combustion chambers of gas turbine installations where a gaseous fuel such as one consisting principally of methane is available.

The burning of such gases in a gas turbine combustion chamber gives rise to difficulties when the speed of the air compressor and the mass of air flowing through the combustion chamber remain constant at all loads as is customary in such installations. The very narrow ignition limits of methane-air mixtures beyond which they will not burn severely limits the possible range of control of a gas turbine installation operated therewith. In a combustion chamber of the usual dimensions the gas velocity often is a multiple of the flame propagation velocity.

Ordinarily, fuel gas is mixed with the combustion air as uniformly as possible. This mixing may occur either in the burner in front of the fire chamber or in the fire chamber itself. In order to attain a high degree of loading of the combustion chamber the turbulence of the gas-air mixture is often artificially increased for example by generating a whirling movement thereof in the combustion chamber by the use of a so-called swirl body by means of which the combustion air, as it is introduced into the combustion chamber, is given a swirling motion. Always, if possible, the gas and air supplies are regulated simultaneously with changes in load so that the ratio thereof remains constant.

With the known means for improving combustion it has not heretofore been possible in gas turbine combustion chambers with a constant air throughput to obtain a stable flame at less than full throttle. Even before reaching the ignition limit the flame begins to vibrate and becomes unstable and this vibration is communicated to the gas and air columns associated with the combustion process. As a result, as already stated, the regulation of the process is severely limited.

The gas burner according to the present invention is so constructed and designed that the above mentioned difficulties are eliminated. It is characterized by a centrally arranged fuel gas nozzle with a radially outwardly directed ring shaped slit nozzle, a ring shaped swirl body arranged around this nozzle for imparting swirling motion to the combustion air entering the combustion chamber and a similarly ring shaped ignition chamber arranged around the fuel gas nozzle. The hot combustion gases generated in the ignition chamber mix with the mixture of air and fuel gas flowing away from the zone between the swirl body and the fuel nozzle whereby the latter is heated and maintained in ignitable condition.

The invention is schematically illustrated in the accompanying drawing.

The burner is mounted on the upper end of a vertically disposed double walled combustion chamber only the upper portion of which is shown in the drawing. The combustion chamber housing includes an outer cylindrical wall **1** having an upper end wall **1***a* and a concentrically arranged inner cylindrical wall **2** spaced therefrom having an upper wall **2***a*. The tubular fuel gas nozzle **3** is arranged in the axis of the combustion chamber and terminates at its lower end in the radial slit nozzle **4**. Connected to the upper end of the gas nozzle **3** is the gas supply conduit **5**. The fuel gas flows at a high variable velocity out of the slit **4** and flows outwardly and downwardly into the swirling current of combustion air which enters through the orifices of the swirl body **6** to which air is supplied through the pipe **7** adjacent the upper end of the combustion chamber. The swirl body **6** may consist of a ring of diagonally disposed, spaced apart plates defining diagonal slits or orifices through which the air passes. The fuel gas penetrates into the air stream flowing from **6** to a depth corresponding to its velocity and mixes therewith and burns. The volume of air which mixes with the fuel gas therefore varies with the amount and velocity of fuel gas introduced. The local excess of air in the flame zone is therefore smaller than the ratio of the total amount of air to the total amount of gas.

Extending through the end walls of the combustion chamber and spaced concentrically around the fuel nozzle **3** is a second tubular conduit **9***a* which terminates a substantial distance from the inner end of the fuel nozzle. Ignition fuel gas is introduced into the upper end of the second tubular conduit **9***a* through the pipe **9** and is emitted radially outwardly from the lower end through the openings **10**. Concentrically arranged about the inner end of the fuel nozzle **3** is a third tubular conduit **8***a* which extends inwardly over the inner end of the fuel nozzle **3** to form an ignition chamber **8**. Five to ten percent of the total fuel gas supplied to the burner is fed through the second tubular conduit **9***a* and is introduced into the ignition chamber **8** through the openings **10**. Combustion air is also introduced into the ignition chamber **8** through the opposed openings **11** in the third tubular conduit **8***a*. The hot combustion gas formed in the ignition chamber flows downwardly and mixes with the mixture of air and fuel gas formed adjacent the nozzle **4** and the swirl body **6** so that locally in this mixing zone a high temperature is attained which increases the combustion velocity of the mixture and broadens the ignition range.

Referring to the drawing it will be seen that a flange **12** extends inwardly from the wall of the ignition chamber **8** below the openings **10** and **11** and serves to define a more restricted mixing chamber or zone for the fuel gas and air admitted to the ignition chamber. A series of holes **13** in the wall of the chamber **8** below the flange **12** permits a limited flow of air into the ignition chamber to provide additional air for the flame. Similarly a series of holes **14** in the wall of the inner cylinder **2** permits a limited flow of air to the interior thereof.

With the described burner it is possible to regulate the combustion in combustion chambers having constant air supplies within a considerable range without the use of additional mechanical means for regulating the air supply. This is essential in gas turbine installations. Thus the burner provides a constructive solution to the problem which is simpler and cheaper than the gas burners heretofore proposed. In installations which are designed to operate with either oil or gas, the burner is so designed that the gas nozzle is easily replaced by an oil jet nozzle. The swirl bodies need not be changed. The time required for the changeover from oil to gas or vice versa is only a fraction of the time which would be required to change the swirl body. Moreover an oil jet nozzle can be built into the gas burner so that it is possible to burn a mixture of gas and oil or to shift from one to the other at any time without interruption.

I claim:

A gas burner comprising a combustion chamber having concentric spaced apart cylindrical side walls and spaced apart upper end walls closing the adjacent ends of said side walls, a tubular fuel nozzle extending axially through

said end walls and having a ring shaped jet adjacent its inner end, a second tubular conduit extending through said end walls and surrounding said fuel nozzle and terminating at a substantial distance from the inner end of said fuel nozzle in jet openings, a third tubular conduit surrounding the inner end portion of said second tubular conduit and extending inwardly over the inner end of said fuel nozzle, jet openings in said third tubular conduit opposed to the jet openings in said second tubular conduit, a ring of orifices in the inner end wall of said combustion chamber surrounding the jet of said fuel nozzle, said orifices being so shaped as to impart a swirling motion to air passing therethrough, means for supplying air under pressure to the space between the inner and outer walls of said combustion chamber, and means for supplying fluid fuel under pressure to said fuel nozzle and separate means for supplying fuel to the space between said fuel nozzle and said second tubular conduit.

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