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Honors Physics II

Lab: H2

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Building a Generator

Generators are devices that take mechanical energy, usually in the form of water moving down hill or pressure by steam, to turn a shaft with moves a magnetic field around a large coil of wire. The generator does not create the charge; it simply moves the charge already present in the wire. This moving charge is used to power the appliances and other electric systems present in our everyday lives.

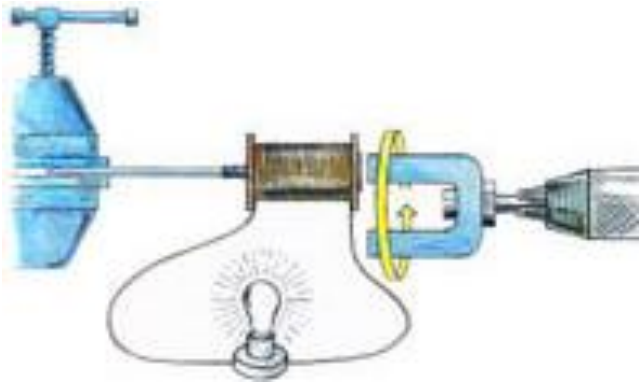
The physical law that is responsible for the generation of the electricity is Faraday's Law. This law states that "for any closed path, C, the emf around the path is related to the magnetic flux through the surface, S, bounded by the path by:

$$emf = \frac{-d\emptyset_m}{dt} = \frac{-d}{dt}\int_s \vec{B} \cdot \hat{n}\, dA$$

That is, emf equals the time rate of change of magnetic flux" (UPII). The emf equals the potential difference, or voltage, resulting in a current.

By exploiting this law, I was able to make a very simple generator of my own. This generator is made of hardwood, a drill, very powerful magnets, a hole saw, large nails,

cardboard, electrical tape, and 30 gauge magnet wire. The original plans for the generator came from this sketch:



but was changed slightly to accommodate the drill, the magnets, and to compensate for the lack of a clamp.

The first step in building the generator was winding the coils. This was accomplished using the 30 guage wire, cardboard, nail, and electrical tape. A base layer of tape was laid down on the nail between two cardboard disks. On top of the tape, between the disks, over 200 feet of wire was wound totaling 2,000 turns. I wound three different geometries:

Circular

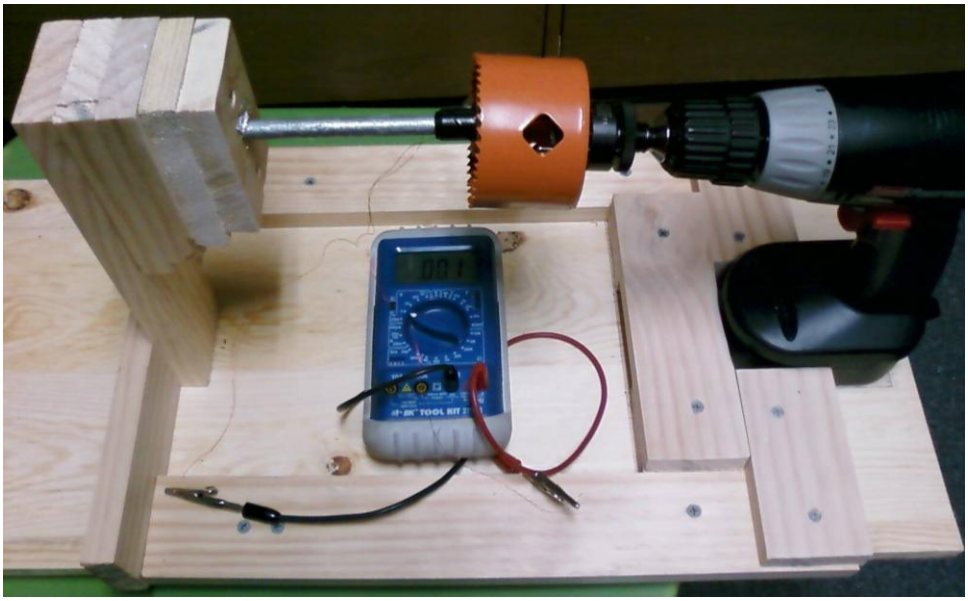
Square

Triangular

The next step in building the generator was building the frame. The frame serves the purpose of keeping everything stable and in place. As previously mentioned, this was partly done to compensate for the lack of a clamp. The vertical section with the hole in the middle of the top piece, is where the end of the nail goes to hold it steady while the magnets turn around it. The area where the three pieces of wood make a slot (at the bottom of the picture) is where the drill is held.

Making the magnetic field which will be moved around the coil was simple in theory. In practice, however, it was very difficult. I used a hole saw, which is essentially a cylinder with one base missing and teeth in its place. It was very hard to place the magnets where I wanted them to be. But once they were in place, the hole saw made it extremely easy to connect to the drill and to move the field around the coil. In the end, I believe I created a magnetic field that is very uniform, which is what I set out to do.

The final step to building the generator is to put the nail in the hole, the drill in its slot, and hook a volt-meter up to the two ends of the wire. The final set up is shown below:



By using this setup I was able to get a small voltage, but a voltage none the less. The results for the three coil geometries are as follows:

Geometry	Turns	Voltage (peak)
Circular	2,000	0.19 V
Square	2,000	0.16 V
Triangular	2,000	0.17 V

Works Cited

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