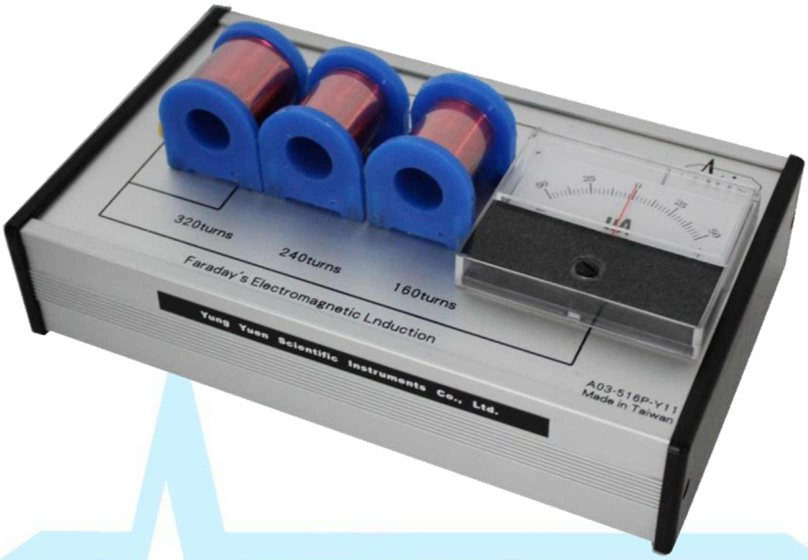
Experiment: Faraday's Electromagnetic Induction



Purpose

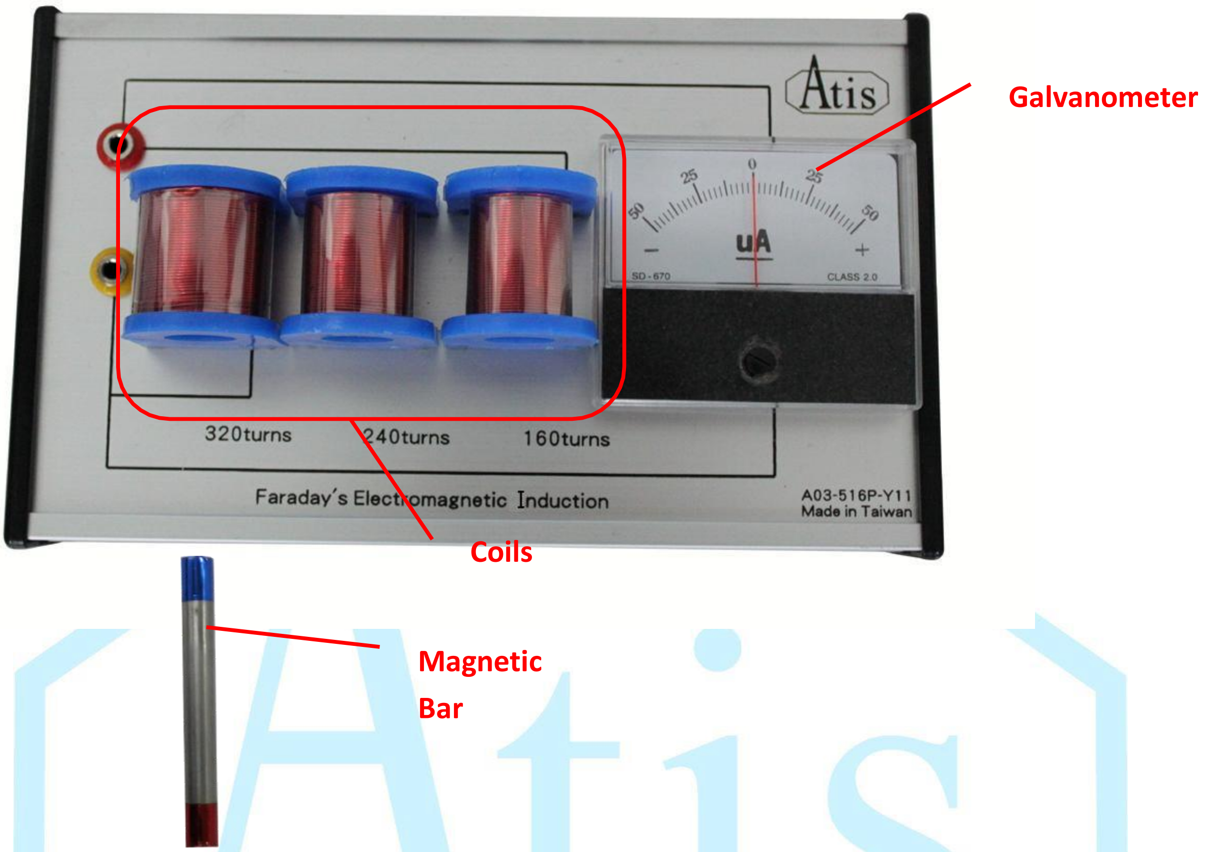
Study the magnitude and direction of the current in the relative motion between magnets and coils.

Theory

In 1831, a British scientist Faraday (Michael Faraday) discovered the relationship between the magnetic field changes and the induced electric field. A conductor produces the induced electromotive force because of the change of the magnetic field, called electromagnetic induction. If a conductor is a closed circuit, the induced electromotive force will be driven by the flow of electrons, which produces the induced current.

In this experiment, we connect the coils of 160 turns, 240 turns and 320 turns with a galvanometer , then insert a magnetic bar in the coils. We can see the pointer of the galvanometer deflect, which means that there are induced current in the coils. If the magnetic bar stays stationary, the galvanometer pointer doesn't move and point to zero. If quickly pull the magnetic bar out of the coil, the pointer deflects to the other direction, which means the direction of the induced current is opposite to the direction of the magnetic bar.

Instrument



Procedure

1. Move the magnetic bar in and out of the 160-turn coil and observe the deflection of the galvanometer.

2. Move the magnetic bar in and out of the coils more quickly to observe the magnitude of the deflection.

3. Repeat the above steps using the 240-turn and 320-turn coils and answer question 1 in the question and discussion part.

4. Take the other magnetic bar and repeat the above steps, and answer question 2 in the question and discussion part.

Questions and Discussions

1. Do the turns of coils affect the deflection of the galvanometer? Describe the relationship between the insert speed and the induced current. (Use the concept of magnetic flux of Faraday's law.)

ANS：When the coil has more turns, the deflection of the galvanometer is greater, which means the induced current is greater, too. There is relative motion between magnets and coils, when the insert speed is higher, the induced current gets bigger, because of the changes of magnetic flux. According to Faraday's law, we know that when the magnetic flux is high, the induced current gets bigger; contrariwise, if the magnetic flux is low, the induced current gets smaller.

2. Why do the different magnetic bars affect the deflection of the galvanometer?

ANS：According to Faraday's law, we know that when the magnetic flux is high, the induced current gets bigger; contrariwise, if the magnetic flux is low, the induced current gets smaller. Because of the magnetic flux magnitude difference, if the two magnetic bars and the coils are at the same speed motion, the magnetic bar which has high magnetic magnitude, the magnetic flux is greater; contrariwise, if the magnetic flux is low, the induced current gets smaller.

3. Brief the phenomenon of electromagnetic induction experiment.

ANS：

1. When the relative motion between the magnets and the coil, there will be producing induced current or electromotive force.

2. Induced current exists in a magnetic bar and the coil when they're in relative motion, if there is no relative motion between the two, then there is no induced current.

3. The faster the relative motion between the magnet and the coil, the greater the current.

4. The magnetic field generated by the induced current of the coils stops the movement of the magnetic bar.

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