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Electricity and Magnetism

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A very important device that uses an electromagnet is a motor. The latter has an electromagnet that is free to rotate. The rotating electromagnet is called a rotor. It is allowed to rotate because it is placed in the field of a strong magnet.

A motor spins by the constant changing of the poles of the rotor. The current reverses just at the right time to keep the motor running. Current reverses because of a split ring commutator. When the rotor reaches the large magnet's poles, each wire slides onto a different part of the commutator. At this point the current through the rotor reverses direction and the motion continues.

The spinning motion of the rotor in a motor can be used to move things. A long rod or shaft attached to a motor can turn pulleys, fan blades, or wheels. Electric motors are used to run golf carts, elevators, record turntables, and many other useful and convenient machines [1].

Suppose you held a coil of wire next to a strong magnet. Now suppose you move the coil back and forth across the magnetic field. If you connect the ends of the coil to a meter, the meter needle moves when the coil moves.

The coil connected to the meter makes a complete circuit. When you move the coil across the magnetic field, electrons flow through the circuit. That is, a current is produced. When you reverse the direction of the moving coil, the current reverses direction.

Producing a current by moving a coil of wire across a magnetic field is called electromagnetic induction. The current that is produced is called an induced current. Electromagnetic induction is the key to another important device, the generator.

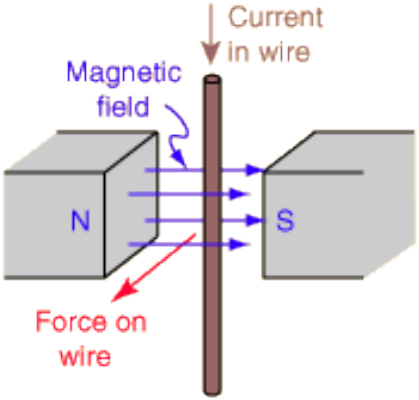

Figure 1: Moving a Coil of Wire Through a Magnetic Field

A motor changes electric energy into mechanical energy of motion. It uses an electric current to magnetize a rotor, causing it to spin. In these respects, a motor is the opposite of a generator. The latter is a device that uses the energy of motion to produce electricity [2].

Basically, a generator is a coil of wire moving within a very strong magnetic field. A large generator has a coil with thousands of loops of wire mounted on a shaft. The shaft is placed within a strong magnetic field. Falling water, steam, or wind sets the shaft in spinning motion within the field. As it spins, an electric current flows through the coil and lead wires.

The current here keeps changing direction. You have seen that a current reverses when you move a coil back and forth across a magnetic field. Instead of moving back and forth,

the coil in a generator spins around within a magnetic field. With each half-spin of the coil, the current reverses once. With each complete spin, the current reverses twice. In most generators the coils spin thousands of times each second. So, current reverses twice as many times each second.

Large Generators

A dry cell and a generator are both sources of electric current. Each source, however, produces a different kind of current. A dry cell supplies direct current (DC). It is current that flows in one direction only. Electrons flow from the negative terminal to the positive terminal of the dry cell.

A generator, on the other hand, produces current that reverses its direction after each half-turn of the shaft. This kind of current is alternating current (AC). It is current that reverses its direction of flow. Most generators supply AC to cities, homes, factories, and businesses. In the United States, these generators usually provide current that changes direction 60 times a second [3].

The speaker in a radio, television, or stereo uses an electromagnet. So does the speaker in the earpiece of a telephone receiver. Figure 2 shows that in these devices, the

current flowing through the electromagnet gets alternately stronger and weaker.

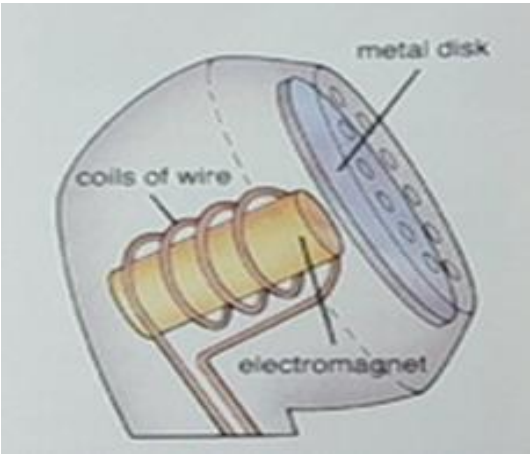

Figure 2: Telephone Speaker

A strong current makes the electromagnet attract a thin metal disk. A weak current causes the electromagnet to release the disk. The current changes strength many times per second. So the disk is attracted and released many times per second. The back and forth motion of the disk produces the sounds that you hear from the speaker.

References:

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2. Generator Principle [Electronic resource]. – Mode of access: https://www.generatorsource.com./. – Date of access: 22.03.2020.
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