United States Patent	12392282
Kind Code	B2
Date of Patent	August 19, 2025
Inventor(s)	Menheere; Dave

Constant volume combustor for gas turbine engine

Abstract

A combustor assembly for a turbine engine includes a combustor assembly where a first combustion space is defined between a first closed end of a combustion chamber and a first piston, a second combustion space is defined between a second closed end of the combustion chamber and a second piston and a center combustion space is defined between the first piston and the second piston. An air inlet assembly provides for communication of inlet air to the first combustion space, the second combustion space and the center combustion space. First, second and center injectors are provided to inject fuel into a corresponding one of the first combustion space, the second combustion space, and the center combustion space. An exhaust outlet communicates an exhaust gas flow generated in each of the first combustion space, the second combustion space and the center combustion space to a turbine section.

Inventors: **Menheere; Dave (Norval, CA)**

Applicant: **Pratt & Whitney Canada Corp.** (Longueuil, CA)

Family ID: **1000008762387**

Assignee: **PRATT & WHITNEY CANADA CORP. (Longueuil, CA)**

Appl. No.: **18/127155**

Filed: **March 28, 2023**

Prior Publication Data

Document Identifier	Publication Date
US 20240328349 A1	Oct. 03, 2024

Publication Classification

Int. Cl.: **F02C5/08** (20060101); **F23R7/00** (20060101)

U.S. Cl.:

CPC **F02C5/08** (20130101); **F23R7/00** (20130101); F05D2240/35 (20130101)

Field of Classification Search

CPC: F02C (5/08); F02C (5/06); F23R (7/00)

References Cited

U.S. PATENT DOCUMENTS

Patent No.	Issued Date	Patentee Name	U.S. Cl.	CPC
3005306	12/1960	Bush	60/613	F02B 71/04
4815294	12/1988	David	N/A	N/A
8127544	12/2011	Schwiesow et al.	N/A	N/A
9062601	12/2014	Stude	N/A	N/A
11193424	12/2020	Roda	N/A	N/A
2008/0271711	12/2007	Cheeseman	123/46E	F02B 71/00
2010/0192764	12/2009	Ries	N/A	N/A
2015/0308301	12/2014	McConville	123/90.15	F01L 1/34
2018/0306110	12/2017	Ohishi	N/A	F02C 5/08

FOREIGN PATENT DOCUMENTS

Patent No.	Application Date	Country	CPC
19625182	12/1997	DE	N/A
27724	12/1907	GB	N/A
55116025	12/1979	JP	N/A
2020141981	12/2019	WO	N/A

OTHER PUBLICATIONS

Extended European Search Report for European Application No. 24167071.0 mailed Aug. 1, 2024. cited by applicant

---

Primary Examiner: Sung; Gerald L

Attorney, Agent or Firm: Carlson, Gaskey & Olds, P.C.

Background/Summary

TECHNICAL FIELD

(1) The present disclosure relates generally to a combustor assembly for a gas turbine engine that includes pistons movable within a constant volume combustion chamber.

BACKGROUND

(2) A turbine engine includes a compressor section where inlet air is compressed and delivered into the combustion section where a high-energy exhaust gas flow is generated and expanded through a turbine section. The high-energy exhaust gas flow expands through the turbine section to generate power utilized to drive the compressor and the fan section. A constant volume combustor utilizes heat generated by compression of inlet air to ignite a fuel mixture and generate an exhaust gas flow.

Free pistons that are movable within the combustion chamber compress the inlet air to generate the heat required to ignite the injected fuel. Opposing movement of the pistons reduces or eliminates vibration while providing the desired gas flow to drive the turbine section.

SUMMARY

(3) A combustor assembly for a turbine engine according to a disclosed example embodiment includes, among other possible things, at least one combustion chamber that is closed at a first end and at a second end, a first piston and a second piston moveable within the combustion chamber, wherein a first combustion space is defined between the first end and the first piston, a second combustion space is defined between the second end and the second piston and a center combustion space is defined between the first piston and the second piston. An air inlet assembly is provided where an inlet airflow is communicated to the first combustion space, the second combustion space and the center combustion space. A first injector is configured to inject fuel into the first combustion space, a second injector is configured to inject fuel in to the second combustion space, and a center injector is configured to inject fuel into the center combustion space. An exhaust outlet assembly is configured for receiving an exhaust gas flow generated in each of the first combustion space, the second combustion space and the center combustion space.

(4) A turbine engine assembly according to another disclosed example embodiment includes, among other possible things, a compressor section where inlet air is compressed to generate a core airflow, and a combustor assembly where the core airflow is mixed with fuel and ignited to generate an exhaust gas flow. The combustor assembly includes at least one combustion chamber closed at a first end and at a second end and a first piston and a second piston both movable within the combustion chamber. A first combustion space is defined between the first end and the first piston, a second combustion space is defined between the second end and the second piston and a center combustion space is defined between the first piston and the second piston. A turbine section is configured to receive the exhaust gas flow from the combustor section to generate shaft power.

(5) A method of operating a turbine engine assembly according to another disclosed example embodiment includes, among other possible things, communicating a core airflow to a combustion chamber between a first piston and a second piston, compressing the core airflow within the combustion chamber in a center combustion space between the first piston and the second piston, injecting fuel into the center combustion space at a predefined time to ignite the fuel and generate a first exhaust gas flow and drive the first piston and the second piston apart from each other toward a corresponding first closed end and second closed end, compressing the core airflow within a first combustion space with the first piston and within a second combustion space with the second piston, injecting fuel into the first combustion space and the second combustion space at a predefined time to ignite the fuel and generate a second exhaust gas flow, and communicating the first gas flow and the second exhaust gas flow to a turbine section to generate power.

(6) Although the different examples have the specific components shown in the illustrations, embodiments of this invention are not limited to those particular combinations. It is possible to use some of the components or features from one of the examples in combination with features or components from another one of the examples.

(7) These and other features disclosed herein can be best understood from the following specification and drawings, the following of which is a brief description.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

(1) FIG. **1** is a schematic view of an example gas turbine engine.

(2) FIG. **2** is a schematic cross-sectional view of an example combustion chamber.

(3) FIG. **3** is another schematic cross-sectional view of the example combustion chamber.

(4) FIG. **4** is a schematic view of a combustion chamber with pistons in a combustion position.
(5) FIG. **5** is another schematic view of the combustion chambers with pistons in an exhaust position.
(6) FIG. **6** is another schematic view of the combustion chamber with pistons in another combustion position.
(7) FIG. **7** is schematic view of an example combustor section embodiment.

DETAILED DESCRIPTION

(8) FIG. **1** schematically illustrates a gas turbine engine **20**. The example gas turbine engine **20** includes a combustor assembly **26** that utilizes double acting free pistons disposed within a constant volume combustion chamber **34** to generate a high energy exhaust gas flow. Two combustion events occur to generate the exhaust gas flow for each single cycle of the free pistons within the chamber **34**.

(9) The engine **20** is illustrated by way of example as a turbofan that generally incorporates a fan section **22**, a compressor section **24**, the combustor assembly **26** and a turbine section **28** arranged along an engine longitudinal axis A. The fan section **22** drives air along a bypass flow path B in a bypass duct defined within a nacelle **30**. The compressor section **24** drives air along a core flow path C into the combustor assembly **26**. In the combustor assembly **26**, compressed air is mixed with fuel from a fuel system **32** and burnt to generate the high energy exhaust gas flow that expands through the turbine section **28** to generate shaft power.

(10) Although the disclosed non-limiting example embodiment is depicted as a turbofan turbine engine for use in aircraft propulsion, it should be understood that the concepts described herein are not limited to use with turbofans as the teachings may be applied to other types of gas turbine engine architectures and applications.

(11) Referring to FIG. **2**, an example combustion chamber **34** is shown schematically and is closed at a first end **40** and at a second end **42**. A first piston **50** and a second piston **52** are moveable within the combustion chamber **34** to define different combustion spaces. In one example embodiment, a first combustion space **46** is defined between the first end **40** and the first piston **50**. A second combustion space **48** is defined between the second end **42** and the second piston **52**. A center combustion space **44** is defined between the first piston **50** and the second piston **52**. The combustion spaces **44**, **46** and **48** expand and contract with movement of the pistons **50**, **52** to compress a core airflow **36** and expel generated exhaust gases **78**.

(12) The combustion chamber **34** includes an air inlet assembly **55** where an inlet airflow **76** is communicated into the different combustion spaces **44**, **46**, **48**. In the disclosed example, the air inlet assembly **55** includes an inlet manifold **66** that communicates a compressed core airflow **36** to a first inlet **54**, a second inlet **56** and a center inlet **58**. The first inlet **54** communicates core airflow **36** to the first combustion space **46**. The second inlet **56** communicates core airflow **36** to the second combustion space and the center inlet **58** communicates core airflow **36** to the center combustion space **44**. The inlets **54**, **56** and **58** are open to the chamber **34** and inlet airflow **76** into the corresponding combustion spaces **44**, **46**, and **48** is controlled by movement of the pistons **50**, **52**.

(13) An exhaust outlet assembly **65** communicates the high energy exhaust gas flow **38** to the turbine section **28**. The generated gases **78** within the combustion chamber **34** are combined in an exhaust manifold **68** and communicated as the combined exhaust gas flow **38** to the turbine section **28**. A first outlet **60**, a second outlet **62** and a center outlet **64** are provided in communication with a corresponding one of the first combustion space **46**, second combustion space **48** and center combustion space **44**. The outlets **60**, **62** and **64** are open and selectively blocked and uncovered based on a position of the pistons **50**, **52**.

(14) The fuel system **32** communicates fuel flow **80** to each of a first injector **70**, a second injector **72** and a center injector **74**. The first injector **70** communicates a fuel flow to the first combustion space **46**. The second injector **72** communicates fuel to the second combustion space **48** and the

center injector communicates fuel to the center combustion space **44**. The injectors **70**, **72** and **74** are controlled by a controller **86** to inject fuel at a predefined time into the corresponding combustion space **44**, **46**, and **48**.

(15) A first sensor assembly **82** is arranged to provide information indicative of a position of the first piston **50** to the controller **86**. A second sensor assembly **84** is arranged to provide information indicative of a position of the second piston **52**. The sensor assemblies **82**, **84** may be proximity sensors, pressure sensors or any other sensor system that is capable of providing information to the controller **86** that is indictive of a position of the corresponding piston **50**, **52** within the chamber **34**.

(16) The example controller **86** includes, among other possible devices, a processor **90** and a memory device **88**. The controller **86** relates to a device and system for performing necessary computing or calculation operations for operation of the combustor assembly **26**. The controller **86** may be specially constructed for operation of the combustor assembly **26**, or it may comprise at least a general-purpose computer selectively activated or reconfigured by software instructions stored in the memory device **88**. The controller **86** may further be part of full authority digital engine control (FADEC) or an electronic engine controller (EEC).

(17) The disclosed memory device **88** may include any one or combination of volatile memory elements (e.g., random access memory (RAM, such as DRAM, SRAM, SDRAM, VRAM, etc.) and/or nonvolatile memory elements (e.g., ROM, hard drive, tape, CD-ROM, etc.). Software instructions in the memory device **88** may include one or more separate programs, each of which includes an ordered listing of executable instructions for implementing logical functions. Software in memory, in whole or in part, is read by the processor **90**, and executed to operate the combustor assembly **26**.

(18) The example controller **86** includes all devices that operate to communicate with the combustor assembly **26** to generate the desired exhaust gas flow **38** based on a thrust setting **100**. The controller **86** governs output exhaust gas flow **38** by controlling fuel flow through of the fuel injectors **70**, **72** and **74** into a corresponding one of the combustion spaces **44**, **46** and **48**. The controller **86** is programed to control fuel flow through the first injector **70**, the second injector **72** and the center injector **74** to inject fuel into a corresponding one of the first combustion space **46**, the second combustion space **48** and the center combustion space **44**. Timing of fuel injection provides control over the oscillation of the pistons **50**, **52** within the combustion chamber **34**, and thereby the amount of exhaust gas flow generated.

(19) Referring to FIG. **3**, with continued reference to FIG. **2**, in one disclosed operational embodiment, the exhaust gas flow **38** is produced through two ignitions for each stroke of the pistons **50**, **52**. FIG. **2** illustrates a first combustion in the center combustion space **44**. Combustion is initiated by heat generated by compression of the inlet airflow **76** between the pistons **50**, **52**. Fuel **80** is injected into the center combustion space **44** at a predefined time that produces an ignition of the fuel **80**. Control of the time and quantity of fuel injected into the center combustion space **44** as the pistons **50**, **52** move toward each other provides for control of production of the exhaust gas flow **38**.

(20) In this example as shown in FIG. **2**, the pistons **50**, **52** are moving toward each other to compress the inlet airflow **76** within the center combustion space **44**. The compression of the inlet airflow **76** raises the temperature to a level where injected fuel will ignite. The fuel **80** is injected based on the position of the pistons **50**, **52** and the pressure and temperature within the center combustion space **44**.

(21) As the pistons **50**, **52** move toward each other, compressed inlet airflow **76** flows into the first and second combustion spaces **46**, **48**. Concurrently, exhaust gas flow **78** is exhausted through corresponding exhaust outlets **60**, **62** into the exhaust manifold **68**. The separate gas flows **78** from the different combustion spaces **46**, **48** mix into the combined gas flow **38** communicated to the turbine section **28**.

(22) Compression of the inlet air within the center combustion space **44** heats the air to a temperature that ignites the fuel **80**. The fuel **80** injected into the center combustion space **44** ignites and pushes the pistons **50**, **52** outwards toward corresponding first and second ends **40**, **42** as is shown in FIG. **3**.

(23) As the pistons **50**, **52** move toward respective ends **40**, **42**, the air present in the respective combustion spaces **46**, **48** is compressed and heated. At the same time, compressed inlet airflow **76** is communicated into the center combustion space **44** and exhaust gas **78** communicated into the exhaust manifold **68**.

(24) Fuel injected into the first and second combustion spaces **46**, **48** ignites to generate the expanding exhaust gas flow and drive the pistons **50**, **52** back toward each other to repeat the cycle as is shown in FIG. **2**.

(25) Referring to FIGS. **4**, **5** and **6**, an example combustion cycle is illustrated schematically. The disclosed example combustion cycle generates the gas flow **78** twice for each cycle of the pistons **50**, **52** within the chamber **34**. In this disclosed embodiment, a first set of inlets **92** are provided to communicate inlet airflow **76** from the compressor section **24** to the first combustion space **46**. A second set of inlets **102** communicate inlet airflow **76** into the second combustion space **48**. A center set of inlets **96** provide for communication of inlet airflow **76** into the center combustion space **44**.

(26) A first set of outlets **94** provide for exhausting of the generated hot gas flow **78** into the exhaust manifold **68**. A second set of outlets **104** provide for exhausting the gas flow **78** from the second combustion space **48**. A center set of outlets **98** provide for exhausting of the generated gas flow from the center combustion space **44**. Each of the inlets **92**, **96** and **102** and the outlets **94**, **98** and **104** are open to the corresponding combustion space **44**, **46**, and **48**.

(27) Flow into and out of any of the combustion spaces **44**, **46**, and **48** is controlled by a position of the pistons **50**, **52**. As the pistons **50**, **52** cycle back and forth within the chamber **34**, some of the inlets **92**, **96** and **104** is uncovered while others are blocked. The inlet airflow **76** flows automatically through the corresponding inlet **92**, **96** and **102** when uncovered by movement of a corresponding piston **50**, **52**. Exhaust flow **78** (FIG. **5**) out of the corresponding combustion space **44**, **46** and **48** is also provided upon movement of the pistons **50**, **52** to uncover a corresponding outlet **94**, **98** and **104**. Accordingly, no valving is utilized in controlling the intake of the inlet airflow **76** and the exhausting of the generated exhaust gas flow **78**.

(28) Cycling of the pistons **50**, **52** is controlled by timing the injection of fuel **80** into a corresponding one of the combustion spaces **44**, **46**, **48**. Injection of fuel **80** earlier in a compression stroke reduces pressure and thereby emissions. Injection of fuel **80** later in the compression stroke provides a higher pressure. Moreover, more frequent injection of fuel **80** will speed up cycling of the pistons **50** and thereby provide an increased amount of the combined exhaust gas flow **78**. Slowing of the frequency of injection of fuel **80** will provide a corresponding slowing of cycling of the pistons **50**.

(29) In a disclosed example operational embodiment, fuel **80** injected into the center combustion space **44** ignites once heat from compression of the inlet core airflow **76** reaches the fuel ignition temperature. Compression is provided as the pistons **50**, **52** move toward each other and block the corresponding ones of the inlets **96** and the outlets **98**. As the center inlets **96** and outlets **98** are blocked, the inlets **92**, **102** and outlets **94**, **104** are uncovered to enable compressed core airflow **76** into the combustion space and provide exhaust flow out through outlets **94** and **104** as is illustrated in FIG. **4**.

(30) Upon combustion in the center combustion space **44**, the pistons **50**, **52** are driven apart toward the corresponding one of the first and second combustion spaces **46**, **48** as is shown schematically in FIG. **5**. As the pistons **50**, **52** move to compress air in the first and second combustion spaces **46**, **48**, the center inlets **96** and outlets **98** are uncovered and core airflow **76** flows in and the exhaust gas flow is exhausted.

(31) The pistons **50**, **52** continue movement toward the corresponding ends **40**, **42** until the core airflow is compressed such that the ignition temperature of the fuel **80** is reached and the injected fuel is ignited. The ignited fuel **80** drives the pistons **50**, **52** back toward each other to begin the cycle again with combustion in the center combustion space **44**.
(32) Referring to FIG. **7**, with continued reference to FIG. **1**, an example combustion assembly **26** embodiment is shown schematically looking along the engine axis A. The combustion assembly **26** includes a plurality of combustion chambers **34** arranged about the engine longitudinal axis A. Each of the combustion chambers **34** may generate an exhaust gas flow that is combined and communicated to the turbine section **28**. It should be appreciated that although a specific number of combustion chambers **34** are shown by way of example, other numbers and combinations of combustion chambers **34** may be utilized and are within the contemplation and scope of this disclosure.
(33) The controller **86** is provided to control operation of the combustor assembly **26** based on the input engine power setting **100**. The controller **86** is configured to adjust the amount of exhaust gases produced by selectively activating, or deactivating specific some of the combustion chambers **34**. The example controller **86** is further programmed to control operation of each of the plurality of combustion chambers **34** by activating and deactivating select ones of the plurality of combustion chambers **34** to generate a predefined amount of the high energy gas flow.
(34) A combustor assembly **26** for a turbine engine according to a disclosed example embodiment includes, among other possible things, at least one combustion chamber **34** that is closed at a first end **40** and a second end **42**, a first piston **50** and a second piston **52** that are moveable within the combustion chamber **34**. A first combustion space **46** is defined between the first end **40** and the first piston **50**, a second combustion space **48** is defined between the second end **42** and the second piston **52** and a center combustion space **44** is defined between the first piston **50** and the second piston **52**. An air inlet assembly **55** is provided where an inlet airflow **76** is communicated to the first combustion space **46**, the second combustion space **48** and the center combustion space **44**. A first injector **70** is configured to inject fuel into the first combustion space **46**, a second injector **72** is configured to inject fuel in to the second combustion space **48**, and a center injector **74** is configured to inject fuel into the center combustion space **44**. An exhaust outlet assembly **65** receives a high energy exhaust gas flow that is generated in each of the to the first combustion space **46**, the second combustion space **48** and the center combustion space **44**.
(35) In a further embodiment of the foregoing combustor assembly **26**, the air inlet assembly **55** includes a first set of inlets **54** that communicate air to the first combustion space **46**, a second set of inlets **56** that communicate air to the second combustion space **48** and a center set of inlets **58** that communicate air to the center combustion space **44**.
(36) In a further embodiment of any of the foregoing combustor assemblies, the exhaust outlet assembly **65** includes a first set of outlets **60** that are in communication with the first combustion space **46**, a second set of outlets **62** that are in communication with the second combustion space **48** and a center set of outlets **64** that are in communication with the center combustion space **44**.
(37) In a further embodiment of any of the foregoing example embodiments, the combustor assembly **26** includes an exhaust manifold **68** where the high energy exhaust gas flow from each of the first set of outlets **60**, the second set of outlets **62** and the center set of outlets **64** are combined.
(38) In a further embodiment of any of the foregoing example embodiments, the combustor assembly **26** includes a controller **86** that is programed to control fuel flow through the first injector **70**, the second injector **72** and the center injector **74** to inject fuel into a corresponding one of the first combustion space **46**, second combustion space **48** and center combustion space **44**.
(39) In a further embodiment of any of the foregoing example embodiments, the combustor assembly **26** includes at least one sensor assembly **82** for measuring a position of the first piston **50** and a position of the second piston **52** within the combustion chamber **34** and generating a signal that is indicative of the measured position of the first piston **50** and the second piston **52** for

communication to the controller **86**.
(40) In a further embodiment of any of the foregoing combustor assemblies, the at least one combustion chamber **34** includes a plurality of combustion chambers **34**.
(41) In a further embodiment of any of the foregoing example embodiments, the combustor assembly **26** includes a controller **86** that is programmed to control operation of each of the combustor assembly by selectively activating and deactivating select ones of the plurality of combustion chambers **34** to generate a predefined amount of the high energy gas flow.
(42) In a further embodiment of any of the foregoing combustor assemblies, the controller **86** is programmed to activate and deactivate select ones of the plurality of combustion chambers **34** in response to a predefined engine power setting.
(43) A turbine engine assembly **20** according to another disclosed example embodiment includes, among other possible things, a compressor section **24** where inlet air is compressed to generate a core airflow **36**, and a combustor assembly **26** where the core airflow **36** is mixed with fuel and ignited to generate a high energy exhaust gas flow. The combustor assembly **26** includes at least one combustion chamber **34** that is closed at a first end **40** and a second end **42**, and a first piston **50** and a second piston **52** that are both moveable within the combustion chamber **34**. A first combustion space **46** is defined between the first end **40** and the first piston **50**, a second combustion space **48** is defined between the second end **42** and the second piston **52** and a center combustion space **44** is defined between the first piston **50** and the second piston **52**. A turbine section **28** receives the high energy exhaust gas flow from the combustor assembly **26** where it is expanded to generate shaft power.
(44) In a further embodiment of the foregoing turbine engine assembly **20**, including a first injector **70** to inject fuel into the first combustion space **46**, a second injector **72** to inject fuel into the second combustion space **48**, and a center injector **74** to inject fuel into the center combustion space **44**.
(45) In a further embodiment of any of the foregoing example embodiments, the turbine engine assembly **20** includes an air inlet assembly **55** where the core airflow **36** from the compressor section **24** is communicated to the first combustion space **46**, the second combustion space **48**, and the center combustion space **44**, and an exhaust outlet assembly **65** for communicating the high energy exhaust gas flow to the turbine section **28**.
(46) In a further embodiment of any of the foregoing turbine engine assemblies, the exhaust outlet assembly **65** includes a first set of outlets **60** that are in communication with the first combustion space **46**, a second set of outlets **62** that are in communication with the second combustion space **48** and a center set of outlets **64** that are in communication with the center combustion space **44**.
(47) In a further embodiment of any of the foregoing example embodiments, the turbine engine assembly includes a controller **86** that is programed to control fuel flow through the first injector **70**, the second injector **72** and the center injector **74** to inject fuel into a corresponding one of the first combustion space **46**, the second combustion space **48** and the center combustion space **44**.
(48) In a further embodiment of any of the foregoing example embodiments, the turbine engine assembly includes at least one sensor assembly for measuring a position of the first piston **50** and a position of the second piston **52** within the combustion chamber **34** and generating a signal indicative of the measured position of each of the first piston **50** and the second piston **52** for communication to the controller **86**.
(49) In a further embodiment of any of the foregoing turbine engine assemblies, the at least one combustion chamber **34** includes a plurality of combustion chambers **34**.
(50) In a further embodiment of any of the foregoing example embodiments, the turbine engine assembly includes a controller **86** that is programmed to control operation of the combustor assembly **26** by activating and deactivating select ones of the plurality of combustion chambers **34** to generate a predefined amount of the high energy gas flow.
(51) A method of operating a turbine engine assembly **20** according to a disclosed example

embodiment includes, among other possible things, communicating a core airflow **36** to a combustion chamber **34** between a first piston **50** and a second piston **52**, compressing the core airflow **36** within the combustion chamber **34** in a center combustion space **44** between the first piston **50** and the second piston **52**, injecting fuel into the center combustion space **44** at a predefined time to ignite the fuel and generate a first high energy exhaust gas flow and drive the first piston **50** and the second piston **52** apart from each other toward a corresponding first closed end **40** and second closed end **42**, compressing the core airflow **36** within a first combustion space **46** with the first piston **50** and within a second combustion space **48** with the second piston **52**, injecting fuel into the first combustion space **46** and the second combustion space **48** at a predefined time to ignite the fuel and generate a second high energy exhaust gas flow, and communicating the first high energy gas flow and the second high energy gas flow to a turbine section **28** to generate power.

(52) In a further embodiment of the foregoing example embodiment, the method includes measuring a position of each of the first piston **50** and the second piston **52** within the combustion chamber **34** and injecting fuel into the first combustion space **46**, the second combustion space **48** and the center combustion space **44** based at a predefined time on the measured position.

(53) In a further embodiment of any of the foregoing example embodiments, the method further includes selectively activating and deactivating a plurality of combustion chambers **34** with a controller **86** that is programmed to tailor generation of exhaust gas flow to a predefined engine operating condition.

(54) Although depicted as a turbofan turbine engine in the disclosed non-limiting embodiment, it should be understood that the concepts described herein are not limited to use with turbofans as the teachings may be applied to other types of turbine engines.

(55) Although an example embodiment has been disclosed, a worker of ordinary skill in this art would recognize that certain modifications would come within the scope of this disclosure. For that reason, the following claims should be studied to determine the scope and content of this disclosure.

Claims

1. A combustor assembly for a turbine engine, the combustor assembly comprising: at least one combustion chamber closed at a first end and at a second end; a first piston and a second piston moveable independent of each other within the combustion chamber, wherein a first combustion space is defined between the first end and the first piston, a second combustion space is defined between the second end and the second piston and a center combustion space is defined between the first piston and the second piston; an air inlet assembly where an inlet airflow is communicated to the first combustion space, the second combustion space and the center combustion space; a first injector configured to inject fuel into the first combustion space; a second injector configured to inject fuel in to the second combustion space; a center injector configured to inject fuel into the center combustion space, wherein the center combustion space is configured to combust a fuel air mixture to drive the first piston and the second piston apart toward a corresponding one of the first combustion space and the second combustion space; and an exhaust outlet assembly for receiving an exhaust gas flow generated in each of the first combustion space, the second combustion space and the center combustion space.

2. The combustor assembly as recited in claim 1, wherein the air inlet assembly comprises a first set of inlets communicating air to the first combustion space, a second set of inlets communicating air to the second combustion space and a center set of inlets communicating air to the center combustion space.

3. The combustor assembly as recited in claim 2, wherein the exhaust outlet assembly comprises a first set of outlets in communication with the first combustion space, a second set of outlets in

communication with the second combustion space and a center set of outlets in communication with the center combustion space.
4. The combustor assembly as recited in claim 3, wherein the exhaust outlet assembly includes an exhaust manifold where the exhaust gas flow from each of the first set of outlets, the second set of outlets and the center set of outlets are combined.
5. The combustor assembly as recited in claim 3, including a controller programed to control fuel flow through the first injector, the second injector and the center injector to inject fuel into a corresponding one of the first combustion space, the second combustion space and the center combustion space.
6. The combustor assembly as recited in claim 5, including at least one sensor assembly for measuring a position of the first piston and a position of the second piston within the at least one combustion chamber and for generating a signal indicative of the measured position of the first piston and the second piston for communication to the controller.
7. The combustor assembly as recited in claim 1, wherein the at least one combustion chamber comprises a plurality of combustion chambers.
8. The combustor assembly as recited in claim 7, including a controller programmed to control operation of the combustor assembly by selectively activating and deactivating select ones of the plurality of combustion chambers to generate a predefined amount of the exhaust gas flow.
9. The combustor assembly as recited in claim 8, wherein the controller is programmed to activate and deactivate select ones of the plurality of combustion chambers in response to a predefined engine power setting.
10. A turbine engine assembly comprising: a compressor section where inlet air is compressed to generate a core airflow; a combustor assembly where the core airflow is mixed with fuel and ignited to generate an exhaust gas flow, wherein the combustor assembly includes at least one combustion chamber closed at a first end and at a second end and a first piston and a second piston that are both movable independent of each other within the combustion chamber, wherein a first combustion space is defined between the first end and the first piston, a second combustion space is defined between the second end and the second piston and a center combustion space is defined between the first piston and the second piston, wherein the center combustion space is configured to combust a fuel air mixture to drive the first piston and the second piston apart toward a corresponding one of the first combustion space and the second combustion space; and a turbine section where the exhaust gas flow from the combustor assembly is expanded to generate shaft power.
11. The turbine engine assembly as recited in claim 10, including a first injector to inject fuel into the first combustion space, a second injector to inject fuel into the second combustion space, and a center injector to inject fuel into the center combustion space.
12. The turbine engine assembly as recited in claim 11, including an air inlet assembly where the core airflow from the compressor section is communicated to the first combustion space, the second combustion space and the center combustion space, and an exhaust outlet assembly for communicating the exhaust gas flow to the turbine section.
13. The turbine engine assembly as recited in claim 12, wherein the exhaust outlet assembly comprises a first set of outlets in communication with the first combustion space, a second set of outlets in communication with the second combustion space and a center set of outlets in communication with the center combustion space.
14. The turbine engine assembly as recited in claim 13, including a controller programed to control fuel flow through the first injector, the second injector and the center injector to inject fuel into a corresponding one of the first combustion space, the second combustion space and the center combustion space.
15. The turbine engine assembly as recited in claim 14, including at least one sensor assembly for measuring a position of the first piston and the second piston within the at least one combustion

chamber and generating a signal indicative of the measured position of each of the first piston and the second piston for communication to the controller.

16. The turbine engine assembly as recited in claim 15, wherein the at least one combustion chamber comprises a plurality of combustion chambers.

17. The turbine engine assembly as recited in claim 16, including a controller programmed to control operation of the combustor assembly by activating and deactivating select ones of the plurality of combustion chambers to generate a predefined amount of the exhaust gas flow.