

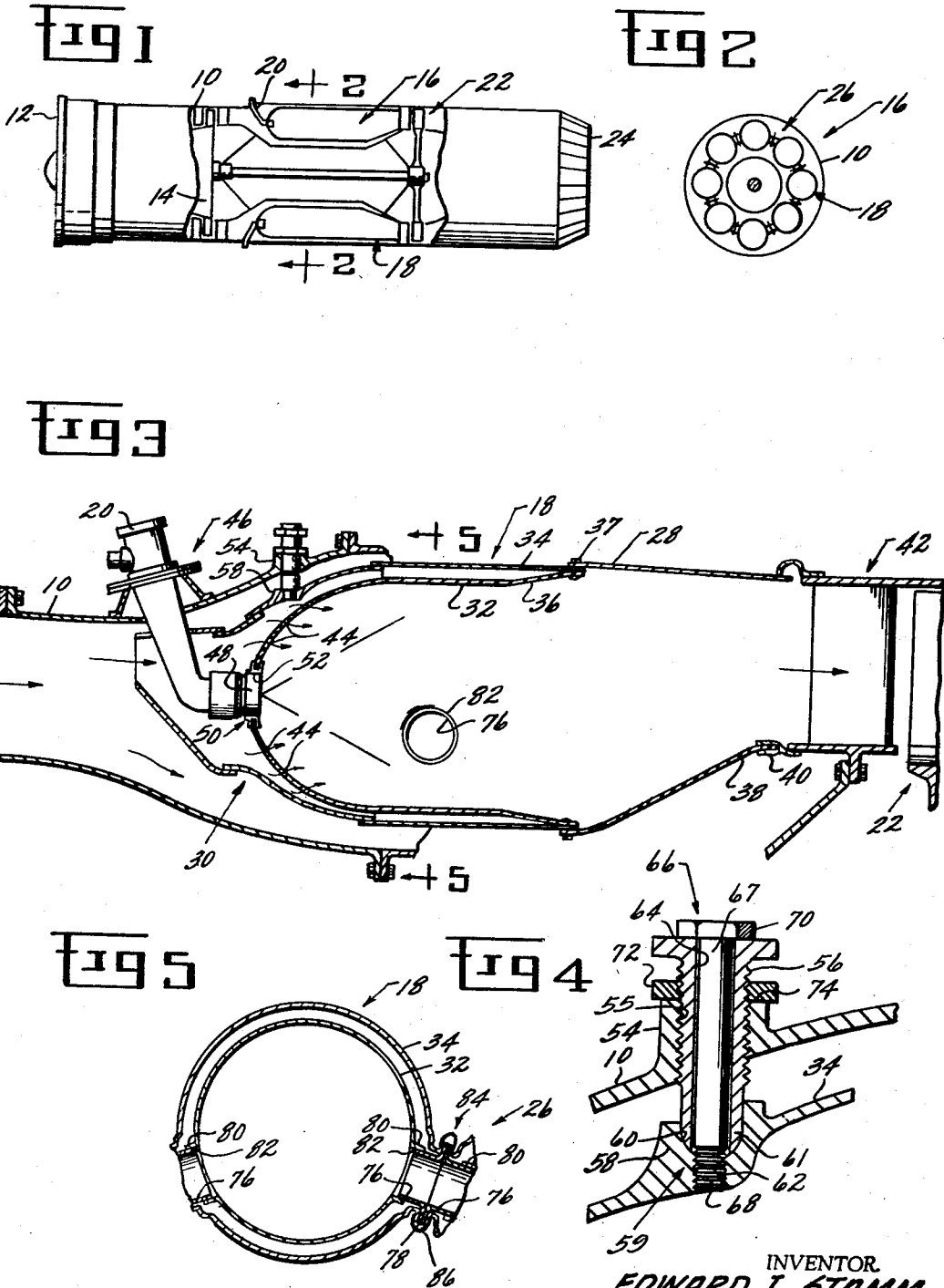
March 17, 1970

E. I. STAMM

3,500,639

COMBUSTION CHAMBER MOUNTING MEANS

Filed Sept. 10, 1968



INVENTOR
EDWARD I. STAMM
BY

Edwin F. Benning Jr.
ATTORNEY

1

3,500,639

COMBUSTION CHAMBER MOUNTING MEANS
Edward I. Stamm, Cincinnati, Ohio, assignor to General
Electric Company, a corporation of New York
Filed Sept. 10, 1968, Ser. No. 758,823
Int. Cl. F02c 7/20
U.S. Cl. 60—39.31

10 Claims

ABSTRACT OF THE DISCLOSURE

Improved means are provided for rigidly securing a cannular or cellular type combustion chamber to a suitable gas turbine engine frame in alignment with the fuel nozzle discharge axis. Each combustion chamber is formed with means at its upstream end to receive its fuel nozzle and establish proper alignment therebetween. Variable means are provided to rigidly space and secure each chamber from the frame without disturbing the nozzle-chamber aligned relationship. Cross over conduit means are provided for interconnecting adjacent chambers in a manner which will tolerate installation misalignment and thermal growth.

This invention relates to gas turbine engines and, more particularly, to a mounting arrangement for a cannular, cellular, or like type combustor.

In mounting each individual combustion chamber of a cannular or cellular combustor it is important to obtain good alignment between each fuel nozzle discharge axis and the axis of its respective chamber so as to prevent excessive localized heating of the chamber wall and to enable uniform delivery of combustion support air to the fuel spray. In prior mounting arrangements, each individual combustion chamber was generally secured to the engine frame at its upstream end by a fastening device in fixed non-variable relationship to the engine frame. Since the fuel nozzle is generally fixedly secured to the engine frame the fuel nozzle/combustion chamber interface floated to allow for the inherent tolerance stack up.

In such prior mounting arrangements, then, there was great likelihood of misalignment between each fuel nozzle spray axis and its respective combustion chamber longitudinal axis. Such misalignment often resulted in the fuel spray being directed against a portion of the chamber wall with the consequence of overheating of that portion of the chamber wall. Of equal importance, such asymmetrical delivery of the conoidal fuel spray into the combustion chambers resulted in non-uniform delivery of combustion support air thereto which contributes to localized over and/or under rich combustion and, hence, efficiency losses and smoke generation.

This invention, then, is directed to a chamber mounting arrangement which overcomes the above problems in an economical manner.

Therefore, a primary object of this invention is to provide a combustion chamber/fuel nozzle mounting arrangement which enables each combustion chamber to be rigidly secured to the engine supporting frame in accurate alignment with its respective fuel nozzle.

A further object of this invention is a combustion chamber/fuel nozzle mounting arrangement which enables exact and repeatable fuel entry positioning within each chamber irrespective of component dimensional variations.

Other objects and advantages of the invention will become apparent upon reading the following description of the preferred embodiment.

Briefly stated, the present invention provides improved means for rigidly mounting combustion chambers to a gas turbine engine frame with each combustion chamber

2

longitudinal axis accurately aligned with the fuel spray axis of its respective fuel nozzle. Each combustion chamber is formed at its upstream end with means for receiving the fuel discharge end of its respective fuel nozzle and for positioning the chamber longitudinal axis in aligned relationship with the fuel nozzle spray axis. Variable means secured to the frame are provided to rigidly space each chamber from the frame together with means to secure each chamber to the frame through the spacing means in said aligned relationship. In the preferred form, a first hollow threaded member is engaged in a threaded aperture provided in the frame and extends into variable spacing engagement with the chamber. A second member extends through the first member and engages a threaded aperture provided in the chamber to thereby rigidly secure the chamber to the frame in aligned relationship with its fuel nozzle.

While the specification concludes with claims particularly pointing out and distinctly claiming the subject matter of this invention, it is believed the invention will be better understood from the following description of the preferred embodiment taken in connection with the accompanying drawings wherein:

FIGURE 1 is a cross-sectional view diagrammatically showing a gas turbine engine of the type in which the improved mounting means of this invention may be employed;

FIGURE 2 is a cross-sectional view taken along line 2—2 of FIGURE 1;

FIGURE 3 is a cross-sectional view, drawn to an enlarged scale showing the combustor portion of the gas turbine engine of FIGURE 1;

FIGURE 4 is an enlarged cross-sectional view showing the combustion chamber mounting means of this invention; and

FIGURE 5 is a cross-sectional view taken along line 5—5 of FIGURE 3.

Like reference numerals will be used to identify like parts in the following description of the preferred embodiment.

Referring now to the drawings and particularly to FIGURES 1 and 2, a gas turbine engine has been diagrammatically shown including a frame 10 supporting or cooperatively forming an air intake 12, a suitable compressor 14, a cannular or cellular combustor 16 comprising a plurality of generally cylindrical combustion chambers 18 arranged as an annulus about the engine longitudinal axis, a fuel nozzle 20 for each chamber 18 for delivery of fuel thereto, suitable turbomachinery 22 for driving the compressor 14, and an exhaust nozzle 24. Cross-over tube means 26 may be provided to communicate each combustion chamber 18 with each immediately adjacent combustion chamber so as to enable ignition of fuel within each chamber 18 with suitable ignition means (not shown) located in one chamber 18.

As best shown in FIGURE 3, each combustion chamber 18 is formed with a generally cylindrical body portion 28 and a double wall, domed upstream end 30 which includes an inner liner 32 and an outer liner 34. The inner liner may be formed with a conoidal portion 36 to provide a smooth transition between the domed upstream end 30 and the enlarged main body portion 28. The main body portion 28, inner liner 32, and outer liner 34 may be joined by any suitable means, such as rivets or the like, as at 37. The downstream end 38 of each combustion chamber 18 is suitably secured as at 40 to nozzle means 42 adapted to receive the hot gas stream generated within each combustion chamber 18 and direct such hot gas stream to the turbomachinery 22. Suitable louvers or apertures 44 may be provided in the inner liner 32 for delivery of compressor discharge

ir to the chamber for combustion support and cooling purposes.

Each fuel nozzle 20 is generally L-shaped and is adapted for delivery of fuel into its respective combustion chamber 18 in a generally conoidal spray pattern as shown in FIGURE 3. Each fuel nozzle 20 is rigidly secured to the frame 10 by suitable brackets, as at 46, and extends generally radially inwardly through the supporting casing or frame 10 with its fuel spray axis oriented generally parallel to the axis of the gas turbine engine. Each fuel nozzle 20 has a discharge end formed with a generally cylindrical outer surface 48 in close alignment with its fuel spray axis. Means 50 are provided at the upstream end of each combustion chamber inner liner 32 for receiving the outer surface 48 of its respective fuel nozzle 20 so as to accurately align or position the chamber longitudinal axis relative to the fuel spray axis.

As shown in FIGURE 3, the receiving means 50 preferably comprise a neck, projecting axially from the upstream end of the inner liner 32, which is formed with an inner surface 52 having a central axis generally coaxial with the axis of the combustion chamber 18 and sized to slidably receive, in tight fitting relationship, the fuel nozzle discharge end surface 48.

As best shown in FIGURE 4, the frame or casing 10 is provided with a boss 54 radially outwardly of each combustion chamber 18 and formed with a threaded aperture 55 adapted for receipt of a first hollow threaded member 56. In like manner, the outer liner of 34 of each combustion chamber 18 is provided with a boss 58 radially aligned with its respective casing boss 54 and formed with an aperture 59. Each aperture 59 is formed with a first portion 60, contoured to receive, in close fitting relationship, and to seat a conical end 61 of each threaded member 56, and a second threaded portion 62. Each threaded member 56 is formed with a passage 64 adapted to receive a second threaded member 66 having an elongated shank portion 67 threaded at one end 68 and formed with an enlarged head 70 at its outer end. Each threaded member 66 is threadably engaged in its respective chamber aperture portion 62 with its enlarged head 70 abutting member 56 to thereby secure the chamber to the frame 10.

Means may be provided to securely lock the hollow threaded member 56 in spacing position such as a suitable lock nut 72 which is threaded radially inwardly along the hollow threaded member 56 until it seats on its respective boss face 74.

As previously mentioned and shown in FIGURE 5, suitable crossover combustion tube means 26 may be provided to communicate each chamber 18 with each adjacent combustion chamber. Since each chamber 18 is individually mounted to the frame 10, it will be understood that there will be some degree of radial and angular mismatch between adjacent chambers. Further, it will be understood that during engine heat up there will be attendant growth in the combustion chambers 18, which, if restrained, might result in excessively high stresses in the chamber walls and the chamber support means. To accommodate such installation misalignment as well as permit unrestrained thermal growth during engine heat up, the cross-over tube means preferably comprise tubes 76, formed with flanges 78, which telescope within or around a tubular neck 80 projecting from and defining a generally circumferentially directed opening 82 (relative to the longitudinal axis of the engine) to each chamber 18. The flanges 78 of adjacent tubes 76 are secured in abutment by any suitable means 84 such as a U-shaped peripheral clamp 86. It will be noted that the above described telescoping flanged tube configuration permits both radial and angular mismatch between adjacent chambers due to installation misalignment and thermal growth.

The use, operation and function of the invention are as follows:

Each combustion chamber 18 of the combustor 16 is secured at its downstream end 38 to nozzle means 42 by any suitable means as at 40. The upstream domed end of each combustion chamber 18 is positioned with its longitudinal axis in accurate aligned relationship with the fuel discharge or spray axis of its respective fuel nozzle 20 by means 50 which slidably receive the cylindrical outer surface 48 of the fuel nozzle 20. With each chamber 18 so aligned, the hollow threaded member 56 is threaded radially inwardly through the frame aperture 55 until its inner conical end 61 extends into and seats in its respective combustion chamber aperture portion 60 thereby rigidly and variably space each chamber from the frame 10. Threaded member 66 is then inserted into passage 64 of threaded member 56 and threadably engaged in combustion chamber aperture portion 62 with its enlarged head 70 abutting threaded member 56. Accordingly, each chamber 18 may be rigidly secured to the supporting frame 10 without disturbing the alignment between the fuel nozzle spray axis and the longitudinal axis of the combustion chamber.

As previously mentioned, compressor discharge air is delivered into each combustion chamber 18 to support combustion of the fuel therein and for cooling purposes through the louvers or openings 44 formed in the inner liner 32. When there is misalignment between the axis of the conoidal fuel spray and the axis of the combustion chamber 18, such asymmetry causes, to a greater or lesser extent, non-uniform delivery of combustion air to the fuel spray which may result in localized over or under rich combustion with resultant efficiency losses and smoke generation. Additionally, such asymmetry may cause local breakdown of the protective cooling air film and excessive localized heating of the inner liner.

Accordingly, it will be appreciated that the combustor mounting arrangement of this invention obviates the above problems in an extremely economical manner while providing a rigid mounting for each chamber.

Although the upstream portion 30 of each combustion chamber 18 has been shown as being of dual walled construction with the mounting boss 58 being carried by the outer liner and the fuel nozzle receiving means 50 being carried by the inner liner 32, it should be understood that such upstream portion may be formed of a single wall construction which carries both the boss 58 and the fuel nozzle receiving means 50.

Having thus described the invention, what is claimed as novel and desired to be secured by Letters Patent of the United States is:

1. In a gas turbine of the type having a plurality of combustion chambers annularly arranged with respect to a supporting frame, each said chamber having an upstream end and a downstream end, a plurality of fuel nozzles, each said fuel nozzle secured to said frame and having one end adapted to discharge fuel into one said combustion chamber, the improvement comprising means for rigidly securing each said combustion chamber to said frame in alignment with its respective fuel nozzle discharge axis, said means including:

means formed at the upstream end of each said combustion chamber for receiving the discharge end of its respective fuel nozzle and positioning said combustion chamber in aligned relationship with the fuel discharge axis of said fuel nozzle,

variable means secured to said frame for rigidly spacing each said combustion chamber from said frame in said aligned relationship, and

means for rigidly securing each said combustion chamber to said frame through said spacing means.

2. The structure of claim 1 further characterized in that said means for receiving said discharge end of said fuel nozzle comprise means adapted to slidably receive said fuel nozzle discharge end.

5

3. The structure of claim 1 further characterized in that said frame is generally annular, said combustion chambers being housed within said frame.

4. The structure of claim 1 further characterized in that said frame is formed with a threaded aperture for each said combustion chamber and said spacing means comprising a first hollow member threadably engaged with and projecting through each said aperture into abutment with its respective combustion chamber.

5. The structure of claim 4 further characterized in that each said combustion chamber is formed with an aperture, said aperture having a first portion, contoured to receive and seat one end of its respective first hollow member, and a second threaded portion, said securing means comprising a second member for each said combustion chamber, each said second member having an elongated shank portion formed with an enlarged head at one end and thread means at the other end, each said second member projecting through its respective first member with said enlarged head and said thread means abutting and engaged in, respectively, said first member and said combustion chamber aperture threaded portion.

6. The structure of claim 5 further characterized in that each said combustion chamber includes a generally cylindrical outer liner and a generally cylindrical inner liner, said inner liner secured in spaced telescoping relationship within said first liner, said combustion chamber aperture carried by said outer liner and said means for receiving said fuel nozzle carried by said inner liner.

7. The structure of claim 5 further characterized in that said frame is formed with a boss for each said combustion chamber, each said threaded aperture being formed, respectively, through one said boss.

8. The structure of claim 5 further characterized in that each said combustion chamber is formed with a boss, with said chamber aperture formed in said boss.

6

9. The structure of claim 1 further characterized by and including cross-over conduit means for interconnecting each said combustion chamber with each immediately adjacent chamber to enable ignition of each said combustion chamber by ignition means carried by one said chamber.

10. The structure of claim 9 further characterized in that said cross-over conduit means comprise a pair of tubular necks carried by each said chamber, each said neck projecting generally circumferentially and mutually oppositely from each said combustion chamber relative to said annulus of chambers, a tube telescopically and slidably engaged with each said neck, each said tube formed with a peripheral flange at its outward end, and clamp means for joining the flanges of adjacent combustion chamber tubes.

References Cited

UNITED STATES PATENTS

2,575,889	11/1951	Oulianoff	60—39.65
2,611,243	9/1952	Huyton	60—39.69
2,711,072	6/1955	Wetzler	60—39.37
2,760,338	8/1956	Keast	60—39.36
3,119,234	1/1964	Murray et al.	60—39.37

FOREIGN PATENTS

686,382 1/1953 Great Britain.

CARLTON R. CROYLE, Primary Examiner

U.S. Cl. X.R.

60—39.32, 39.37