

Singing Shoebox

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For the 2011 Google Science Fair

Choosing My Project

- I decided that I wanted to do my project on making a homemade speaker. I didn't know how I was going to make it though.
- I found a paper online by Scott Porter, Daniel J. Domme and Jeffrey S. Whalen, Graduate Students, Pennsylvania State University. That paper helped me decide on how I was going to do my project.

How a Speaker Works

- A speaker works by sending an electronic version of your music (a changing current) through a coil of wire which is placed in a strong magnetic field. The current in the wire creates its own magnetic field that interacts with the other magnetic field. The changes in the signal shakes the coil. This coil is attached to the bowl of the speaker. When it shakes, it makes sound, creating the music.



How My Speaker Will Work

- My speaker uses magnetic wire and cheap, high-grade neodymium magnets. The wire is wrapped around part of a paper towel tube that is attached to the bottom of a Styrofoam bowl. The wire and magnets create the signal and cause the vibrations which will resonant in a bowl, creating music.

Materials

- For my project, to make my speaker, I used a shoebox with an attached, folding lid, two, 2" c-clamps, eighteen neodymium half inch diameter magnets, a medium sized foam bowl, an empty paper towel roll, magnetic wire, latex sheeting, and Gorilla Glue.
- It was a bit hard finding all of the materials, but most were very cheap. The ones that had to be ordered online and were more expensive were the neodymium magnets and the latex sheeting (\$50 total).



These are the materials I started with for my project.

Assembly

- I started my project first by trimming my paper towel roll to what I thought was the correct length, 2 ½”.
- I rolled some of the magnetic wire around the bottom of the roll. I then used a small amount of tape to secure the wire.



Assembly

- Following that, I glued the end of the roll that the magnetic wire was not on to the center of the bottom of the foam bowl.



Assembly

- After the roll had dried to the bowl, I glued the top of the bowl to the latex sheeting.
- Once that had also securely dried, I cut out the latex covering the bowl with scissors.



Assembly

- Following that, I cut out a hole in the top of the box slightly larger than the bowl.
- I then placed the bowl in the hole so it was suspended by the latex sheeting.
- I finally glued the latex to the top of the box.



Assembly

- After I finished the top part of my box, I put the magnets on the c-clamps, eight on the outside and one inside.



Assembly

- I finally glued the c-clamps down as the last part of my project.

Testing

- I couldn't tell until the c-clamps were dry if they were in the correct spot.
- When I tested to see if they were in the correct spot, they were off by a great amount in front of where the tube was.

Perfecting

- With the discovery that my c-clamps were in the wrong spot, I glued them again.
- They were closer this time, but still slightly off.
- With many tries, closer each time, I finally got them in the desired spot.
- With them in the correct spot, I realized that the paper towel roll was cut too long and it didn't allow for the bowl to move down at all.



Perfecting

- I trimmed the paper towel roll to the right length by taking off the wire and cutting part of the end of the roll off, about an half inch. I then rewrapped.
- After the roll was trimmed, it came to my attention that I couldn't get the ends of both c-clamps to fit in the roll. Only one would fit at a time.
- It took me awhile to think of something; but, I finally decided to cross the c-clamps over just a bit, but I was careful to not cross the magnetic fields.

Perfecting

- This time the c-clamps fit correctly I could actually try and play music on it!

Final Testing

- I finally got to test my speakers by wrapping the leads of my magnetic wire to the cords of an old stereo system.



Failure

- When I first tried playing music on my speakers, I got no sound and was disappointed.
- I double checked everything but could not figure out what was wrong. I thought my speaker was not going to work.
- Then I noticed that the magnetic wire was a different color than the speaker wire. I decided to try filing my magnet wire with a fingernail file, in case the wire was insulated.

Final Testing Again

- After I filed the end of the wire, I tried it again, this time it worked and actually played music!
- It had problems on bass sounds crackling a lot. It did fine on high notes though.
- The speaker went to 85 decibels and then the wire started to overheat, turned bright red, and smoked, which was not good!
- When I compared this same volume setting on a normal speaker, it measured 120 decibels which can cause instant hearing damage!

Final Project

- My final project was a great achievement to me and it was very wonderful for it to be a shoebox and play music.
- I also thought that for the most part it looked very nice, not messy!



After the Project

- I spent a lot of time on the project because of the gluing and having to wait to get all of my materials.
- In total, I spent around three months doing this project.
- It was fun to work on it and to assemble it. I also enjoyed purchasing the parts for it.
- It was pretty cheap and it was able to play medium quality music.

Plans For Future Improvement

- I plan to change and try different things on my project, I would try maybe a larger shoebox and different sizes of c-clamps. I would see what kind of difference that they would make on the sound.
- I would also try a plastic bowl on top and also try a stretchy polyester top instead of latex.
- I would mainly try to get rid of the buzzing sound it makes when playing bass and to get louder sound without overheating. Maybe thicker wire will help with that.

More Planes for Future Improvement

- In redoing this project I would also try to get the speaker pieces more accurate on the first try and not have to keep adjusting things over and over.
- I am also going to submit it to the Acoustical Society of America to see if they will post it on their website as an easy to understand project on how to make a shoebox into a speaker!

Thanks

- I want to thank my mom for telling me about the Google science fair, helping me decide what to do for my project, and encouraging me to solve my problems throughout the project.
- I also wanted to thank Scott Porter, Daniel J. Domme, and Jeffrey S. Whalen for the list of materials they used on their Singing Shoebox.