Axial Compressor Design for High Compression-Low Temperature Brayton Cycle Power Unit With Decoupled Hot and Cold Ends

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The Brayton cycle describes the operation of certain heat engines use air or gas the working fluid; it is known for its low vibrations and high power to weight ratio. This is achieved by its continuous combustion, constant pressure heat source, giving a smooth output compared to periodically peaking output in Otto or Diesel cycles, eliminating the need for bulky combustion chambers to handle the peaks while maximizing the chamber's duty cycle. However, continuous combustion brings the average temperature much higher than periodical explosions. Therefore, the need for advanced cooling and insulation in the hot (turbine) side limits Brayton cycle units almost exclusively for use in large industrial applications like providing mechanical energy to ships, planes, or factories. Smaller units like RC jets suffer from inadequate compression and apply excessive heat to maintain power output, resulting in poor efficiency with pressure loss and heat loss and have no practical use beyond the hobby industry. With superior cold (compressor) side designs, however, less heat is needed for certain output, reducing losses and allowing lighter materials for the hot side. Mechanically decoupled hot and cold sides enabled the hot side to operate in optimal load and speed for different output power while maintaining steady conditions in the compressor. The work here presents several advancements that allow wider use in different engine applications.

Awards Won:

Fourth Award of $500