CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
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Project Number
S1502

Project Title
A Study of the Qualities that Determine Maximum CPU Cooling Efficiency

Abstract

Objectives/Goals
The purpose of this experiment was to determine what qualities of a heat sink were important in cooling a CPU.

Methods/Materials
Ten heat sinks were built using copper, bronze, and aluminum bases. Black, blue, and silver colored aluminum fins were tested with each base. Each heat sink had three trials, each trial consisting of a nine hundred second time period in which the CPU and heat sink temperature measurements were taken with BIOS and a Cooling Gate thermometer simultaneously.

Results
* Increasing surface area of heat sink results in Faster cooling of the CPU.
* The color of a heat sink minimally affects the cooling of a CPU under a forced convection situation.
* The heat sinks kept the CPU at relatively stable temperatures 300 seconds after the computer was turned on.
* A common trend: As the heat sink color became darker (silver/blue/black) , the temperature decreased in minute amounts with the exception of the Bronze Base + Silver Al. Fins and Al. Base + Silver Al. Fins heat sinks.
* The difference between the CPU and Heat Sink temperatures reflected the conductivity of the base metal.

Conclusions/Discussion
* The surface area of a heat sink directly determines its efficiency.
* It was known that darker colored heat sinks cool heat generating sources more efficiently than lighter colored heat sinks up to 3-8% during natural convection. However, in this experimentation, there was no strong evidence of this trend most likely because of the forced convection caused by the CPU fan.
* The mass of heat sink does not determine the efficiency of a heat sink.
* Highest to lowest conductivity between base metal:
1.) Aluminum Base with Aluminum Fins
2.) Copper Base with Aluminum Fins
3.) Bronze Base with Aluminum Fins

Summary Statement
This experiment ultimately demonstrated that a heat sink with the most surface area and highest conductivity would be most suitable in sustaining a minimal temperature of a CPU.

Help Received
Father helped setup Lab equipment.