Cup Speaker

Make a speaker that turns changing electric current into sound.

Wind up a coil of wire, attach it to the bottom of a paper cup, hold a magnet nearby, and listen to the radio! You've made your own speaker.

Tools and Materials

- Eight feet (2.5 meters) or more of magnet wire that is 24-gauge or higher (thinner)
- Piece of sandpaper, a few inches (5–8 centimeters) square
- C- or D-cell battery (it can be dead; it's just used to wind the coil)
- A 1/8-inch (3.5-millimeter) mono phone plug (if you don't want to buy one, you can cut the head gear off a pair of old headphones, but leave the cable intact; any plug that fits into a radio, phone, or other amplified audio device will work)
- Two alligator-clip leads

- Scotch tape or masking tape
- Wire cutter/strippers or scissors
- One or two donut magnets about 1 inch (2.5 centimeters) in diameter and 1/4 inch (6.4 millimeters) thick
- Paper cup
- A working audio device (such as a radio or phone) with headphone plug

Assembly

1. Sand the enamel off the last 2 in (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 4 in (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 or wire strippers, strip off the ends of the mini phone plug wire and separate the two strands (if there's a third ground wire in there, just bundle it with one of the other strands).
7. Attach the free end of the alligator clip leads to the two strands of wire on the mini phone plug.

To Do and Notice

Plug the mini phone plug into your radio, phone, or other device, then turn it on and play some music (you may have to turn the volume up louder than you normally would). With one hand, hold the cup to your ear. With your other hand, bring a magnet closer and closer to the coil of wire until you can hear the sound produced by your homemade speaker.

If you have two magnets, you can put one inside the bottom of the cup and the other next to the coil, on the outside of the cup (so the two magnets hold each other on) to keep the sound going.

What's Going On?

Look down at the loop of wire. When electric current goes around the loop clockwise as you look at the loop, there is a south magnetic pole nearest you. When the current reverses, there is a north magnetic pole nearest you.

When the south magnetic pole of a magnet is near the coil of wire, it will attract a north pole and repel a south pole of the coil electromagnet. The coil will move toward and away from the magnet, depending on the direction of the electric current. Because the coil is attached to the cup, the cup will also move toward and away from the magnet.

The cup pushes air back and forth, creating a sound that travels to your ear. The bare wire itself does not move much air, so it does not make much sound. However, if the coil is attached to a large, low-mass material, it will vibrate that material which, in turn, will vibrate the air, making a louder sound.

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.

Going Further

Paper cups make handy speakers because they fit easily over the ear, but you can use just about anything to vibrate the air. Attach the coil to other objects, hold them near your ear, and hear what happens.