



US009410441B2

(12) **United States Patent**  
**Macfarlane**

(10) **Patent No.:** **US 9,410,441 B2**  
(45) **Date of Patent:** **Aug. 9, 2016**

(54) **TURBOPROP ENGINE WITH COMPRESSOR TURBINE SHROUD**

(75) Inventor: **Ian Alexander Macfarlane**, St. Bruno (CA)

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

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 922 days.

(21) Appl. No.: **13/613,904**

(22) Filed: **Sep. 13, 2012**

(65) **Prior Publication Data**  
US 2014/0069107 A1 Mar. 13, 2014

(51) **Int. Cl.**  
**F02C 7/20** (2006.01)  
**F01D 11/08** (2006.01)  
**F01D 25/24** (2006.01)  
**F02C 6/20** (2006.01)

(52) **U.S. Cl.**  
CPC ..... **F01D 11/08** (2013.01); **F01D 25/246** (2013.01); **F02C 6/206** (2013.01); **F05D 2230/642** (2013.01); **F05D 2250/411** (2013.01); **Y10T 29/49236** (2015.01)

(58) **Field of Classification Search**  
CPC ..... F02C 7/20; F02C 6/206; F01D 25/243; F01D 25/246; F01D 25/28; F01D 11/08; B64D 27/26; B64D 2027/262-2027/268; F05D 2240/90; F05D 2230/642; F05D 2250/411; F23R 3/60  
See application file for complete search history.

(56) **References Cited**  
U.S. PATENT DOCUMENTS

3,830,058 A 8/1974 Ainsworth  
3,842,595 A \* 10/1974 Smith ..... F02C 7/20  
29/888.012

4,658,579 A 4/1987 Bower et al.  
4,785,625 A 11/1988 Stryker et al.  
4,854,525 A 8/1989 Chee  
5,427,348 A 6/1995 Bacon et al.  
5,452,575 A 9/1995 Freid  
5,474,258 A \* 12/1995 Taylor ..... B64D 27/26  
244/54  
5,593,277 A \* 1/1997 Proctor et al. .... 415/173.1  
5,746,391 A 5/1998 Rodgers et al.  
5,806,792 A \* 9/1998 Brossier et al. .... 244/54  
5,927,644 A \* 7/1999 Ellis ..... B64D 27/26  
244/54  
6,189,830 B1 2/2001 Schnelz et al.  
6,619,030 B1 \* 9/2003 Seda et al. .... 60/226.1  
7,156,343 B2 1/2007 Marche  
7,207,771 B2 \* 4/2007 Synnott et al. .... 415/173.1  
7,296,768 B2 11/2007 Machado et al.  
7,325,770 B2 2/2008 Chevalier et al.  
7,497,443 B1 \* 3/2009 Steinetz ..... F16J 15/0887  
277/644  
7,610,763 B2 \* 11/2009 Somanath et al. .... 60/796  
7,681,833 B2 3/2010 Fournier et al.  
7,789,619 B2 \* 9/2010 Durand et al. .... 415/173.1

(Continued)

*Primary Examiner* — William H Rodriguez  
*Assistant Examiner* — Jason H Duger  
(74) *Attorney, Agent, or Firm* — Norton Rose Fulbright Canada

(57) **ABSTRACT**

A turboprop engine including an annular outer case including a mount ring for attachment to an aircraft along a plane to transfer loads from a propeller and having an annular flange extending radially inwardly therefrom within the plane, an annular turbine support case received within the outer case and connected to the outer case only through a direct connection with the annular flange allowing a limited relative pivoting motion between the turbine support case and the mount ring, and a turbine section including a rotor closely surrounded by a shroud with an annular tip clearance being defined therebetween, the shroud being directly connected to and located by the turbine support case. A method of isolating a turbine shroud from propeller loads in a propeller engine is also disclosed.

**19 Claims, 4 Drawing Sheets**

