SLIDING RAMP NOZZLE SYSTEM FOR A GAS TURBINE ENGINE

BACKGROUND OF THE INVENTION

The present invention relates to a gas turbine engine and more particularly to a nozzle system therefor.

Variable cycle engines power high performance aircraft over a range of operating conditions yet achieve countervailing objectives such as high specific thrust and low fuel consumption. A variable cycle engine essential alters the engine bypass ratio during flight to facilitate efficient performance over a broad range of altitude and flight velocity such as to generate high thrust for maneuver and optimized fuel efficiency for loiter.

Variable cycle engines typically include a variable exhaust nozzle system which operates over a wide range of pressure ratios by adjustment of a nozzle throat based on the demands of the engine cycle, and may include provision for adjustment of a nozzle area ratio to facilitate desired engine performance at various operating points.

The variable cycle engine and exhaust described herein comprises of three flow streams, exhausting through two nozzles. The low pressure compressor stream and core stream exhaust through the primary nozzle. The fan stream exits the variable secondary nozzle. Varying the secondary nozzle alters thrust at the nozzle exit. Also varying the secondary nozzle exit area affects the overall engine cycle by directing of flow into or diverting away from the primary flowpath by varying third stream back pressure, thus effectively altering the bypass ratio.

SUMMARY OF THE INVENTION

A regulator system according to an exemplary aspect of the present invention includes an axially slidable ramp intermediate a secondary flow path and a primary flow path of a gas turbine engine nozzle section.

BRIEF DESCRIPTION OF THE DRAWINGS

The various features and advantages of this invention will become apparent to those skilled in the art from the following detailed description of the currently disclosed embodiment. The drawings that accompany the detailed description can be briefly described as follows:

FIG. **1** is a general sectional view an exemplary gas turbine engine embodiment for use with the present invention;

FIG. **2**A is a perspective side view of a nozzle system;

FIG. **2**B is an aft partial phantom view of the nozzle system;

FIG. **3**A is an expanded view of a regulator system in a first position for use with the gas turbine engine; and

FIG. **3**B is an expanded view of a regulator system in a second position for use with the gas turbine engine.

DETAILED DESCRIPTION OF THE DISCLOSED EMBODIMENT

FIG. **1** schematically illustrates a gas turbine engine **10** which generally includes at least a fan section **12**, a compressor section **14**, a combustor section **16**, a turbine section **18**, an augmentor section **19**, and a nozzle section **20**. The compressor section **14**, combustor section **16**, and turbine section **18** are generally referred to as the core engine. An axis of the

engine A extends longitudinally through these sections. It should be understood that the engine **10** may include alternative and additional sections.

An engine duct structure **22** and an inner structure **24** define an at least partially annular secondary flow path **26** at least partially around a perimeter of a primary flow path **28** which directs a primary combustion core gas exhaust flow (illustrated schematically by arrow E). It should be understood that the engine duct structure **22** may also at least partially define various airflow paths other than the disclosed secondary flow path **26**.

The secondary flow path **26** guides a secondary airflow S between the engine duct structure **22** and the inner structure **24**. The secondary airflow S is typically sourced from the fan section **12** and/or compressor section **14**. The secondary airflow S is utilized for a multiple of purposes including, for example, cooling, pressurization, and mixing with the core gas exhaust flow E prior to discharge through the nozzle section **20** during particular operational profiles. The secondary airflow S as defined herein is any airflow different from the primary combustion core gas exhaust flow E such that a variable cycle third stream fan flow and auxiliary third flow stream deployed, for example, by opening a set of vanes located in the secondary flow path **26** surrounding the core engine may be considered a secondary airflow S as defined herein.

Referring to FIG. **2**A, the nozzle section **20** generally includes a secondary flow duct **30** with a generally planar secondary nozzle **32** and a primary duct **34** with a generally planar primary nozzle **36**. The secondary flow duct **30** communicates secondary airflow S therethrough and the primary duct **34** communicates primary combustion core gas exhaust flow E therethrough. The secondary flow duct **30** in one non-limiting embodiment is a bifurcated duct arrangement **30**A, **30**B which join at the secondary nozzle **32** (FIG. **2**B). The primary duct **34** is generally circular in cross-section at an upstream segment and transitions into the planar primary nozzle **36** at an aft end segment. The secondary nozzle **32** and the primary nozzle **36** in the disclosed non-limiting embodiment include a straight shaped trailing edge, however, it should be understood that any other configuration may alternatively be utilized.

Referring to FIG. **3**A, a regulator system **38** is located intermediate the secondary nozzle **32** and the primary nozzle **36** to selectively communicate secondary airflow S into the primary gas flow path E though a passage **40**. The regulator system **38** allows variance of the fan stream secondary nozzle A**8** and/or A**9** of a convergent/divergent nozzle. The passage **40** may be generally transverse to the axis A. It should be understood that the regulator system **38** may be utilized in any nozzle location to control the mixture or injection of secondary airflow S and primary flow E.

The regulator system **38** generally includes a ramp **42** which is axially movable between a closed position (FIG. **3**B) and an open position (FIG. **3**A). It should be understood that essentially infinite intermediate positions are available. The ramp **42** may be mounted to the secondary nozzle **32** to provide for communication between the secondary flow path **26** and the primary flow path **28** through the passage **40**. The passage **40** may include a mesh, grid, metering hole, honeycomb or other shaping structure to directs and smooth the airflow therethrough as well as reduces noise generation.

An actuator system **44** having a hydraulic, pneumatic or electromagnetic actuator **46** controls movement of the ramp **42** through a linkage **48** or the like. A plenum **50** behind the ramp **42** may be provided to facilitate balance to a reference pressure such that actuator loads are reduced. It should be