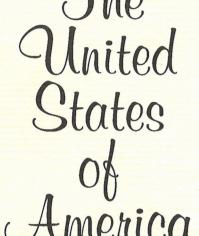
# The United States America



## The Director of the United States Patent and Trademark Office

Has received an application for a patent for a new and useful invention. The title and description of the invention are enclosed. The requirements of law have been complied with, and it has been determined that a patent on the invention shall be granted under the law.

Therefore, this

### **United States Patent**

Grants to the person(s) having title to this patent the right to exclude others from making, using, offering for sale, or selling the invention throughout the United States of America or importing the invention into the United States of America for the term set forth below, subject to the payment of maintenance fees as provided by law.

If this application was filed prior to June 8, 1995, the term of this patent is the longer of seventeen years from the date of grant of this patent or twenty years from the earliest effective U.S. filing date of the application, subject to any statutory extension.

If this application was filed on or after June 8. 1995, the term of this patent is twenty years from the U.S. filing date, subject to any statutory extension. If the application contains a specific reference to an earlier filed application or applications under 35 U.S.C. 120, 121 or 365(c). the term of the patent is twenty years from the date on which the earliest application was filed, subject to any statutory extensions.

Director of the United States Patent and Trademark Office



# (12) United States Patent

Akmandor et al.

US 7,314,035 B2 (10) Patent No.: Jan. 1, 2008 (45) Date of Patent:

#### (54) ROTARY VANE ENGINE AND THERMODYNAMIC CYCLE

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Subject to any disclaimer, the term of this (\*) Notice: patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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	See application file for complete search history.

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#### **ABSTRACT** (57)

A heat engine having a rotary vane compressor and a rotary vane turbine operates in a highly efficient thermodynamic cycle which includes a power expansion phase up to ambient pressure and a limited temperature constant volume combustion followed by a constant pressure combustion and/or a constant temperature combustion. A compound propulsion engine utilizing the thermodynamic cycle has a primary stage having an axial compressor and a rotary vane turbine, and a secondary stage having an axial turbine and a rotary vane compressor, the two stages being aero-thermodynamically coupled to each other without provision of an interconnecting drive shaft.

#### 6 Claims, 10 Drawing Sheets

