CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)

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Project Number

38060

Project Title

Does the Number of Turns per Inch within a Coil Affect the Speed of an Electric Train?

Abstract

Objectives/Goals

The purpose of this project was to find out whether the number of turns within a coil per inch affects the speed of an electric train traveling through the coil.

My hypothesis is that the train will travel through a coil faster if the turns within this coil are closer together (greater coil density). This is expected because a greater number of turns per length of the train makes a greater magnetic field pushing it forward faster.

Methods/Materials

In my experiment, I built an electric train consisting of a AAA battery with a front and rear magnet (1cm diameter). The train traveled through two copper coils. I created the coils by wrapping 18 gage bare copper wire around a metal rod then removing the rod. The two copper coils had 13 and 14.5 turns per inch. I measured the time the train traveled through this coils and repeated at least ten times.

Results

It took the train less time to travel through the coil that had more turns per inch. The average (of ten trials) for the train to travel through the coils of 13 turns/inch and 14.5 turns/inch was 1.336 sec and 1.126 sec. respectively. I calculated the speed to be 0.374 m/s with 13 turns per inch and 0.4 m/s with 14.5 turns per inch.

Conclusions/Discussion

My hypothesis that the train will travel through a coil faster if the turns within this coil are closer together (greater coil density) was supported by the data, with the train achieving a speed of 0.374 m/s in the coil with 13 turns per inch and a speed of 0.4 m/s in the coil with 14.5 turns per inch. This was expected as a greater number of turns per length of the train makes a stronger magnetic field pushing it forward faster.

Summary Statement

I showed that the speed of a train made of a battery and front and rear magnets riding through a copper coil depends on the density of the windings in the coil.

Help Received

I designed the train and my dad helped me building it. I performed the experiments, collected the data and got help in understanding the underlying electromagnetic phenomena from my mom.