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Adelizzi et al.

[11] **3,742,704**

[45] **July 3, 1973**

[54] **COMBUSTION CHAMBER SUPPORT STRUCTURE**

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[52] **U.S. Cl.** **60/39.31**, 431/154, 60/39.69

[51] **Int. Cl.** **F02c 7/20**

[58] **Field of Search** 60/39.31, 39.32, 60/39.69; 431/154, 155

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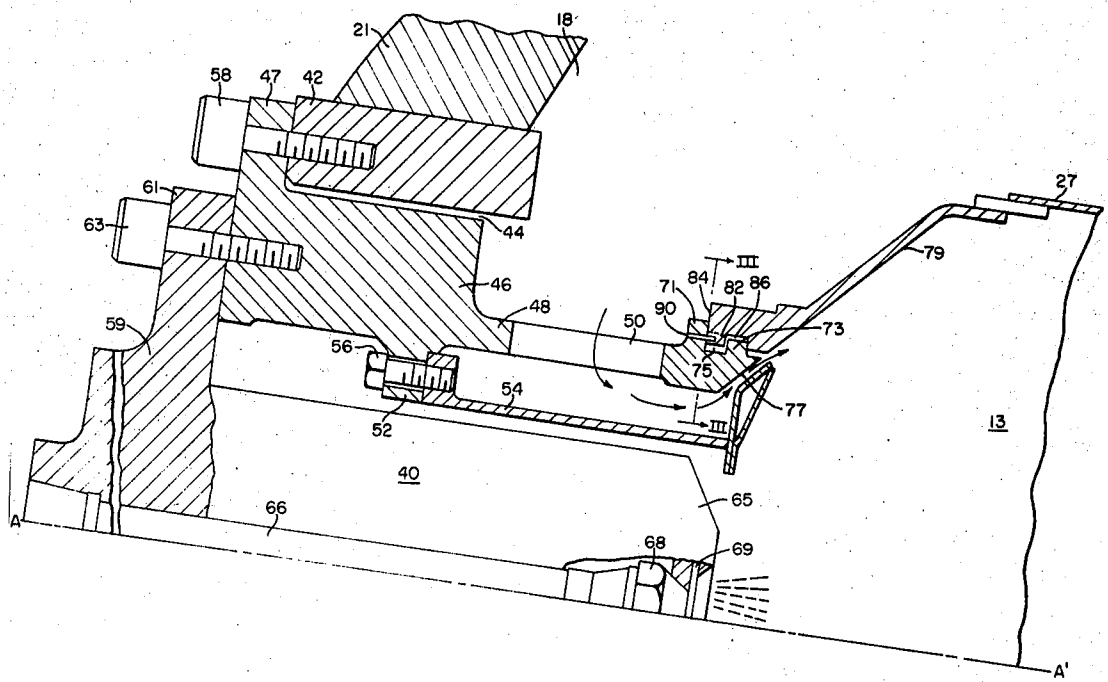
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Assistant Examiner—Warren Olsen
Attorney—A. T. Stratton et al.

[57] **ABSTRACT**

A support structure for the upstream portion of a combustion chamber. The combustion chamber includes a conically shaped collar portion having a circumferential groove on its inner diameter surface. A plurality of axial slots extend from the upstream surface of the collar to the groove. On the downstream portion of a fuel injector structure is a plurality of radially extending protuberances which are inserted through the corresponding axial slots in the collar into the annular groove. The combustion chamber is rotated and the housing and the combustion chamber are axially locked relative to each other.

5 Claims, 5 Drawing Figures



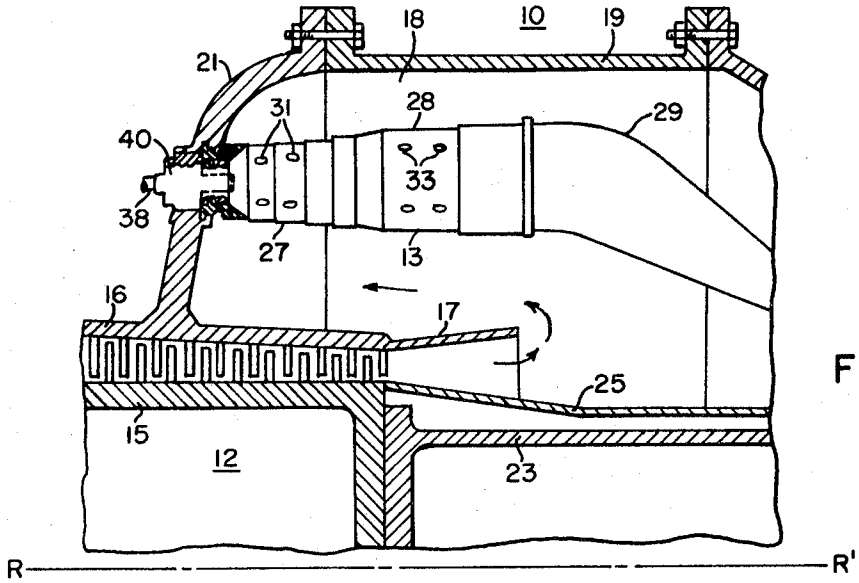


FIG. 1

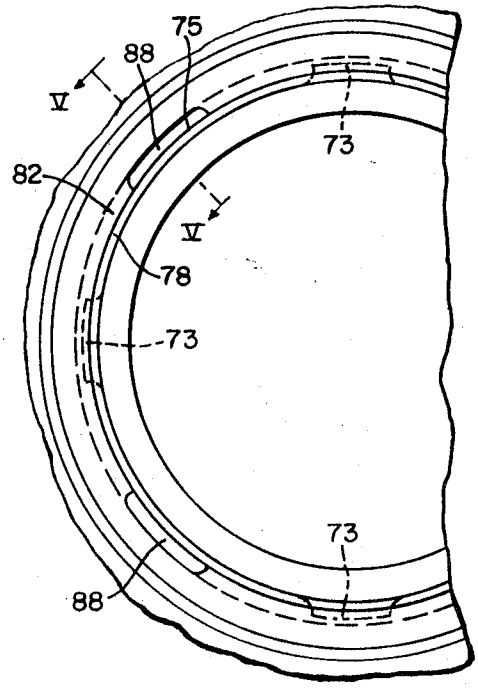


FIG. 3

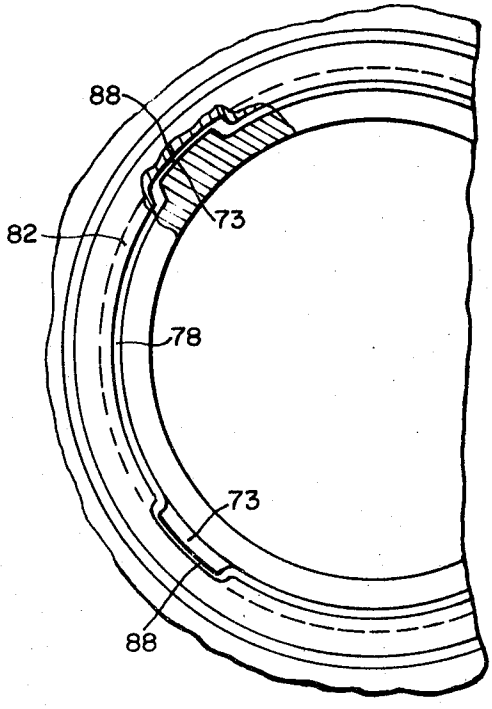


FIG. 4

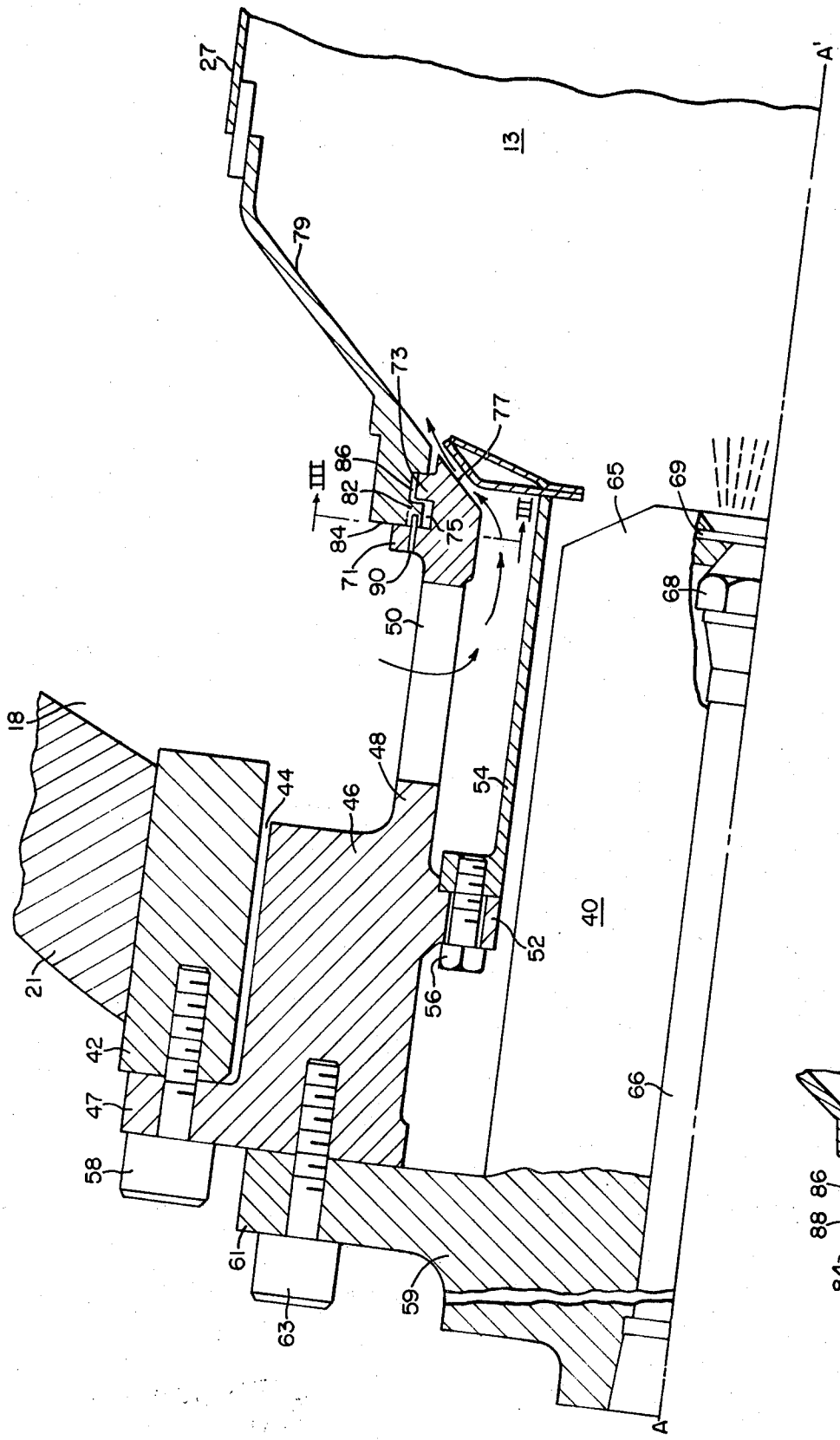

27
A'
13
79
73
77
III
86
82
84
71
90
75
III
65
69
68
50
18
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54
44
46
40
52
56
21
42
47
58
66
61
59
63
A

FIG. 2

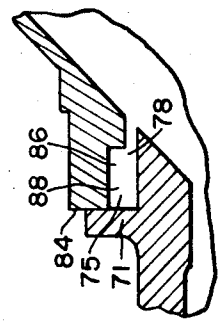

78
86
88
84
75
71

FIG. 5

COMBUSTION CHAMBER SUPPORT STRUCTURE

BACKGROUND OF THE INVENTION

The following disclosure relates to a support structure for the upstream end of a combustion chamber in a gas turbine.

It is common practice in most gas turbines having a plurality of combustion chambers to remove the combustion chambers through cover plates in the side wall of the combustion section. Before the combustion chambers are removed, the fuel injector structure is removed, an extended neck portion of the combustion chamber is disconnected from the cover plate, and the cover plate is removed. It is desirable to eliminate end removal of combustion chambers as disclosed in U.S. Pat. No. 3,657,883 to S. M. DeCorso. By elimination of the end removal of the combustion chambers, the chambers are removed upwardly through the top of the turbine after removing the upper half of the turbine casing structure. The foremost advantage of top removal is that the outside diameter of the combustion portion of the turbine is substantially reduced resulting in a saving in material and cost associated therewith.

To use the present support structure in the top removal of combustion chambers provides substantial problems, namely that the fuel housing must be removed, the extended neck portion of the combustion chamber must be disconnected, and the cover plate must be removed.

It is desirable, then, to devise a structure to support the combustion chamber at its upstream end, which would allow for easy installation and removal of the combustion chamber and which support structure could be applicable for both end removal and top removal of the combustion chamber.

SUMMARY OF THE INVENTION

A gas turbine power plant having a combustion chamber disposed therein and a fuel injector structure through which fuel is supplied to the combustion chamber.

In accordance with the invention there is provided a housing structure for said injector structure, a downstream portion of the housing having an annular ledge, and downstream therefrom, a plurality of protuberances radially extending from the housing. The ledge and protuberances jointly define an annular groove. A plurality of axial slots extends from the downstream portion of the housing through the protuberances to the annular groove.

A generally conical shaped collar portion is at the upstream end of the combustion chamber. The collar has a circumferential groove facing the housing structure and a plurality of protuberances radially extending from the upstream end of the collar. A plurality of axial slots extends from the upstream surface of the collar portion through the protuberances to the groove.

The protuberances on the housing are inserted through the axial slots in the collar into the groove in the collar and, correspondingly, the protuberances on the collar are inserted through the axial slots in the housing into the groove in the housing. The sleeve on the housing abuts the upstream face of the collar and when the combustion chamber is rotated, the slots and the protuberances are out of registry, so that the combustion chamber is locked in an axial direction relative to the housing structure. This fastening structure is generally well known as a bayonet lock. A pin is inserted through the ledge into the collar to prevent annular rotation. The ledge and the collar form a seal at their respective abutting surfaces.

What is disclosed then is a support structure for the upstream portion of a combustion chamber, which support structure provides for easy installation and removal of the combustion chamber. The support structure allows for either end or top removal of the combustion chamber.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is an axial sectional view of a portion of the upper half of a gas turbine power plant provided with a combustion chamber which is supported in accordance with the principles of the present invention;

FIG. 2 is an enlarged sectional view of one half of the support structure for the combustion chamber shown in FIG. 1;

FIG. 3 is a view taken along line III—III in FIG. 2 on a somewhat smaller scale, and showing the support structure in the locked position;

FIG. 4 is a view similar to FIG. 3 but showing the support structure in the unlocked position; and

FIG. 5 is a view taken along line V—V in FIG. 3 and on a slightly larger scale.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings in detail, and more specifically to FIG. 1, there is shown a portion of an axial flow gas turbine **10**. The power plant **10** includes an axial flow compressor **12** for directing air to a combustion chamber **13**. The combustion chamber **13** delivers hot motive products, which are burned therein, to a turbine portion (not shown). Only the upper half of the power plant **10** is shown since the lower half may be substantially identical and symmetrical about the axis of rotation R—R¹ of the power plant. The air compressor **12** includes, as well known in the art, a multi-stage bladed rotor structure **15** cooperatively associated with a stator structure **16**, having an equal number of multi-stage stationary blades for compressing the air directed there-through, to a suitable pressure value for combustion in the combustion chamber **13**. The outlet of the compressor **12** is directed through an annular diffusing member **17** forming an air intake for a plenum chamber **18**, partially defined by a housing structure **19**. The housing structure **19** is of cylindrical shape and is parallel to the axis of rotation R—R¹ of the power plant **10**. The upstream portion of the housing structure **19** is secured to a forward dome-shaped wall member **21**. The wall member **21** is secured to the outer casing member of the compressor **12**. The compressor rotor structure **15** is drivenly connected to the turbine (not shown) by a tubular connecting shaft member **23**, and a tubular liner or fairing member **25** is suitably supported in encompassing spaced relation with the connecting shaft **23** to provide a smooth air flow surface for the air entering the plenum chamber **18** from the compressor diffuser **17**.

Disposed within the plenum chamber **18** are a plurality of tubular combustion chambers or combustors **13** of the telescopic step-liner type. The combustors **13** are disposed in an annular mutually spaced array concentric with the axis of rotation R—R¹ of the power plant

10 and are equally spaced from each other within the housing.

Each combustor 13 is comprised of an upstream primary portion 27, an intermediate secondary portion 28 and a downstream transition portion 29. There are a plurality of apertures 31 for admitting primary air from within the plenum chamber 18 into the primary portion 27 of the combustor to support combustion of fuel injected therein to provide hot motive gases. In the intermediate portion 28, there is provided a plurality of annular rows of apertures 33 for admitting secondary air from the plenum chamber 18 into the combustor 30 during operation, to cool the hot gaseous products and make it adaptable to the turbine (not shown). The transition portion 29 directs the hot motive products to the turbine.

Fuel is supplied to the combustion chamber from any suitable source by conduit 38. The conduit 38 supplies fuel to a fuel injector structure 30. The fuel injector structure 40 may be of the well known atomizing type formed in a manner to provide a substantially conical spray of fuel within the primary portion 27 of the combustion chamber 13. Although not shown, a suitable electrical igniter can be provided for igniting the fuel and air mixture in the combustor 13.

In FIG. 2, only the upper half of the support structure for the combustion chamber 13 is shown, since the lower half is symmetrical about the axis A—A¹. The dome-wall member 21 has a plurality of annular bosses 42 (only one being shown), one boss corresponding to each combustion chamber 13. An end wall aperture 44 is machined in each boss 42, through which the fuel injector structure 40 is inserted. The fuel injector structure 40 includes a tubular housing structure 46. At the upstream portion of the housing structure 46 is a flange 47 extending radially outward relative to the axis A—A¹ which is the central axis of the fuel injector structure 40 of the combustor 13. As shown, the axis A—A¹ is slightly inclined relative to a horizontal plane.

There is a smaller outer diameter downstream portion 48 having a plurality of air inlet apertures 50 (only one being shown) for admitting air from the plenum chamber 18 into the combustion chamber 13 to support combustion. The end of the downstream portion 48 will subsequently be described.

Extending radially inward from the annular housing structure 46 is an annular flange 52. An annular air baffle structure 54 is secured to the flange 52 in a downstream axially extending direction by any suitable means such as bolts 56. The baffle structure 54 may be of any suitable well known type used to direct the air flowing from the plenum chamber 18 through the apertures 50 into the combustor 13, as indicated by the arrows.

The housing structure 46 is secured to the boss 42 by a plurality of bolts 58. The housing 46 and the boss 42 are in an annular spaced relation 44 to allow for thermal expansion and easy removal of the housing.

Forming a part of the fuel injector structure 40 is a nozzle portion 59. On the upstream end of the nozzle portion 59 is a radially extending flange 61. The nozzle portion 59 is secured to the housing structure 46 at the flange 61 by any suitable means, such as a plurality of bolts 63. The nozzle portion 59 has an axially extending central portion 65, in which is disposed the fuel supply passageway 66 and fuel nozzle 68. Air supply passageways 69 are provided within the central portion 65 to provide a suitable amount of air to mix with the fuel to support combustion. The nozzle portion 59 may be any suitable fuel nozzle to supply combustible fuel to the combustion chamber 13.

At the downstream portion 48 of the housing 46, there is provided a radially extending annular ledge 71 which is axially downstream of the apertures 50. Downstream of the ledge 71, and in a spaced relation therefrom, is a plurality of first protuberances 73 radially extending from the downstream portion 48 of the housing structure 46 (FIGS. 2, 3, and 4). The protuberances 73 are equally spaced from each other in an annular direction as best seen in FIG. 3. The ledge 71 and protuberances 73 jointly define an annular groove 75 on the radially outer surface of the downstream portion 48. The furthest downstream face 77 of the housing 46 is inclined relative to the central axis of the fuel injector AA'.

A plurality of first axially extending slots 78 extends from the annular groove 75 through the protuberances 73 to the downstream face 77 of the housing 46 as best seen in FIGS. 3 through 5. The first axial slots 78 partially define the radially extending protuberances 73.

A generally conical shaped collar portion 79 is at the upstream end of the combustion chamber 13. The collar 79 has a generally axially extending upstream portion which cooperates with the annular housing structure 46 to lock the combustion chamber 13 to the fuel injection structure 40. The collar 79 has a plurality of second protuberances 82 (FIGS. 2–4) at the upstream face 84 of the collar 79 extending radially inward. Immediately downstream of the second protuberances 82 is a circumferential groove 86. A plurality of second generally axially extending slots 88 extend from the upstream surface 84 of the collar portion 79 through the protuberances 82 to the groove 86 (FIGS. 2–5) and partially define the protuberances 82.

As best seen in FIG. 4, the first protuberances 73 on the housing 46 are inserted through the second axial slots 88 on the collar 79. The larger second protuberances 82 on the collar 79 are correspondingly inserted through the corresponding first axial slots 78 on the housing. The first protuberances 73 on the housing are inserted into the circumferential groove 86 in the collar 79 and correspondingly the second protuberances 82 are inserted into the groove 75 in the housing. FIG. 4 shows the corresponding protuberances and slots in registry for insertion or removal of the combustor.

The annular ledge 71 on the housing abuts the upstream face 84 of the collar (FIG. 2) to properly position the housing 46 and collar relative to each other in a generally axial direction and to provide a seal therebetween. The downstream surface of the first protuberances 73 on the housing 46 and the surface defining one wall of the annular groove 86, also abut each other.

The combustion chamber 13 is rotated relative to the fuel injector structure 40 to the locked position as shown in FIG. 3. The first protuberances 73 are slidably rotated in corresponding groove 86 and the second protuberances 82 are slidably rotated in circumferential groove 75. Therefore, as seen in FIG. 3, the first protuberances 73 and second slots 88 are out of registry, and the second protuberances 82 and first slots 88 are out of registry. In the locked position, the protuberances 73 and 82 mutually block each other in an axial direction. The slots 78 and 88 align (FIG. 5) so that no protuberances are blocking each other at that portion.

However, the downstream face on the ledge **71** and the upstream face **84** on the collar, mutually abut to seal the plenum chamber **18** from within the combustion chamber **13.** This locking structure is commonly known as a bayonet type of lock.

As best seen in FIG. **2,** the protuberances **73** and groove **86** are in spaced relation with two of the defining wall surfaces of the groove, to allow for both radial and axial thermal expansion. Likewise protuberances **82** are in spaced relation with two of the wall surfaces defining groove **75** to also allow for relative thermal expansion in the radial and axial directions.

To lock the combustion chamber relative to the nozzle portion **40** in the circumferential direction, a tapered locking pin **90** is inserted through the ledge **71** on the housing structure **46** into a corresponding opening on the upstream portion of the collar **79.** Any other suitable antirotational structure well known in the art can be used.

What is disclosed then is a support structure for a combustion chamber which allows for easy assembly and disassembly of the combustion chamber **13** from the fuel injector structure **40.** An effective seal is provided between the fuel injector structure **40** and the combustion chamber **13** so that only the desired amount of air from the plenum chamber **18** will enter the combustion chamber **13.** While the support structure has greatest advantage in the top removal of combustion chambers, as previously described, it is also applicable to side removal. Finally, there is a savings of materials and simplification of the support structure.

Though the invention has been shown in the preferred embodiment, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of changes without departing from the spirit and scope thereof.

We claim as our invention:

1. In a gas turbine comprising an annular outer casing having a combustion portion, at least one combustion chamber disposed in said combustion portion, a fuel injection member, means to support said combustion chamber within the combustion portion, said fuel injection member having a plurality of radially extending first protuberances at its downstream end, a circumferential groove upstream of the first protuberances, and a plurality of first slots extending generally axially from the downstream end of the member between said protuberances to said groove, said combustion chamber having a plurality of radially extending second protuberances at its upstream end, a circumferential groove downstream of said second protuberances, and a plurality of second slots extending generally axially from the upstream end of the combustion chamber between said second protuberances to said last-mentioned groove, said protuberances being insertable through said slots into the grooves, whereby said combustion chamber is locked in the generally axial direction of said outer casing upon relative rotation of the fuel injection member and the combustion chamber.

2. The structure recited in claim **1** wherein the first protuberances are insertable through the second slots into the groove in the combustion chamber member,

the second protuberances are insertable through the first slots into the groove in the fuel injection member,

the first protuberances being rotatable in the groove in the combustion chamber member and the second protuberances being rotatable in the groove in the fuel injection member to lock the members relative to each other in a generally axial direction.

3. The structure recited in claim **1** wherein an annular ledge portion extends radially from the fuel injection member,

said ledge portion being upstream of the groove in the injection member,

said ledge portion abutting the adjacent surface of the upstream portion of the combustion chamber member to form a seal between the members.

4. The structure recited in claim **1** wherein the groove on the combustion chamber member faces the fuel injection member and the groove on the fuel injection member faces the combustion chamber member.

5. The structure recited in claim **1** wherein the groove on the combustion chamber member is on the radially inner surface thereof, and the groove on the fuel injection member is on the radially outer surface thereof.

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