The alternating current generator (Item No.: P1399100)

Curricular Relevance

Area of Expertise:	Education Level:	Topic:	Subtopic:	Experiment:
Physics	Age 14-16	Electricity	Electric generator, motor, transformer	The alternating current generator

Difficulty	Preparation Time	Execution Time	Recommended Group Size
Intermediate	10 Minutes	20 Minutes	2 Students

Additional Requirements:

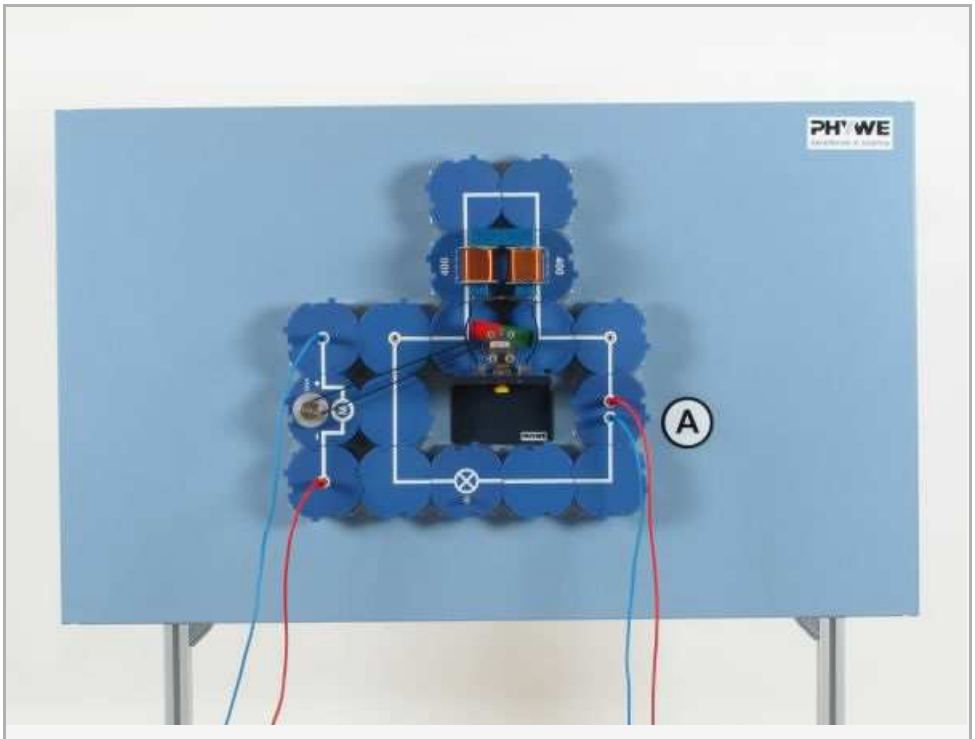
Experiment Variations:

Keywords:

Principle and equipment

Principle

The construction and mode of action of an alternating current generator are to be demonstrated.



Experimental set-up

Equipment

Position No.	Material	Order No.	Quantity
1	Multimeter ADM2, demo., analogue	13820-01	1
2	PHYWE power supply, universal DC: 0...18 V, 0...5 A / AC: 2/4/6/8/10/12/15 V, 5 A	13500-93	1
3	Demo Physics board with stand	02150-00	1
4	Motor model f. magnet board	07850-20	1
5	Coil 400 turns, module DB	09472-01	2
6	Motor 12 V, module DB	09475-01	1
7	U-core	07832-00	1
8	Magn.rotor f.generator model	07850-22	1
9	Socket for incandescent lamp E10 ,module DB	09404-00	1
10	Connector interrupted, module DB	09401-04	1
11	Junction, module DB	09401-10	2
12	Electr.symbols f.demo-board,12pcs	02154-03	1
13	Connector, straight, module DB	09401-01	2
14	Connector, angled, module DB	09401-02	6
15	Connector, angled with socket, module DB	09401-12	2
16	Holder f.electr.motor,magn.board	07849-00	1
17	Filament lamps 4V/0.04A, E10, 10 pieces	06154-03	(1)
18	Connecting cord, 32 A, 1000 mm, red	07363-01	2
19	Connecting cord, 32 A, 1000 mm, blue	07363-04	2

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

- Fit the magnetic rotor in the model of a motor and set up the experiment as shown in Fig. 1, at first without the driving belt
- Select the 10–0–10 mA measurement range
- Move the rotor by hand at different speeds by means of the countered milled screw; observe the ammeter and the lamp (1)
- Select the 100 A~ measurement range and bring the rotor to a horizontal position; fit the driving belt on
- Apply a 5…6 V direct voltage to the motor and switch on the power supply; observe the lamp and the measuring instrument (2)
- Vary the speed of revolution of the motor, and so of the generator, by increasing and decreasing the voltage several times; observe the lamp and the measuring instrument (3)
- If possible, set the measuremenr range for direct current, e.g. set 100 mA, and in a brief "continuous operation" observe the lamp and the measuring instrument (4)

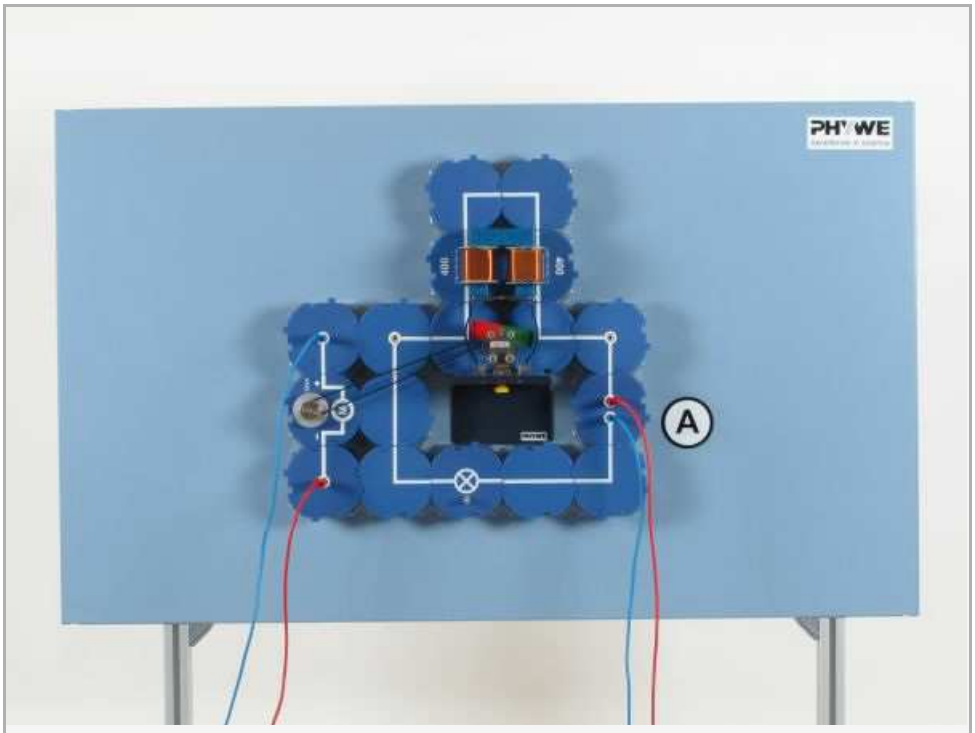


Fig. 1

Observation and evaluation

Observation

1. When the magnet is turned by hand, i.e. relatively slowly, the measuring instrument deflection is alternately to the left and the right, the lamp does not light up.
2. When the magnet is driven by the motor, i.e. revolves rapidly, then the lamp lights up and the measuring instrument shows an alternating current of approx. 40 mA.
3. The higher the speed of revolution, the greater are the current and the brightness of the lamp.
4. The lamp lights up, but the measuring instrument shows no current.

Evaluation

An alternating current is induced when the magnet is turned past the ends of the coils. The larger the area of the magnetic field of the permanent magnet that the coil spans, i.e. the quicker the magnet rotates, the higher the current.

An electric motor that generates electrical energy from mechanical energy is called a generator. it consists of a stator (carries the induction coils in this experiment), a rotor (carries the permanent magnet in this experiment) and a receiving device for the electrical current generated.

The receiving device used in this experiment is in the form of an inner pole machine, with the the connections of the induction coils on the stator. With an outer pole machine, the rotor carries slip rings.

The last step in the experiment shows that a direct current measuring instrument cannot be used to measure alternating current, as the pointer of the measuring instrument cannot follow the rapid alternation in the direction of the current, so that the measuring system could be damaged or even destroyed.

Remarks

The last step in the experiment, together with the corresponding observations and their evaluation, are recommended as a supplement. They are not necessary for the understanding of the construction and mode of action of an alternating current generator but are, however, of educational importance with respect to the proper, independent handling of measuring instruments by students when they are carrying out experiments on alternating current.

Alternating current generators with permanent magnets are only put to use when relatively low electrical performances are required, for example for bicycle lights. In higher performance alternating current generators, the magnetic fields are generated by electromagnets, which conduct the excitation current via slip contacts and slip rings.

For the detection of the current generated by turning by hand, a light-emitting diode (article no.: 09454-00) can be used instead of the filament lamp. This will periodically light up at relatively low speeds of revolution of the rotor.

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www.phywe.com