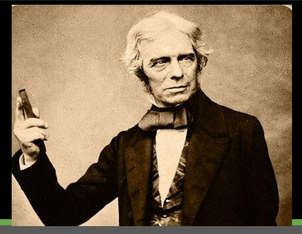
The Faraday Motor



Concept to Demonstrate

Can I build a Faraday Motor at home that works?

Background Information

Michael Faraday was a famous English scientist. He was known for doing many experiments and had many important inventions. Michael Faraday is known for the Faraday cage, but is also known for the Faraday motor, which is the first ever motor.

The Faraday motor used electricity, magnets, and a liquid that conducts electricity. This created an electro-magnetic field, and motion that turned something. Michael Faraday used liquid mercury in his experiment, but I am using saltwater. Otherwise, it's pretty much the same.

Procedure

1. Create a stack of magnets that is stable. Put your largest magnet on the bottom.
2. Make a bowl or cup of saltwater.
3. Attach a piece of aluminum foil to the cup of saltwater so it is both on the inside and outside of the cup.
4. Place the stack of magnets in the middle of the cup of saltwater.
5. Create your copper wire that will be moved. Get a tall glass or bottle, and attach a piece of copper wire to the top of it with tape. Have a little bit of tape showing on one side, and a lot on the other side.
6. Put your paperclips together in a chain, and hang them from your copper wire that is taped on top of your bottle or glass.
7. Make a small copper wire that will hang from your paperclip chain. Make a tiny hook on one end, and keep the rest straight.
8. Set up your electricity. Get the 9 volt battery and attach alligator clips. Use blue to one terminal and red on the other.
9. Attach one clip to some aluminum foil, and place on the edge of your saltwater bowl.
10. Finally, place the other alligator clip on the tiny bit of copper wire that is sticking out from the tape on the top of your glass or bottle.

Materials

Quantity (detailed list)	Materials (be specific)
1 spool	Copper wire, 16 gauge (at least 12 inches)
4	Paper clips
15	Small neodymium magnets, circular. These are sometimes called "rare earth" magnets.
1	Medium ceramic magnet
1	9v battery
2	Alligator clip wires
1	Bowl or cup (to hold saltwater)
1	Unit of water (cup or bowl)
1	Tablespoon of salt for each cup of water
3	Pieces of tape
1	Piece of aluminum foil
1	Tall glass or bottle
1	Battery tester (optional)
1	Electromagnetic field reader (optional)

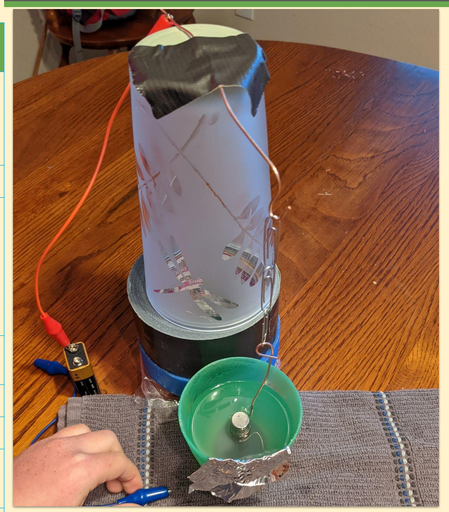
Results

I WAS able to get the Faraday motor to work, but it was not as good as the You Tube video from Rimstar.org. I was disappointed.

The very first time I did it, the salt water was very bubbly and fizzy when I connected everything. The first copper wire in the salt water actually turned black! Then I replaced it. The second copper wire went around the magnet pile in the salt water, but it was not a perfect circle. It went around about one minute. I thought it would go for a long time. I didn't even think I needed to time it, because I thought it would go on for a very long time. It DID show an electromagnetic field. The beeper went off on my electromagnetic field tester.

When I tried to run the experiment again after it stopped the first time, it did not seem to work anymore. One time the copper wire moved around for about 6 seconds, and the other time only 4 seconds.

Photos



My completed Faraday motor. The magnet pile is in the cup. The copper wire dangles around the pile. Electricity connects because the alligator clips are metal, and the edge of the cup is metal. The only part not connected with metal is the saltwater. (This picture was actually the second try later, when I switched out saltwater to try again. This cup is green. By this time, it only worked a few seconds.

Photo 2: showing how copper wire got burnt when I first started.

Photo 3: copper wire moving around the magnet pile while saltwater fizzes like crazy. This was my best time, and it went for about a minute.

Photo 4: Electro-magnetic tester beeping and showing electro-magnetic field.

Conclusion

I was able to build a Faraday motor that worked, but not for very long.

I tried to make it work again, but I couldn't get it to really work again, except for a few seconds of motion. I tried replacing the salt water, replacing the foil, replacing the wire, adding a fresh battery, etc. and none of it helped. We also added vinegar in case that would help.

I am not sure what went wrong. I tested the battery on a battery tester, and it was still good.

I think maybe there was a chemical reaction that burnt the magnets, or maybe the paperclips. The paperclips did not look different, but the magnets had dark marks on them that I could not clean off.

I would like to do this experiment again with all new magnets and 100% new materials and see if it works again.

It was still pretty cool when it worked. The electricity did create motion and an electromagnetic field for about 1 minute.

References

Rimstar.org: YouTube Video of Demonstration of Faraday motor: https://youtu.be/MRFqYRHT3Wk

Ludic science: Faraday's Motor. https://www.youtube.com/watch?v=r967ko07qg8

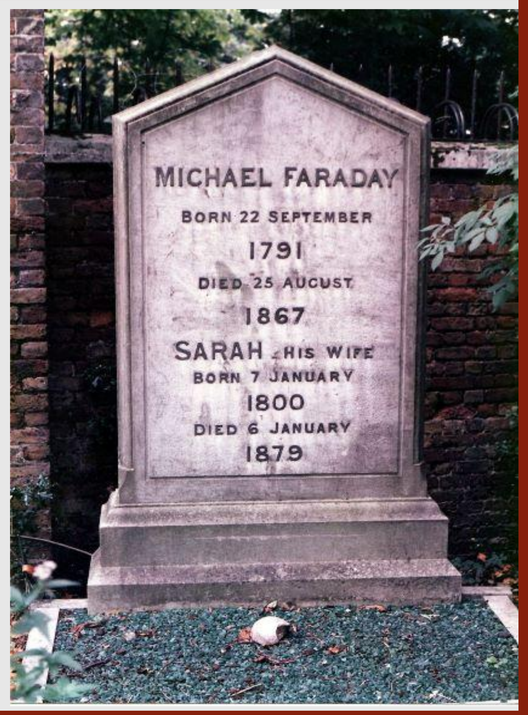
Spark Museum: The Development of the Electric Motor. http://www.sparkmuseum.com/MOTORS.HTM

Photo and Display Credits

My mom and my sister took all the photographs.

The pictures of Michael Faraday are from Wikipedia. Thanks to my mom for typing and buying the magnets.

Reflections on Learning: The Faraday Motor



1. Where did you do your project and who supervised you?

ANSWER: I did this project in my dining room. My mom supervised me.

2. Please fill out the chart with the safety risks for your project and the safety measures you used.

ANSWER: There were no risks. The battery was very tiny and it was just saltwater.

Did you follow all of the Austin Energy Regional Science Fest's Elementary Rules and Guidelines?

ANSWER: YES.

3. What gave you the idea for this project?

ANSWER: My mom picked it out for me. I wanted to do a demonstration. The last science fair I did a Leyden jar and it was very fun. I got to show my class how you can shock yourself on the jar.

I would like to show my Faraday motor experiment to my class this year and have people see if it works in actual class.

4. What did you learn from doing your project?

ANSWER: I learned that electrical energy can create motion.

I also learned that the magnets in saltwater make an electro-magnetic field that I could measure with my meter.

5. What would you change about the project and why?

ANSWER: I would probably buy way more magnets, and try to redo my experiment with 100% new materials each time. Just in case the magnets were getting too corroded to work right.

6. What new questions do you have?

ANSWER: I do not understand why the copper wire turned black when I first put it in the saltwater. I would like to do research to figure that out.

I also don't understand why I could only get it to work for about a minute. That seems wrong. The You Tube videos go for much longer. I would like to figure out why mine stopped and see if I can make it go longer.

7. Is there anything else you want to tell your judge?

ANSWER: Thank you for judging!