CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
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Project Number
J0924

Project Title
Boxed Lightning: The Effect of Run Time on the Electrical Resistance of an Alternating Current (AC) Carbon Arc

Abstract

Objectives/Goals
This experiment explores the topic of how the run time of a carbon arc would affect its resistance. My approach was to build a carbon arc and measure the resistance at different intervals of time. I hypothesized that over time, resistance would decrease. This was based on the principle that when a carbon arc is running, the carbon in the tips of the rods sublimates and ionizes, creating a more conductive environment.

Methods/Materials
The first thing I did was build two rod holders out of 2x2's. To do this I had two long pieces and two small. I glued the small on top of the large. I drilled holes through the top block. The rods would go through these holes. Next I took two pieces of molding and glued them parallel to each other just wide enough for the two rod holders to fit in. One rod holder I glued down so that it would be stationary. I would move the other so that I could adjust the gap between the rods. Next I built my circuit using two space heater wired in parallel as resistors. In order to take data, I used one ammeter and one voltmeter. Since Ohm's law states that R=V/I, I could divide the measured voltage by the measured current to find resistance. I set up my meters next to each other. I set up a camera on a tripod so that it could take pictures of the two meters and put it on a setting where it would take successive pictures of the same spot. Before running the arc I had to put on welding goggles to protect my eyes. SAFETY FIRST! I also built a shield box with a window of the same glass to use for demonstrational purposes. I turned on the arc and at the same moment held the button on the camera down to take pictures of my meters. I did this 7 times. I uploaded the pictures onto my computer and put the data from the pictures into a spreadsheet.

Results
I found that in almost every instance, electrical resistance increased greatly over time. This answered my research question,"How does run time affect electrical resistance of a carbon arc?".

Conclusions/Discussion
Resistance increased over time. I have two possible reasons for this. The first idea I had was that over time, more and more carbon sublimated. This would cause a larger and larger gap between the rods, making it harder for the electricity to jump between the rods. The other idea I had was that the more volatile carbon sublimated first. This would leave behind harder carbon more reluctant to sublimate.

Summary Statement
My project is about how the run time of a carbon arc affects the electrical resistance it causes.

Help Received
Mother helped proofread report; Father helped by teaching my about electricity and approving/disapproving circuit designs as well as reviewing safety procedures; Aunt reviewed safety procedures; Uncle reviewed safety procedures; Science teacher helped give ideas so as to better test