INDUSTRIAL POWER TECHNOLOGIES

Project Fact Sheet

GAS TURBINE COOLING IMPROVEMENT

BENEFITS

- Improves the efficiency of gas turbine and turbojet engines by 8% to 15%
- Creates lighter engine weights, which translate into energy savings in vehicles
- Increases the amount of turbine blade cooling greatly without decreasing the mass flow rate of the turbine
- Makes turbine engines more reliable than previously possible
- Engines fitted with new technology are only 25% as heavy as reciprocating engines of the same power, and would be considerably lighter and more compact than conventional turbine engines due to the consolidation of compressor and turbine into one wheel

APPLICATIONS

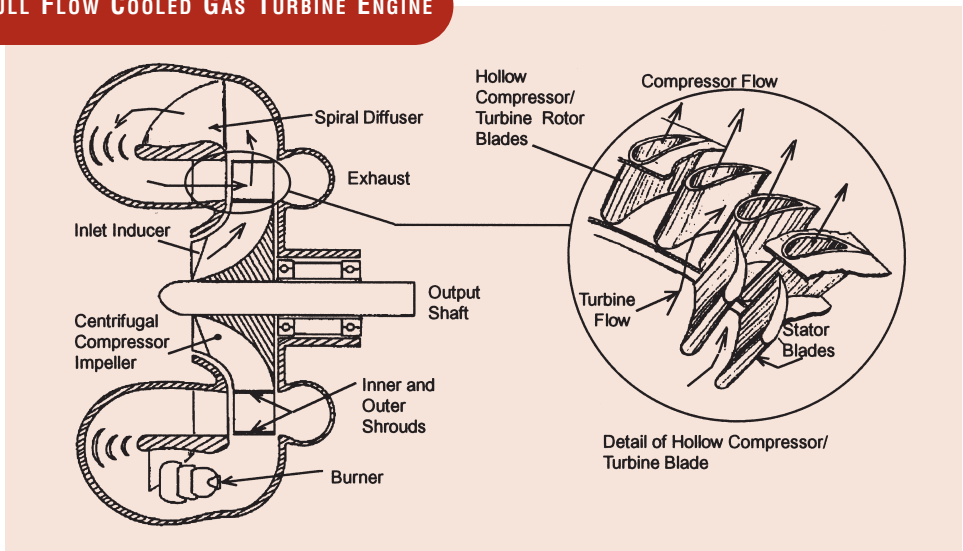
This technology is applicable in the automotive industry, where gas turbine engines can be used in hybrid-electric vehicles. Other applications are possible in auxiliary power plants and as portable high-power emergency units.

ADAPTATION IN GAS TURBINES IMPROVES ENGINE EFFICIENCY

In the world of engines, the gas turbine is perhaps the simplest in principle. Compared to conventional gas engines, like those currently used in automobiles, that require at least 20 moving parts for a four-cylinder engine, elemental gas turbines might require only one moving part. However, despite their relative simplicity, turbine engines have drawbacks that have prevented their widespread use. For example, turbine blades burn up at the temperature required for the engine to be as efficient as a modern reciprocating engine, so present turbines must operate at lower temperatures, making them less efficient.

In a new innovation in turbine engines devised by FluidTherm Engineering, high-pressure air leaving the compressor flows through hollow turbine blades to provide unusually effective cooling. The cooling protects the blades so that the turbine inlet gas temperature can be significantly increased. With the resulting increase in efficiency, this type of turbine engine could, for the first time, compete with much bulkier diesel and gasoline engines on the basis of fuel economy.

FULL FLOW COOLED GAS TURBINE ENGINE



FluidTherm's innovation in turbine engines uses high-pressure air to effectively cool turbine blades, allowing the engines to reach a greater peak efficiency through increased inlet gas temperature.

Project Description

Goal: The goals of the project were to verify claims established by a preliminary study, to use computer simulations to further develop the design, and to establish principle design parameters.

This new innovation improves a fault in the original design of full flow cooled turbine engines. By forcing the air leaving the compressor blades to exit the engine in a continuous stream, the invention improves overall compressor performance. The improvement makes gas turbine engines more attractive to the automotive industry, particularly for use in hybrid-electric vehicles, and opens up the possibilities for using turbine engines in other industrial applications.

Fluidtherm Engineering developed this new technology with the help of a grant funded by the Inventions and Innovation Program through the Department of Energy's Office of Industrial Technologies.

Progress and Milestones

- A test apparatus has been built and demonstrated successfully. A final report is being written to summarize the project.
- The inventor is currently seeking patent protection for the technology.

Economics and Commercial Potential

As the market for alternative fuel source vehicles increases, the demand for lighter weight, more energy-efficient engines will increase. Because a turbine engine creates fewer emissions, the gas turbine engine cooling improvement created by FluidTherm Engineering fits right into the hybrid vehicle market. By offering greater efficiency coupled with the use of alternative fuels and lower emissions, the technology holds great promise for future commercial success in a world more focused on technologies that have less negative environmental impact.

In addition, the gas turbine engine cooling improvement will likely find a market for use in auxiliary power plants and as portable, high-power emergency units.

Industrial Power Technologies

The Industrial Power Generation Program is a collaborative effort between industry, national laboratories, and the government that promotes reliable, cost-saving, and energy-efficient power-generating technologies for industries. The program allows the most energy-intensive industries to realize substantial energy, economic, and environmental benefits by helping to develop and implement cutting-edge technologies in microturbines, advanced turbine systems, and reciprocating engines.

OIT Industrial Power Generation Program Leader: Patricia Hoffman (202) 586-6074.

The Inventions and Innovation Program works with inventors of energy-related technologies to establish technical performance and conduct early development. Ideas that have significant energy savings impact and market potential are chosen for financial assistance through a competitive solicitation process. Technical guidance and commercialization support are also extended to successful applicants.

Project Partners

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