

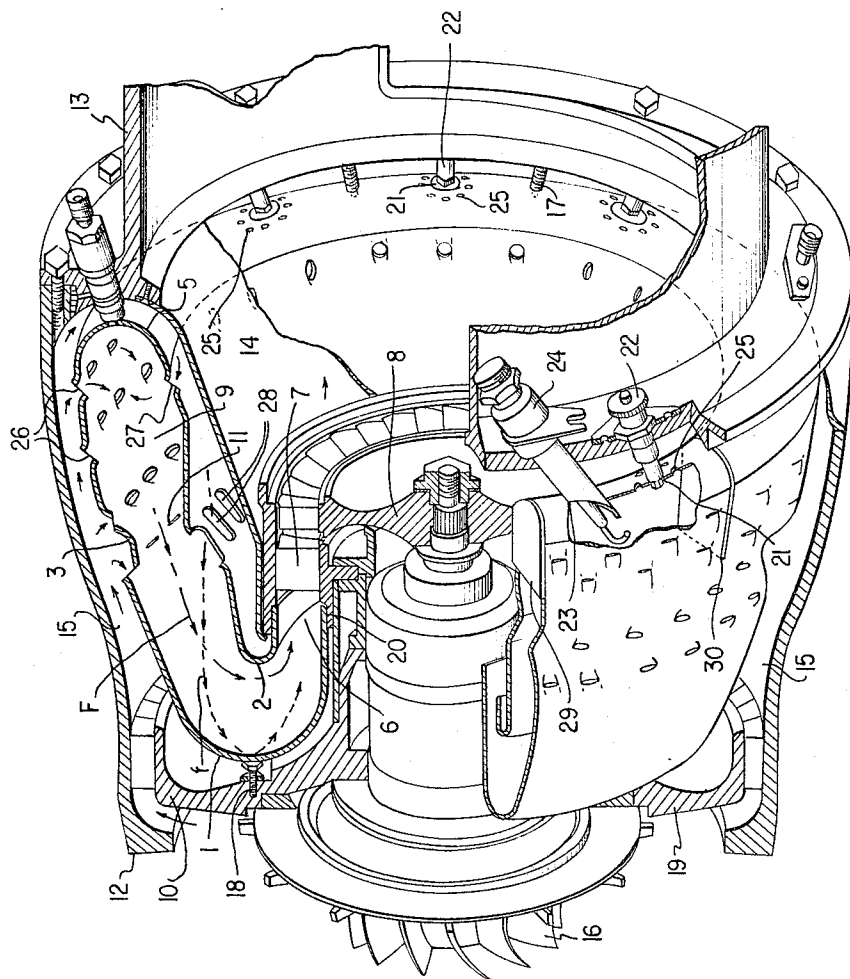
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COMBUSTION CHAMBER FOR A GAS TURBINE

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COMBUSTION CHAMBER FOR A GAS TURBINE

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1 Claim. (Cl. 60—39.36)

The present invention relates to a particular and new embodiment of a combustion chamber of a gas turbine.

The combustion chamber is the element of the gas turbine arranged between the compressor and the turbine, inside which is performed the mixture of the fuel fed by the injectors, with the air fed by the compressor and the combustion of said air and fuel mixture.

The combustion leads to an important increase in temperature of said air, which increases its energy, the fraction of which may be recovered through expansion is used on the one hand for driving the above-mentioned compressor and, on the other hand, for supplying propelling power in the case of a jet engine or of the mechanical power in the case of a turbine engine.

Generally speaking and for reasons which will be disclosed hereinafter, the walls of the combustion chamber define two inner communicating areas: the combustion area which is termed the primary chamber and the dilution area termed secondary chamber.

Inside the primary chamber are arranged the fuel injectors and the sparking plugs. In order that the combustion be possible and stable, it is necessary to form, in the primary chamber, a hot gaseous core with the gases produced through combustion which is essential for the upkeep of the latter combustion. Said core can exist only if there is a local slowing down and a turbulence in the mixture of air and fuel, which mixture should approximate stoichiometric proportions.

The combustion of such a mixture leads to a temperature of the gases approximately 2000° C., the application of which to the turbine, would lead to its destruction. In order to return the gases to a temperature consistent with the resistance of the material, one fraction of the air fed by the compressor, termed secondary flux, is distributed into the secondary chamber where it is mixed with the gases fed by the primary chamber. The introduction of the secondary flux must be such that it leads to a gradient in temperature increasing from the root of the blades to the periphery of the turbine blades.

The combustion chamber, which forms the object of my invention, is of the annular bent type of which the single figure of the accompanying drawings illustrates in partly sectional perspective view, an embodiment selected by way of example.

Said figure shows the preferred shape of the combustion chamber as well as the admission means of the fluxes of primary and secondary air, provided so as to satisfy the general conditions for a good operation as disclosed hereinabove.

Said figure also shows the distribution of the fuel injectors and the position of one of the sparking plugs, the other sparking plug occupying, in the example illustrated, a symmetrical position, as well as the particular organization of the ignition area.

The combustion chamber which forms the object of the invention is provided with an outer wall 1, approximately cylindrical and incurved in its front part, and with an inner wall 2 also approximately cylindrical and incurved in its front part, said two walls being provided furthermore each, with an arcuate notch in their medial part, said notches being respectively designated by the reference numbers 3 and 4.

The rear ends of the walls 1 and 2 are welded over an

annulus 5 in the shape of a half tore. The front ends of the walls 1 and 2 open into an annular channel 6 feeding the distributor 7 for the turbine 8.

The rear section of the walls 1 and 2 lying on the upstream side of the notches 3 and 4 and the annulus 5 defines the primary chamber 9. The front section of the walls 1 and 2 lying on the downstream side of the notches 3 and 4 defines the secondary chamber 10. The primary and secondary chambers 9 and 10 are connected through the throttling means 11 formed by the notches 3 and 4.

The combustion chamber is arranged inside a casing constituted by the body 12, the support 13 and the ferrule 14 connected together through bolting, so as to form round the combustion chamber an annular channel 15 incurved in the shape of a U, inside which the air fed by the compressor 16 flows.

The combustion chamber is held in position in the casing 12—13—14 by abutment screws 17 provided with a stud and passing through the support 13 and engaging the annulus 5 and by abutment screws 18 secured to the wall 19 rigidly secured to the casing. The incurved section of the wall 1 bears on the screws 18 and furthermore, the front edges of the walls 1 and 2 are inserted in the opening 20 of the distributor 7.

The clearance provided when fitting the chamber on the screws 17 and 18 allows said chamber to expand freely. Such a floating assembly cuts out all mechanical longitudinal straining which might arise on account of the flaws in the walls of the chamber.

Inside the annulus 5, holes 21 are bored for the passage of the injector 22 carried by the support 13 and further holes 23 for the passage of the sparking plugs 24 carried by the same support enclosing also the means distributing fuel to the injectors, not illustrated.

Round the holes 21 are bored on concentric circle series of small ports 25 the edges of which are shaped so as to form a lower projecting edge which furthers the input of air.

In the rear sections of the walls 1 and 2 are bored rows of ports respectively 26 and 27, the edges of which facing the stream of air flowing in the channel 5 are raised in a manner such as to further the admission of air into the primary chamber 9.

By reason of the direction of the air entering the primary chamber through the ports 26 being opposed to that of the air entering through the ports 27, there is obtained, in the primary chamber 9, a turbulent tore forming the combustion core. Furthermore, said arrangement allows maintaining, on the inner surface of the walls of the combustion chamber, a layer of fresh air which protects them from the direct action of the flame, said walls being furthermore cooled by the current of fresh air flowing in the channel 5.

The amount of air introduced in the primary chamber or primary flux, required for a good combustion, is adjusted through action on the cross-sectional area provided by the ports 26 and 27 and by the throttled section 11.

In the section of the wall forming the notch 4 and in registry with the concave surface of the opposite wall of the secondary chamber 10 are formed slots 28 through which the flux of air enters said chamber 10.

The secondary flux indicated by the arrow *f* in dotted lines passes through the primary flux of the burnt gases, indicated by the arrow *F* in dot-and-dash lines and cools said latter flux while it is heated itself and is reflected on the opposite incurved wall 1, so as to form permanently along said wall a layer of gas feeding the roots of the blades of the turbine, the temperature of which is lower than that prevailing in the stream of gas flowing along the wall 2 and feeding the periphery of the turbine.

During the starting stage of the gas turbine, the characteristic features of the compressor allow igniting only

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a few injectors, to wit: those arranged near the sparking plugs, two in the example illustrated. In the case of an annular chamber, there is a risk of obtaining in said stage insufficient fuel contents for initiating the combustion. In order to remove said drawback, the ignition area is protected against any objectionable lateral stream of air by partitions 29, 30 arranged longitudinally to either side of each system formed by an injector and the cooperating sparking plug or plugs. Said partitions, welded to the annulus 5, extend over a fraction of the length of the primary chamber 9.

In the portion of the wall 1 extending between partitions such as 29, 30, the edges of the holes 26 are directed so as to slow down the speed of admission of air.

What I claim is:

In combination with a gas turbine having radially outwardly extending blades, a compressor, an annular casing coaxial with and communicating with the turbine and compressor, said casing defining a chamber having a U-shaped cross section in which the U has two legs interconnected by an arcuate bend, one of said legs being directed toward said turbine blades, said casing comprising walls of U-shaped cross section one nested within the other, means for introducing air from the compressor into said other leg of the chamber and for forming and igniting an explosive mixture in said other leg of the chamber, the radially inner said wall bounding said other leg of

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the chamber having an annular portion that extends into and throttles said other leg of the chamber and that has openings for compressed air therethrough on its side toward said bend, said openings being directed toward the radially outer said wall bounding said other leg but inclined toward said bend, so that compressed air entering said other leg through said openings is directed toward and along said other wall and about said bend and toward the roots of said turbine blades.

References Cited by the Examiner

UNITED STATES PATENTS

2,296,023	9/1942	Dallenbach	60—39.72
2,633,705	4/1953	Hawkins	60—39.36
2,867,267	1/1959	Nerad	60—39.65 X
3,088,278	5/1963	Franz	60—39.36 X

FOREIGN PATENTS

721,899	1/1955	Great Britain.
863,011	3/1961	Great Britain.

OTHER REFERENCES

German printed application 21,435, October 1956.

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