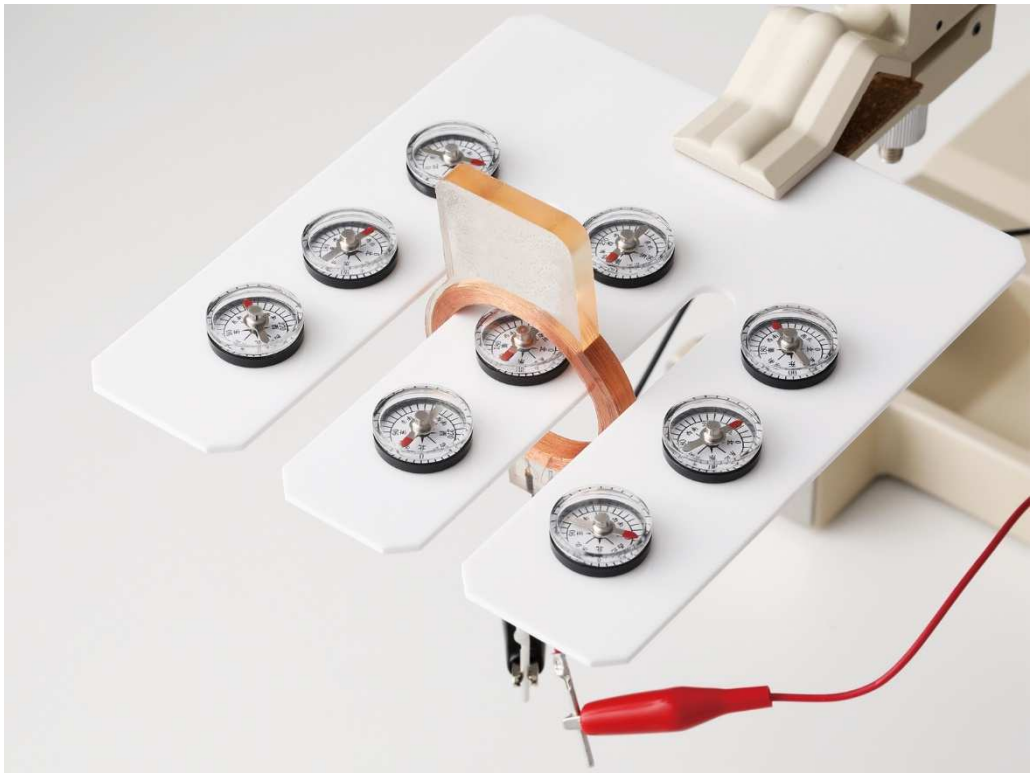
Ampere's Law with Molded Flat Coil

Cat. No. B10-4712-W0



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Introduction

Product's Feature

[Product Description]

This set combines Flat Coils Molded in Plastic (B10-4711-W0), which is hardened with a curing resin to prevent a coil's wire from fraying to have a long life, and small compasses with an E shape pedestal for a magnetic field experiment.

[Overall Advantages to Users]

A contained coil in the set with an outer diameter of 50 mm and an inner diameter of 40 mm is a thin, compact, lightweight, and durable body sealed in resin with 600 windings. The set consists of this durable coil, small compasses, and a pedestal to observe the phenomena of Ampere's law. It may barely fray, loosen, or break like a conventional coil.

[To teachers]

This set containing items necessary for the experiment eases teachers to plan students' experiments for Ampere's law, the magnetic flux generated by current flowing in a coil. In addition, other experiments like the electromagnetic induction based on Faraday's law can be applied by taking advantage of this coil's characteristics (its small size, lightweight, durability, and the number of windings).

[To students]

The student can observe the magnetic flux generated by the current flowing through the coil depending on the direction of the pointers of small compasses on the pedestal.

[Keywords]

*Faraday's law *Electromagnetic induction *Induced electromotive force
*Mutual induction *Ampere's law * Lorentz force

Contents

9 Small compasses Size: ϕ20 mm x ca.7 mm

1 E shape pedestal Size: 150 x 135 x 2(t) mm

Precautions

- **Do not directly connect with the outlet. The coils will be burned.**
- **Do not use it over 12 V. The coil may be burned.**
- **Do not forcibly and strongly pull the wires out. Otherwise, the coils are molded, although, the wires can come out and disconnect.**
- **Do not use the coil over 70℃ as the mold resin may soften.**
- **Repairing the disconnected wire is not available. Purchase a new one.**

How to use

The magnetic flux generated by current flowing in the coil

[Required equipment]

1 Support stand

1 DC Power supply

1 pair of lead wire with clip (red & black)

[Setting up the experiment equipment]

1. Clamp the E shape pedestal horizontally to a support stand (see Fig.1).
2. Slide "Flat Coils Molded in Plastic", its tongue side up, into coves (slits) of E shape of the pedestal till the center (see Fig.1).
3. Connect each of the two plugs of the flat coil to a power supply using clips of lead wires.

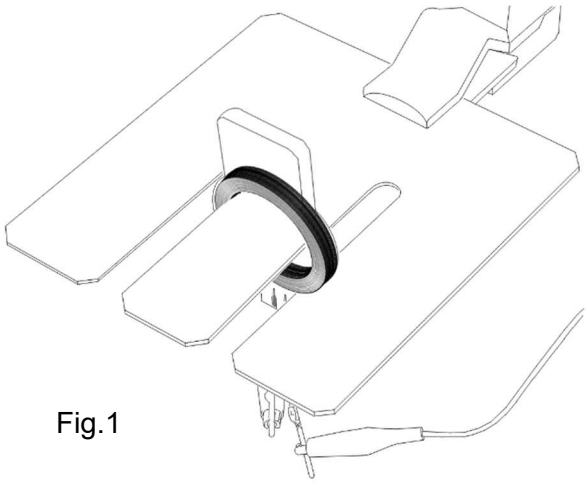

Fig.1

[Observation of Magnetic Flux]

1. Turn on the power supply and set it to DC 10 V.
2. Place four compasses around one side of the flat coil as a center (see Fig.2)

3. Conceive an imaginary magnetic flux along the directions of the pointers in your mind while observing the state of the compasses (see Fig.2).
4. Draw the imaged magnetic flux line on the pedestal with a whiteboard marker while removing each compass (see Fig.2).

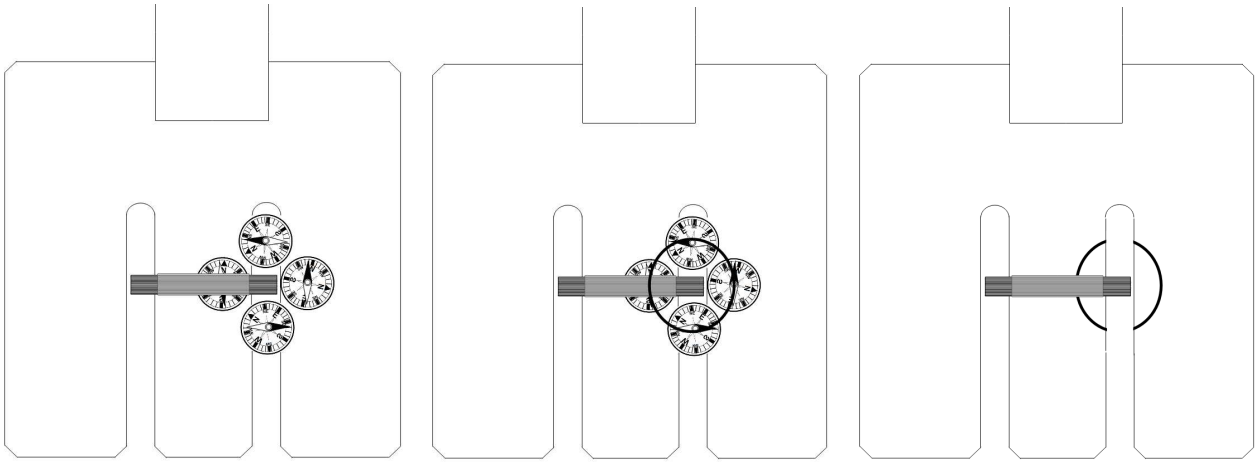

Fig.2 Steps for observing and drawing the magnetic flux line on the pedestal.

5. Place six compasses around one side of the flat coil as a center like in Fig.3 (do not erase the 1st flux line written on the board).
6. Conceive an imaginary magnetic flux along the direction of the pointers in your mind while observing the state of the compasses as the same as in step 3 (see Fig.3).
7. Draw the imaged magnetic flux line on the pedestal with a whiteboard marker while removing each compass as the same as in step 4 (see Fig.3).

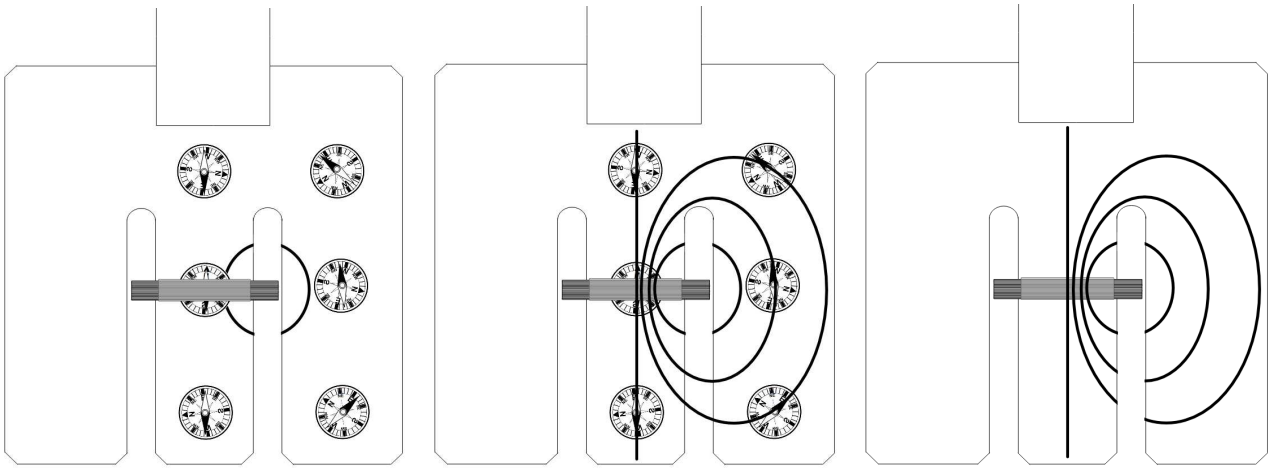

Fig.3 Steps for observing and drawing the magnetic flux lines.

8. Draw the magnetic flux lines on the other side of the pedestal with a whiteboard marker likewise.
9. Complete the magnetic flux lines on the pedestal (see Fig.4).

10. Place nine compasses in each position again to observe the whole magnetic flux around the coil. Additionally, using one of the compasses to check the magnetic flux around the outside of the pedestal will be effective for students learning (see Fig.4).

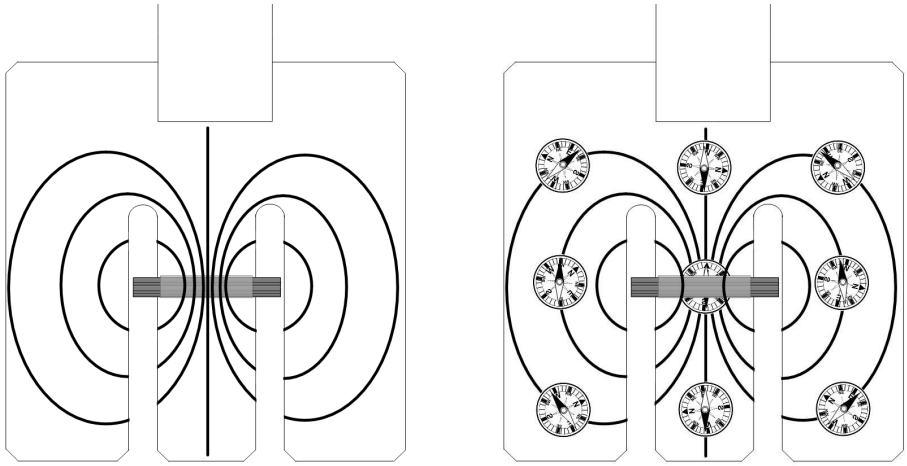

Fig.4 Completed Magnetic flux lines on the pedestal.

Electromagnetic Induction – Effect of Changing Flux from a moving Magnet

[Required other equipment]

1 Galvanometer
1 Bar alnico magnet
1 Pair of red and black lead wires with clips.

[Setting up the experiment equipment]

1. Connect a plastic molded coil to a galvanometer using lead wires (red and black) with the clips (see Fig.5).

[Observation of Electromagnetic Induction]

1. Hold a bar magnet's south or north pole side with your fingers and a coil's tongue with another hand (see Fig.5).
2. Move the bar magnet up and down in the coil.
3. Observe a fluctuating needle of the galvanometer while moving the bar magnet.
4. Change the bar magnet's polarity you held and observe the needle fluctuating while moving the bar magnet in the coil again.
5. Furthermore, move the bar magnet quickly or slowly up and down in the coil and observe the changes of a fluctuating galvanometer's needle.

Although it is possible to observe the electromagnetic induction of Plastic Molded Coils with a general galvanometer, Narika A05-7120 Galvanometer GM-6000 is recommended for this

experiment because of its high sensitivity, which has over 1,000 times of other galvanometers, by a built-in amplifier circuit.

In an advanced way, if you combine computer sensing systems, including an ampere sensor and a voltage sensor, with the coils, you will provide students to analyze the phenomenon of electromagnetic induction in detail using graphs from the systems.

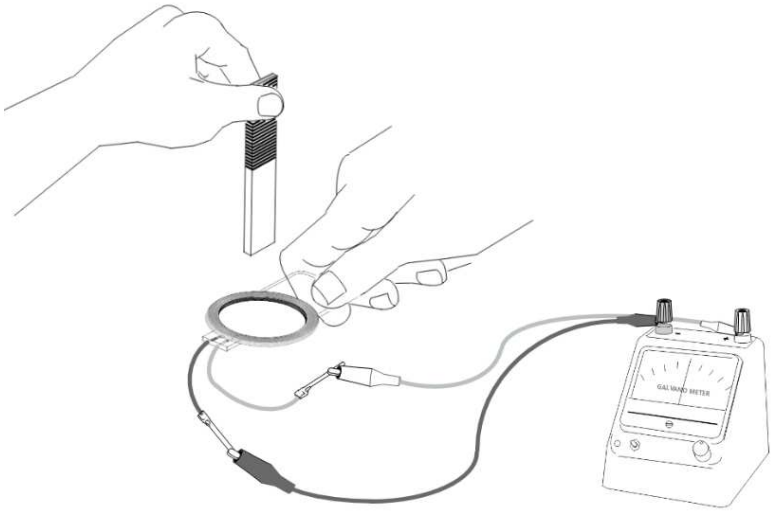

Fig.5 Electromagnetic Induction

Electromagnetic Swing –Lorentz force–

[Required other equipment]

1 Support stand
1 U shaped magnet
1 DC Power supply or Handheld generator (B10-2632-W1 Genecon DUE)
1 Pair of red and black lead wires with clips.

[Setting up the experiment equipment]

1. Connect a plastic molded coil to a power supply or a handheld generator using lead wires (red and black) with the clips (see Fig.6).
2. Hang and clamp lead wires of the plastic molded coil on a support stand so that it can swing like a pendulum (see Fig.6).
3. Place a U shape magnet near the hung coil and arrange its edge of the S or N pole to be the coil center (see Fig.6).

[Observation of Electromagnetic Swing]

1. Turn on the power supply or rotate a handle of a handheld generator.
2. Observe the movement or behavior of the coil swinging when N or S pole of U shape magnet is changed or when the polarity of the power supply or the handheld generator is changed (Fig.6).

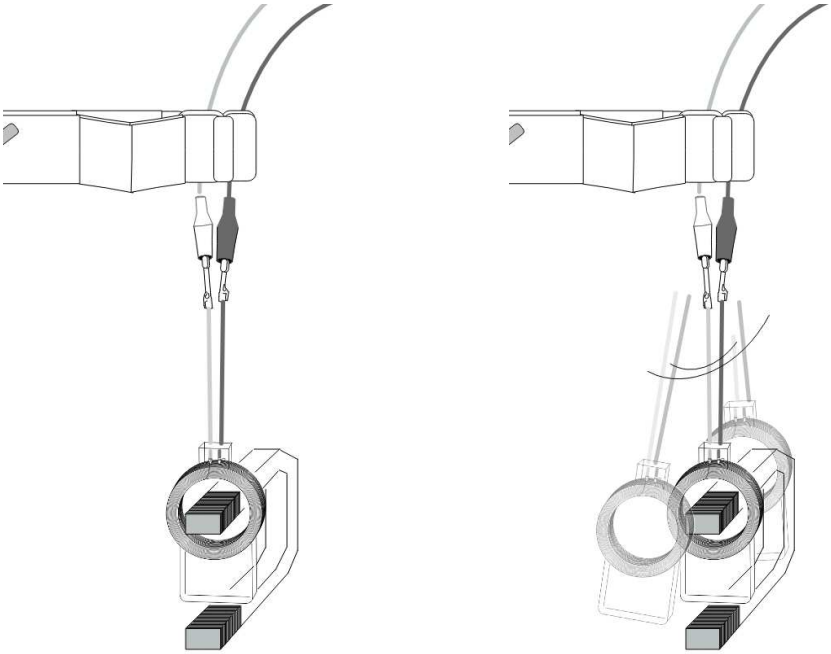

Fig.6 Electromagnetic Swing

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