Generation of induction voltages by a permanent magnet (Item No.: P1398900)

Curricular Relevance

Area of Expertise: Physics
Education Level: Age 16-19
Topic: Electricity
Subtopic: Electromagnetic induction
Experiment: Generation of induction voltages by a permanent magnet

Difficulty	Preparation Time	Execution Time	Recommended Group Size
Intermediate	10 Minutes	10 Minutes	2 Students

Additional Requirements:

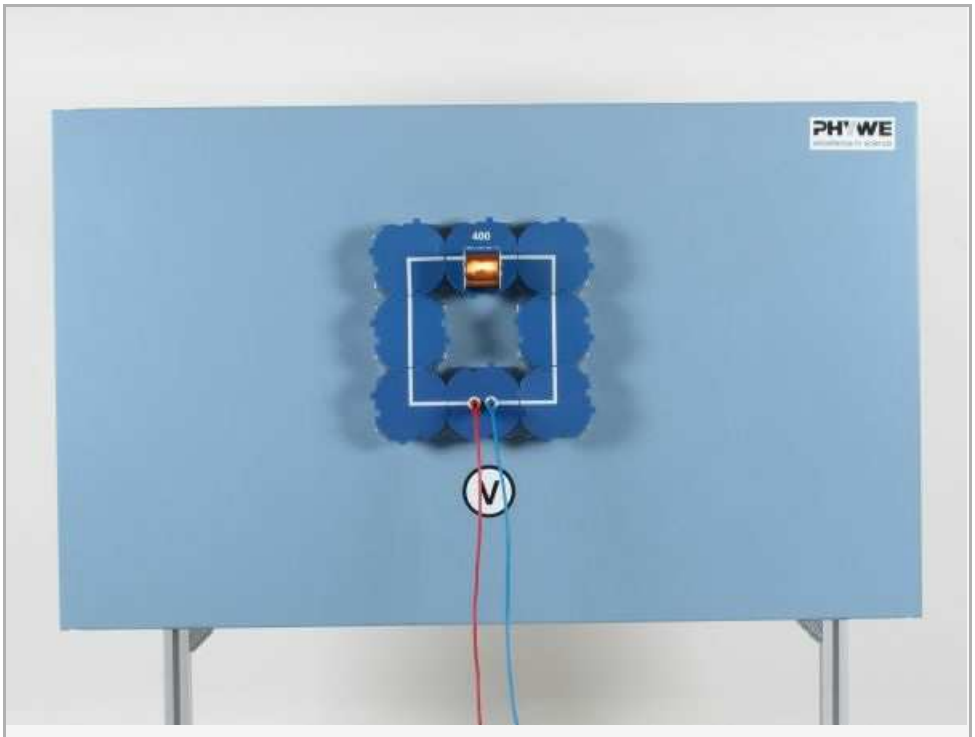
Experiment Variations:

Keywords:

Principle and equipment

Principle

The generation of induction voltages by a permanent magnet is to be demonstrated, and the conditions which govern the size of them are to be investigated.



Experimental set-up

Equipment

Position No.	Material	Order No.	Quantity
1	Multimeter ADM2, demo., analogue	13820-01	1
2	Demo Physics board with stand	02150-00	1
3	Coil 400 turns, module DB	09472-01	1
4	Coil 1600 turns, module DB	09472-02	1
5	Connector interrupted, module DB	09401-04	1
6	Connector, straight, module DB	09401-01	2
7	Connector, angled, module DB	09401-02	4
8	Magnet, bar-shaped, d = 18 mm, l = 70mm	06318-00	1
9	Connecting cord, 32 A, 1000 mm, red	07363-01	1
10	Connecting cord, 32 A, 1000 mm, blue	07363-04	1

Robert-Bosch-Breite 10
D - 37079 Göttingen
Tel: +49 551 604 - 0
Fax: +49 551 604 - 107
info@phywe.de
www.phywe.com

Set-up and procedure

- Set up the experiment as shown in Fig. 1
- Set the 1 0-0-1 0 m V measurement range
- Carry out the following experimental steps successively, in each case under observance of the deflection of the pointer of the voltage measuring instrument (galvanometer); enter each observation in the pre-prepared Table 1.

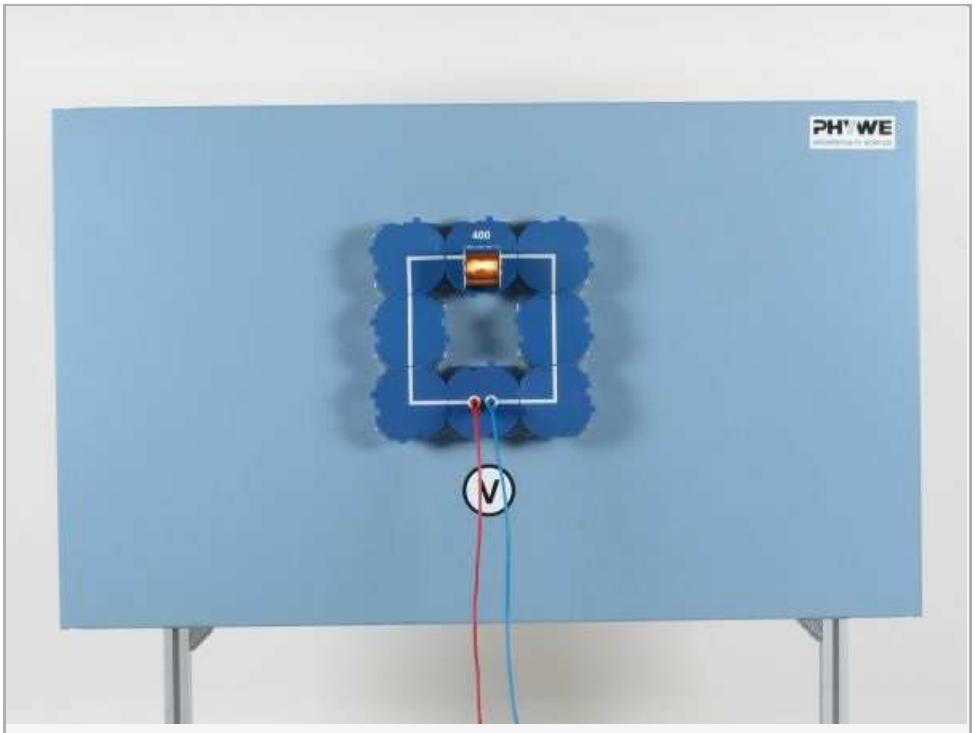


Fig. 1

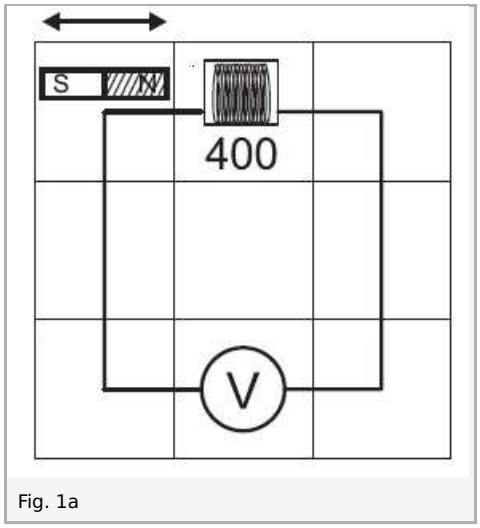


Fig. 1a

Note: The movements in steps 1 to 4, and also step 8, should be carried out at as near the same speed as possible.

1. Move the magnet into the coil with the north pole foremost
2. Remove the magnet from the coil
3. Move the magnet into the coil with the south pole foremost
4. Remove the magnet from the coil
5. Move the magnet quicker into and out of the coil
6. Leave the magnet still in the coil
7. Rotate the magnet lengthwise in the coil
8. Replace the 400 turn coil with the 1600 turn coil and proceed according to steps 1 and 2

Robert-Bosch-Breite 10
D - 37079 Göttingen
Tel: +49 551 604 - 0
Fax: +49 551 604 - 107
info@phywe.de
www.phywe.com

Observation and evaluation

Observation

Table 1

Movement	Pointer deflection (to the left/right, greater/less)
1. North pole into the coil	to the right
2. North pole out of the coil	to the left
3. South pole into the coil	to the left
4. South pole out of the coil	to the right
5. Quicker movement of the magnet	greater
6. Magnet at rest in the coil	no deflection
7. Magnet rotated lengthwise	no deflection
8. As 1 . to 4. with 1600 turn coil	greater

Evaluation

From the results found in steps 1 to 6, it is clear that a voltage is generated, as long as the magnet and the coil are moved relative to one another.
As step 7 shows, the movement must be so that magnetic field that is spanned by the coil is changed. We therefore have: A voltage will be induced in a coil as long as the magnetic field spanned by the coil is changed. The direction of the induced voltage depends on whether the magnet is moved into it or out of it, and which pole of the magnet is directed towards the coil..

The induction voltage is higher the quicker the movement takes place and the more turns the induction coil has. In induction, mechanical energy is coverted to electrical energy. This is the basis of the mode of action of a generator. The process is called electromagnetic induction.

Remarks

The entries in Table 1 have only been made as examples. The observations made in the experiment are dependent on how the voltmeter is connected.

Robert-Bosch-Breite 10
D - 37079 Göttingen
Tel: +49 551 604 - 0
Fax: +49 551 604 - 107
info@phywe.de
www.phywe.com