

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE PATENT TRIAL AND APPEAL BOARD

In re U.S. Patent No. 9,121,412

Filed: July 5, 2011

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Inventors: Edward J. Gallagher, Jun Jiang, Becky E. Rose, Jason Elliot, Anthony R. Bifulco

Assignee: United Technologies Corporation

Title: Efficient, Low Pressure Ratio Propulsor for Gas Turbine Engines

DECLARATION OF REZA ABHARI, PH.D.

I, Reza Abhari, make this declaration in connection with the petition for *inter partes* review submitted by Petitioner for U.S. Patent No. 9,121,412 (“the 412 Patent”). All statements made herein of my own knowledge are true, and all statements made herein based on information and belief are believed to be true. Although I am being compensated for my time in preparing this declaration, the opinions articulated herein are my own, and I have no stake in the outcome of this proceeding or any related litigation or administrative proceedings.

I. INTRODUCTION

1. I am making this declaration at the request of the General Electric Company in the matter of the *Inter Partes* Review of U.S. Patent No. 9,121,412 (the “412 Patent”).

2. In the preparation of this declaration, I have reviewed the relevant portions of the following documents:

GE-1001	U.S. Patent No. 9,121,412
GE-1002	Prosecution File History of U.S. Patent No. 9,121,412
GE-1005	D.G.M. Davies, et al., <i>A Variable Pitch Fan for an Ultra Quiet Demonstrator Engine</i> (1976)
GE-1006	<i>614: VFW's Jet Feedliner</i> , Flight International (November 4, 1971)
GE-1007	U.S. Patent No. 7,374,403 to Decker et al.
GE-1008	NASA SP-7037 (92), <i>A Cumulative Index to the 1977 Issues of Aeronautical Engineering: A Special Bibliography</i> (January 1978) (excerpt)
GE-1009	John W. Schaefer et al., <i>Dynamics of High-Bypass-Engine Thrust Reversal Using A Variable-Pitch Fan</i> (May 1977).
GE-1010	NASA Technical Reports Server Record Details for GE-1016.
GE-1011	William S. Willis, Quiet Clean Short-Haul Experimental Engine (QCSEE) Final Report (August 1979).
GE-1012	Bill Sweetman et al., <i>Pratt & Whitney's surprise leap</i> , INTERAVIA (June 1998).

GE-1013	Gerald Brines, <i>The Turbofan of Tomorrow</i> , Mechanical Engineering (August 1990).
GE-1014	Excerpts from Jack D. Mattingly, <i>Elements of Gas Turbine Propulsion</i> (1996).
GE-1015	Bill Gunston, <i>Pratt & Whitney PW8000</i> , Jane's Aero-Engines Issue 7 (March 2000).
GE-1016	Bruce E. Wendus et al., <i>Follow-On Technology Requirement Study for Advanced Subsonic Transport</i> (August 2003).
GE-1017	Richard Whitaker, <i>ALF502: plugging the turbofan gap</i> , Flight International (Jan. 30, 1982).
GE-1018	About NASA Technical Reports Server (www.sti.nasa.gov/find-sti).
GE-1019	University of California at Davis MARC record for Davies
GE-1020	NASA Technical Reports Server Record Details for Schaefer
GE-1021	U.S. 5,141,400 to Murphy et al.
GE-1022	S.A. Savelle et al., <i>Application of Transient and Dynamic Simulations to the U.S. Army T55-L-712 Helicopter Engine</i> (1996).
GE-1023	<i>A Summary of Commonly Used Marc 21 Authority Fields</i> , Library of Congress

3. In forming my opinions expressed below, I have considered the documents listed above, and my knowledge and experience based upon my work in this area as described below.

4. The application that led to the issuance of the 412 Patent was filed on July 5, 2011. I am familiar with the technology at issue and am aware of the state

of the art around this time. Based on the technology disclosed in the 412 Patent, a person of ordinary skill in the art (“POSITA”) would include someone who has a M.S. degree in in Mechanical Engineering or Aerospace Engineering as well as at least 3-5 years of experience in the field of gas turbine engine design and analysis. My analyses and opinions below are given from the perspective of a POSITA in these technologies in this timeframe, unless stated otherwise.

II. QUALIFICATIONS AND COMPENSATION

5. I am currently a Full Professor of Aerothermodynamics at the Swiss Federal Institute of Technology (“ETH”) in Zurich, Switzerland, which is a position I have held since 1999. I am also the head of the Laboratory for Energy Conversion at ETH.

6. I received a BA degree in Engineering Science from Oxford University in 1984, and a PhD from the Aeronautical and Astronautical Engineering Department at the Massachusetts Institute of Technology (“MIT”) in 1991.

7. My research in the field of gas turbine technology began in 1984 at Oxford University and continued throughout my academic career at Oxford and at MIT. I began working with the relevant technology in the commercial industry in 1991. From 1991-1994, I was a Senior Research and Development Engineer for Textron Lycoming in Stratford CT, where I focused on research, development and

design of engine components for next generation commercial and military gas turbine engines for aircraft propulsion. From 1994-1995, I was the Section Head of Propulsion and Energy Research at the Calspan Advanced Technology Center in Buffalo NY, where I was responsible for heading the group performing research and development of gas turbine technology related to turbine and combustor performance and reliability as well as overall engine operability in severe environments.

8. In 1995, I became an Assistant Professor in the Aeronautical Engineering Department at the Ohio State University in Columbus Ohio, with a joint appointment in the Mechanical Engineering Department. In 1997, I was promoted to Associate Professor with Tenure at the Ohio State University, where I remained until 1999 when I received my current position at ETH. From 1995-1999, I was also one of the two founders and the Associate Director of the Gas Turbine Laboratory at the Ohio State University.

9. In 1999, I became the Full Professor and Director of the Turbomachinery Laboratory at ETH. The Turbomachinery Laboratory at ETH was founded in 1892 and is one of the oldest university research centers performing long-term research in turbomachinery, including gas turbine technology. In 2008, the name of the laboratory was changed from Turbomachinery Lab to Laboratory for Energy Conversion (LEC) to better reflect the breadth of the research.

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