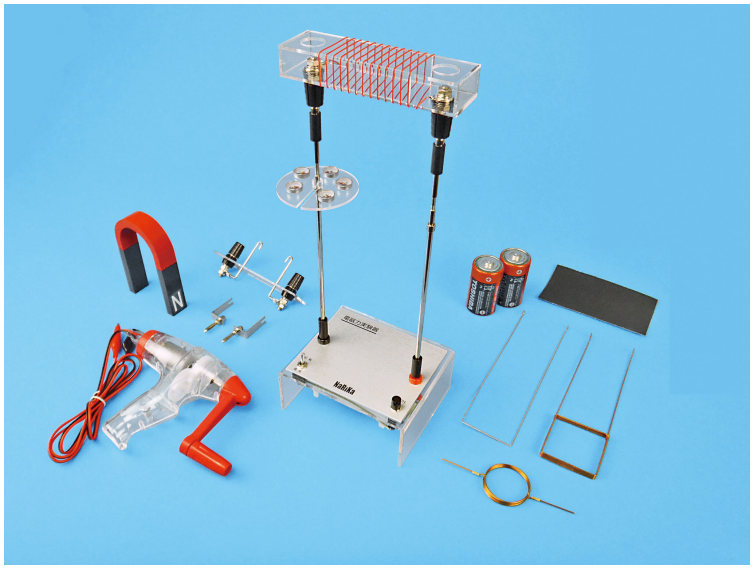
B10-4800-W0

Electromagnetic Force System

Instruction Manual



Thank you very much for purchasing Electromagnetic Force System.
Read all these instructions before use.
The Electromagnetic Force System is specially designed for student experiments in school.

Narika Corporation
2014 Edition

Introduction

The system provides multiple experiments to students such as an experiment of Ampère's circuital law and Fleming's left hand rule. It uses two batteries as the power source or Genecon DUE for those experiments.

Safety Precautions (Read before use.)

⚠Notice

*Keep dry, please do not expose it to water, it may cause failure of the apparatus.

*Check a battery level before the experiment because the apparatus needs a large amount of current (ca. 4A). If the battery level is low, the experiment will not be carried out correctly.

*Keep surface of metal part clean to connect with each part. There is a possibility of a loss of connection to occur during the experiment.

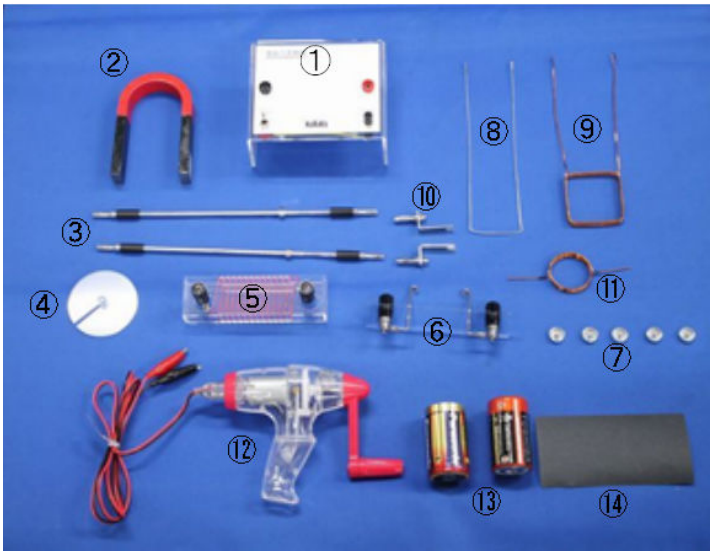
* The batteries will be faster consumed because the apparatus use a big current (ca. 4A).

Features of the apparatus

* The system provides four kinds of experiment which are 1) Making magnetic field by electric current, 2) Magnetic field created by coil, 3) Swing by electromagnet and 4) Motor.

Table of Contents

No	Name of Contents		
1.	Power supply	:	1
2.	U shaped magnet	:	1
3.	Support pillar	:	2
4.	Disk shaped table for compass	:	1
5.	Solenoid coil with plastic box	:	1
6.	Hook for the swing	:	1
7.	Small compass	:	5
8.	Swing (a)	:	1
9.	Swing (b)	:	1
10.	Holder for Coil	:	2
11.	Coil (motor)	:	1
12	Genecon Due	:	1
13.	Battery (D type)	:	2
14.	Sand paper	:	1



Instruction of Experiment

1. Experiment of making magnetic field by electric current (Ampère's circuital law)

1) Assembling apparatus procedure

* Insert two of Support pillar (No. 3) into a plug on Power supply (No. 1), and plug Solenoid coil (with plastic box, No. 5) on top of support pillars. In this experiment, the solenoid coil uses as a connecting bridge between two support pillars (see Fig. 1, 2 and 3).

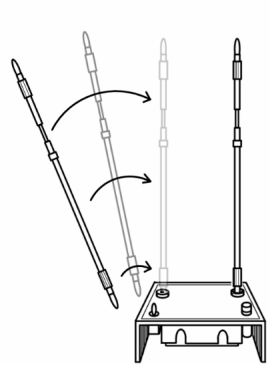


Fig.1

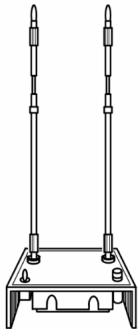


Fig.2

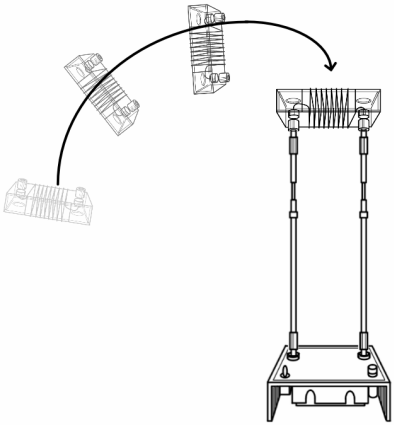


Fig.3

* Insert Disk (No.4) into a narrow area of support pillar and put it onto a stopper ring (see Fig.4).

* Put Small compasses (No. 7) on the disk (see Fig. 5). Fig. 6 shows the completed apparatus for the experiment.

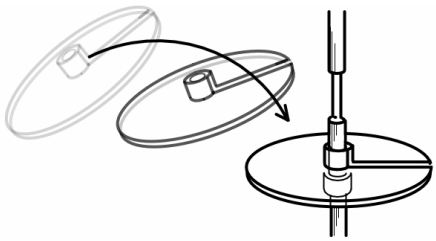


Fig.4

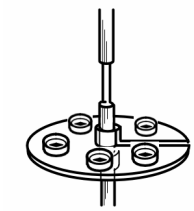


Fig.5

2) Procedure of the experiment

[Using Batteries of as a power supply]

*In case of using batteries, to turn on a switch of power supply in Fig.6. Needle of small compasses on the disk will be moved by the electromagnetic field of support pillar with current flowing.

*When the switch is turn to the other side, the needle of compasses will move different direction. It shows that current flowing direction will make different electromagnetic field.

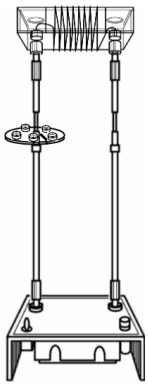


Fig.6

[Using GENECON]

* In case of using GENECON (No.12) as a power supply, you should connect two clips of GENECON with each of the metal part of support pillar (see Fig. 7), and rotate the handle of GENECON clockwise and anticlockwise.

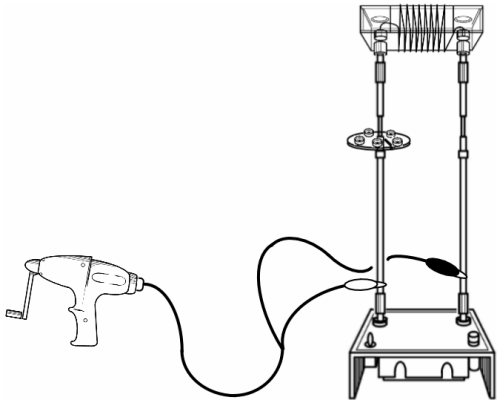


Fig.7

*GENECON generates electricity by turning its handle. When clockwise turning handle, electricity will be provided positive at a red clip, and also when anticlockwise turning handle, it will be provided negative at a red clip.

*Needles of small compasses are moved by the electricity from GENECON, and also the direction of needles of compasses change when the direction of turning handle change.

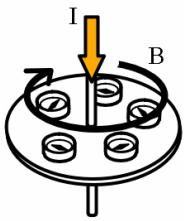


Fig.8

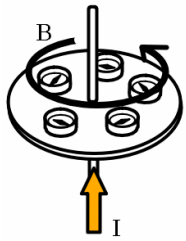


Fig.9

* Both cases of batteries and GENECON, you confirm that the magnetic field creates with current carry, and also you confirm that the direction of magnetic field changes by the direction of current flowing (see Fig.8 and Fig.9).

2. Experiment of magnetic field created by coil.

1) Assembling apparatus procedure

* This experiment uses the same apparatus as in Experiment 1 without the disk. Assembling apparatus procedure is shown in the experiment 1 from Fig. 1 to Fig. 9.

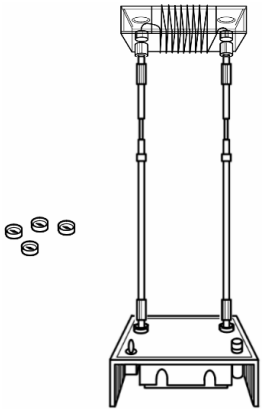


Fig.10

2) Procedure of the experiment

[Using Batteries or GENECON]

*Put four of small compasses anywhere instide the coil or on the coil (see Fig. 11).

*Switch power supply on positive side or rotate the handle of GENECON clockwise. And also, change the switch to negative side or rotate the handle of GENECON anticlockwise.

*You will see needle of the compasses are moving and change its direction depending of polarity of the carrying current.

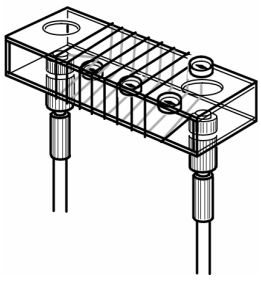


Fig.11

3. Experiment of Swing by electromagnet (Fleming's left hand rule)

1) Assembling apparatus procedure

[Swing (a)]

*Using a model as shown of Fig. 2 as a basic model, set Hook for the swing (No. 6) on top of a basic model, and also hook Swing (a) (No. 8) by the hook for the swing (see Fig. 12 and Fig. 13).

*Set U-shaped magnet in a correct position on power supply, as shown in Fig. 14. Do not set it on a wrong position on the power supply, as shown Fig. 15. At the wrong position, this experiment may fail.

* Turn the alternative switch on, the swing make swinging one direction and other direction by the switch.

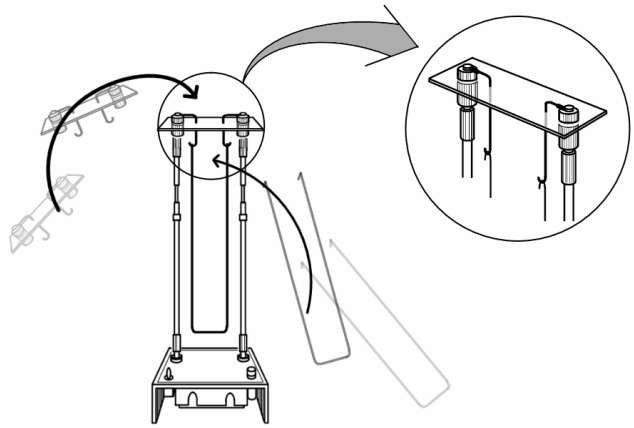


Fig.12

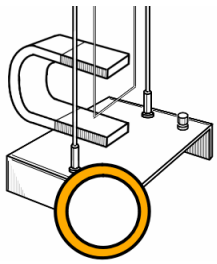


Fig.13

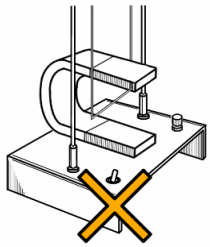


Fig.14

Fig.15

[Swing (b)]

*Using a model as shown on Fig. 2 as a basic model, set Hook for the swing (No. 6) on top of a basic model, and also hook Swing (b) (No. 9) by the hook for the swing (see Fig. 16).

*Set U-shaped magnet in a correct position on power supply, as shown in Fig. 17. Do not set it on a wrong position on the power supply, as shown Fig. 18. At wrong position, this experiment may fail.

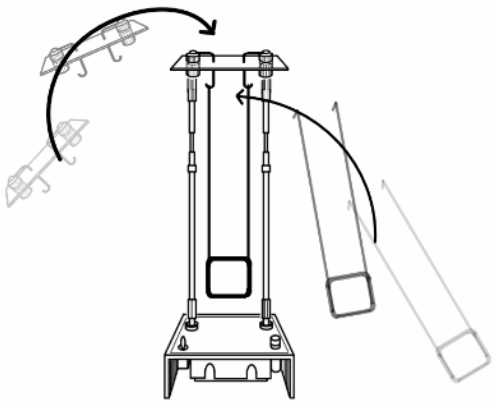


Fig.16

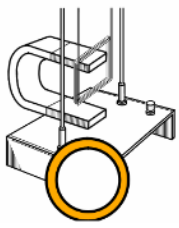


Fig.17

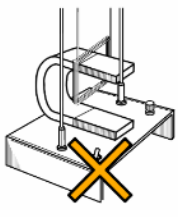


Fig.18

* Student may easier understand that the behavior of Swing (a) or (b) with current flowing in the magnetic field is in compliance with Fleming's left-hand rule based on the result of experiments. When current flows in the swing (a) or (b), and the magnetic field is applied across that flow, the wire experiences a force perpendicular both to that field and to the direction of the current flow.

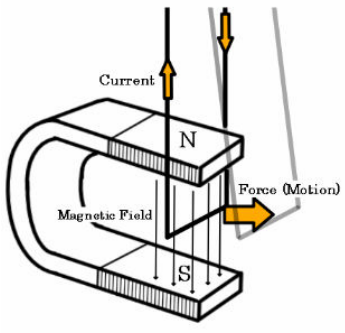


Fig.19

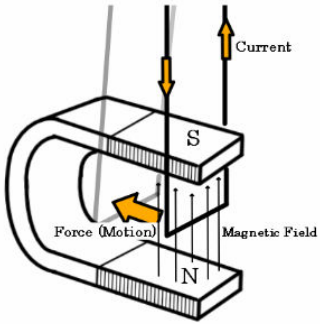


Fig.20

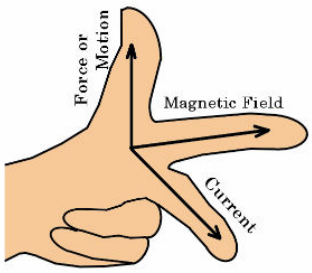


Fig.21

4. Experiment of Motor (Fleming's left hand rule)

[Preparation]

*In the first experiment, the wire coating of Coil (motor) (No.11) should be peeled by a sandpaper (No. 14) (see Fig. 22). If the wire coating is not peeled, the motor does not work.

*After the coating is peeled, one side of the wire should be coated by permanent marker at its half side (see Fig.22). The coated thin film made by marker on the wire is functioning as an insulating film for the motor.

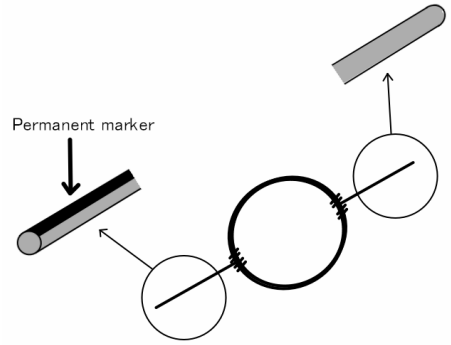


Fig.22

[Assembling apparatus procedure]

*Set Holder for Coil (No. 10) on the power supply (No. 1) (see Fig. 23).

*Set Coil (motor) (No. 11) on the holder for coil (see Fig. 24).

*Set U-shaped magnet on the correct position of the power supply (see Fig. 25).

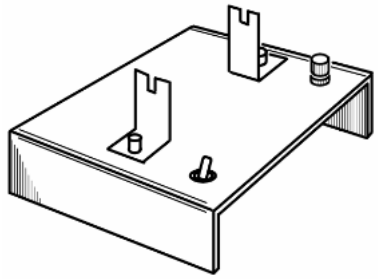


Fig.23

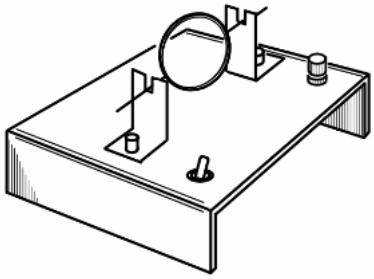


Fig.24

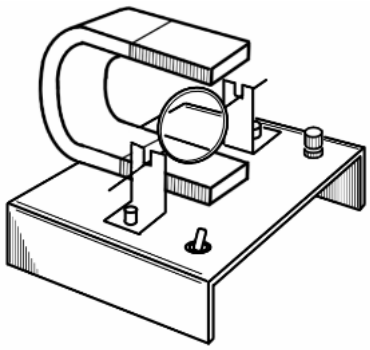


Fig.25

[Note] Before every experiment, you should make the insulating film on the wire by permanent marker!

[Trouble shooting]

1. The apparatus does not work when connected to battery.
   ----- The cause of it will be the poor contact in parts, such as swings and motor.
   ----- Battery life should be check because the apparatuses need a big current (ca. 4A)

2. The motor experiment does not work.
   ----- Check the insulating coating, if it is not suficient use again permanent marker.

3. U-shaped magnet is not stable on the power supply box.
   ----- You should use some spacers to make a stable condition, because enclosed U-shaped magnet has some variability in size.

Memo

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