CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
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Project Number
J0330

Project Title
A "Stirling" Idea

Abstract

Objectives/Goals
The objective of this experiment was to determine if the higher specific heat value of a gas used in a Stirling engine would increase its efficiency.

Methods/Materials
Four gases with different specific heat values, namely air, helium, carbon dioxide and butane, were used in a modified low temperature differential Stirling engine. The Stirling engine was placed over a cup of hot water, and the temperature differential between the bottom plate (resting on a cup of hot water) and the top plate created enough pressure in the chamber to power the flywheel of the Stirling engine. The temperature of the bottom plate minus the temperature of the top plate (ambient temperature) was the temperature differential. The flywheel speed was measured using a photo tachometer. Measurements were taken at ten degree increments until the temperature differential was no longer great enough to turn the flywheel. After the engine was allowed to return to ambient temperature, the working gas was replaced with another gas. The experiment was repeated for each of the gases, replenishing the hot water and measuring the RPM's of the flywheel as the temperature differential decreased.

Results
Helium turned the flywheel the fastest, followed by air, carbon dioxide and then butane at the same temperature differential. From a table of specific heat values of gases, butane was expected to perform faster than air, but it was actually the slowest of the gases.

Conclusions/Discussion
The results did not support the hypothesis that the higher specific heat value of a gas would have a positive effect on the efficiency of a Stirling engine. It was determined that it was not just the specific heat of the gas, but the k value, which is the ratio of the specific heat of a gas at constant pressure divided by the specific heat of the gas at constant volume (Cp/Cv) that may affect the efficiency of the Stirling engine. The molecular structure of the gas as well as other properties of gases need to be further researched as they may influence its behavior and consequently the efficiency of the Stirling engine. A gas that will create the most efficient Stirling engine may provide an alternative means of power generation.

Summary Statement
Four gases with different specific heat values were individually introduced into a Stirling engine to determine if a higher specific heat value of a gas increases its efficiency.

Help Received
Father helped modify the Stirling engine and supervised the experiment.