High Efficiency Combustor and Closed-Cycle Heat Engine Interface

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The U.S. Navy seeks a partner for licensing and collaboration on a high efficiency combustor and closed-cycle heat engine interface.

Coupling a Stirling engine with a combustor presents a challenge since the exit temperature of the combustor cannot be high enough to melt the hot side of the closed cycle heat engine. Typically, this requires that diluent be introduced to the combustor or exhaust stream. For example, burning kerosene with air may produce combustor exhaust temperatures in excess of 3000 F, a temperature that would melt or deform iron-based, cobalt-based, nickel-based, or chromium-based alloys used in the construction of a hot side of a closed cycle heat engine. Excess diluent must be pumped into the combustor to prevent damage, but the diluent causes losses to the system's efficiency since additional power or mechanical work is usually required to pump the diluents into the combustor. In addition, since the required diluent mass and volume flow rates are usually many times that of the combustion products, the combustor must be made larger to accommodate the excess flow which increases its weight and volume and leads to further parasitic heat loss.

Naval Surface Warfare Center, Crane Division (NSWC Crane) has patented a high efficiency combustor and closed-cycle heat engine interface. Small scale combustion, such as combustion used in heat engines to power underwater or space vehicles or small electric generators, often use small combustors that have design issues that prevent them from operating efficiently. For example, the small combustors usually have a large surface area to volume ratio which leads to high parasitic heat loss. The result of parasitic heat loss is a decrease in engine efficiency.

The invention includes an interface for providing heat to the hot side of the engine and includes an enclosure, a combustor having a combustion chamber positioned partially inside the enclosure, and a heat exchanger. The combustion chamber receives fuel and an oxidizer for combustion. A heat exchanger receives the combustion product and cools it through either e heat transfer fluid inside the enclosure.

People:

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