

Experiment #5 Sound and Electricity: Build Your Own Speaker

Objective

A speaker is a device that converts changing electric current into sound. In this experiment, you will build a simple speaker and test it with your phone. In the process you will learn how a speaker works and how the sound travels through a medium.

Theory

In order to translate an electrical signal into an audible sound, speakers contain an electromagnet: a metal coil which creates a magnetic field when an electric current flows through it. This coil behaves much like a permanent magnet, with one particularly handy property: reversing the direction of the current in the coil flips the poles of the magnet.

Inside a speaker, an electromagnet is placed in front of a permanent magnet. The permanent magnet is fixed firmly into position whereas the electromagnet is mobile. As pulses of electricity pass through the coil of the electromagnet, the direction of its magnetic field is rapidly changed. This means that it is in turn attracted to and repelled from the permanent magnet, vibrating back and forth.

The electromagnet is attached to a cone made of a flexible material such as paper or plastic which amplifies these vibrations, pumping sound waves into the surrounding air and toward you.

Inside almost every speaker there will be a magnet, a coil of wire, and a thin material to convey the sound into the air. The invention of strong rare-earth magnets allows speakers to create more sound using less electric current.

Equipment

- 2.5 meters of magnet wire with 0.5 mm thickness
- Piece of sandpaper
- Aluminum cylinder (to wind the copper wire)
- A 3.5-millimeter mono phone plug
- Two alligator-clip leads
- Scotch tape
- Scissors
- Two round magnets
- Paper cup
- A working audio device with headphone plug



Figure 1: Speaker set up

Procedure

1. Sand the enamel off the last 5 cm of each end of the magnet wire until the bare wire gleams at both ends.
2. Wind the magnet wire around the battery, leaving 10 cm free at each end.
3. Slide the wire off the battery and wrap the free ends around the coil to keep the arrangement in place. Leave a few inches of wire sticking out either end of the coil.
4. Tape the coil to the outside bottom of the paper cup.
5. Attach an alligator clip to each of the two protruding ends of the wire coil.
6. With scissors, strip off the ends of the mini phone plug wire and separate the two strands.
7. Attach the free end of the alligator clip leads to the two strands of wire on the mini phone plug.

Discussion

What kind of sound quality do you get out of your speaker? Compare the loudness and the clarity.

Explain how your speaker reproduce sound.