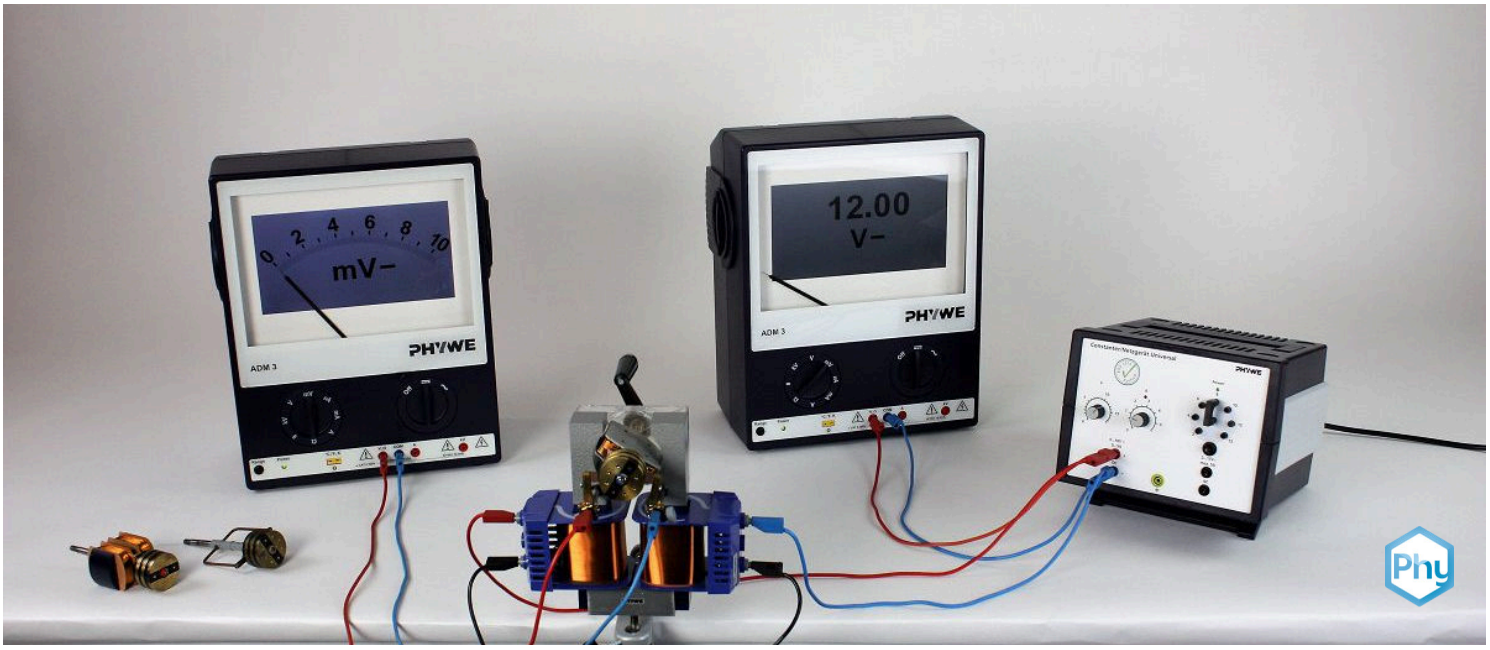
Comparison of the rotor coils (DEMO)



Physics > Electricity & Magnetism > Electromagnetism & Induction

Difficulty level	Group size	Preparation time	Execution time
medium	-	10 minutes	20 minutes

This content can also be found online at:

http://localhost:1337/c/649302513759e100020691e8

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Teacher information

Application

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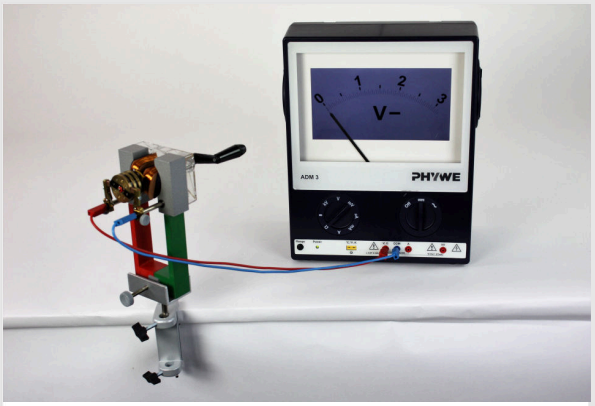

Experimental setup

An electrical generator is an electrical machine that converts kinetic energy into electrical energy. The generator is the counterpart to the electric motor, which converts electrical energy into kinetic energy. It is based on the principle of electromagnetic induction discovered by Michael Faraday in 1831.

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Other teacher information (1/2)

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Prior knowledge

No prior knowledge is required.

Principle

In this experiment, individual components of a direct current generator are tested. In the first part of the experiment, the effect of the number of turns of the rotor coil is examined. In the second part, an electromagnet is installed instead of a permanent magnet and the voltage of the electromagnet is examined.

Other teacher information (2/2)

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Learning objective

Students should understand how a DC generator works.

Tasks

Investigate the dependence of the induction voltage on the number of turns of the rotor coil.

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Student information

Motivation

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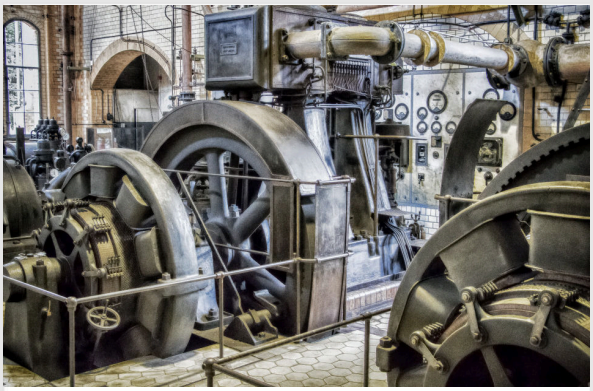

Historical generator

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Equipment

Position	Material	Item No.	Quantity
1	PHYWE Power supply, universal, analog display DC: 18 V, 5 A / AC: 15 V, 5 A	13503-93	1
2	PHYWE Demo Multimeter ADM 3: current, voltage, resistance, temperature	13840-00	2
3	Bench clamp	02012-00	1
4	Plate holder, opening width 2 - 35 mm	06509-00	1
5	U-magnet, large, U-shaped, limb length 130 mm, colored poles	06320-00	1
6	Motor set	06550-00	1
7	Cord pulley	06558-01	1
8	Crank handle	06559-01	1
9	Rotor coil, Double-T armature	06554-00	1
10	Rotor coil,10 turns	06552-00	1
11	Rotor coil,1 turn	06551-00	1
12	Iron core, U-shaped, laminated	06501-00	1
13	Coil, 1200 turns	06515-01	2
14	Connecting cord, 32 A, 750 mm, red	07362-01	3
15	Connecting cord, 32 A, 750 mm, blue	07362-04	3
16	Connecting cord, 32 A, 750 mm, black	07362-05	1

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Set-up (1/3)

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Experiment part 1:

- Assemble the motor attachment according to fig. 1 and fig. 2.
- Push the axle [1] of the double T-anchor into the bearing hole [3] of the motor attachment, screw it tight with the pulley [2] and put the crank on the pulley.
- Place the abrasive brushes [4] of the motor attachment on the interrupted slip ring [7] as shown in Fig. 2 and fasten them with the knurled screws [5] so that the springs are tensioned and the brushes press on the slip rings.

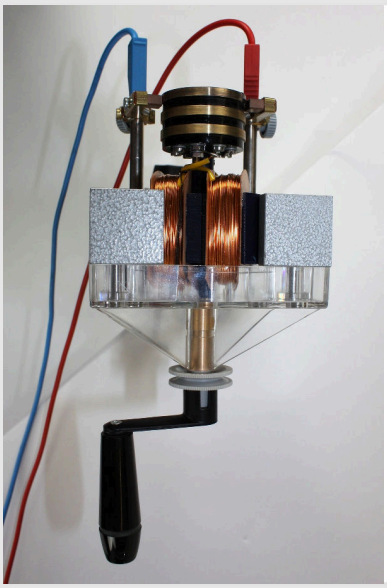

Fig. 1

Set-up (2/3)

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- Tighten the knurled screws [5]. This establishes the electrical contact between the armature coils and the connection sockets [6].
- Set up the experiment according to Fig. 3.

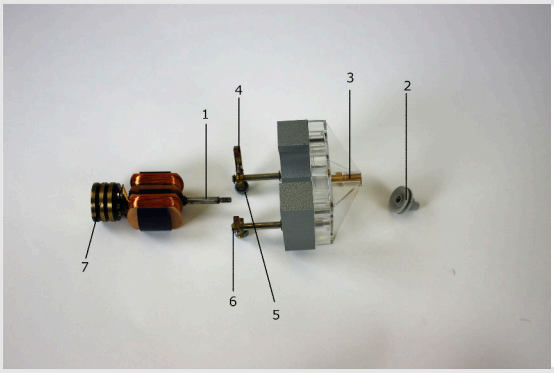

Fig. 2

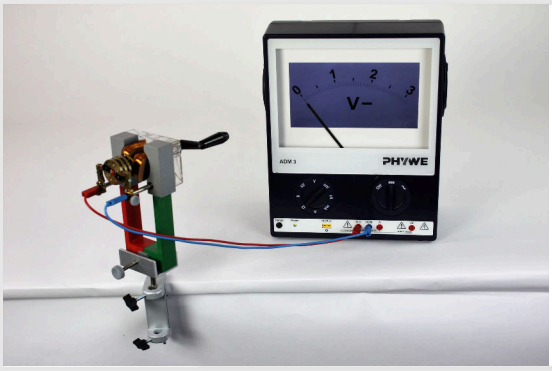

Fig. 3

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Set-up (3/3)

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Experiment part 2:

- Set up the experiment according to Fig. 4.
- Assemble the motor as in experiment part 1 (fig. 1 and 2).
- Place the coils (1200 turns) on the iron core and connect them in series with the power supply unit (direct current).
- Connect a second demonstration multimeter in parallel to the voltage source.

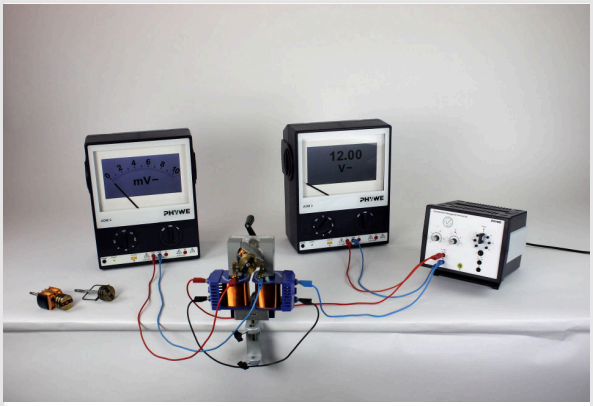

Fig. 4

Procedure (1/2)

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Experiment part 1:

- Select a suitable measuring range (0 V - 3 V) for the demonstration multimeter.
- crank at constant speed and note the induced voltage in report 1.
- Rebuild the generator. Insert the rotor coil with 10 turns. Adjust the measuring range of the demonstration multimeter (0 mV - 10 mV).
- crank at approximately the same speed as for the double-T armature and note the induced voltage in report 1.
- Rebuild the generator again. Insert the rotor coil with 1 turn. Adjust the measuring range of the demonstration multimeter (0 mV - 1 mV).
- crank again at approximately the same speed and note the induced voltage in report 1.

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Procedure (2/2)

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Experiment part 2:

- Select the digital measurement display for the demonstration multimeter to measure the supply voltage.
- Choose a suitable measuring range for the demonstration multimeter, which measures the induced voltage of the rotor coils. For the double-T armature approx. 0 V - 3 V, 10 turns approx. 0 mV - 10 mV, 1 turn approx. 0 mV - 1 mV.
- Crank with constant speed.
- Limit the current at the power supply unit to 1 ampere and increase the voltage at the power supply unit in 4 V steps. Note the induction voltage for each 4 V step in report 2.
- Rebuild the generator and repeat the experiment with the rotor coil with 10 turns and 1 turn.

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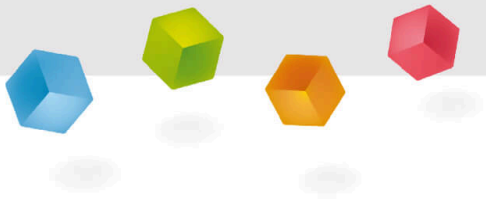

Report

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Task (1/5)

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Measured values test part 1:

	Double T anchor	Rotor coil 10 turns	Rotor coil 1 turn
U_{ind} [mV]			

Task (2/5)

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Measured values test part 2:

U_0 [V]	Double T	Rotor coil 10 turns	Rotor coil 1 turn
0			
4			
8			
12			
16			

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Task (2/5)

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Measured values test part 2:

U_0 [V]	Double T	Rotor coil 10 turns	Rotor coil 1 turn
0			
4			
8			
12			
16			

Task (3/5)

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What is the dependence between induction voltage and supply voltage?

- antiproportional
- No dependence
- proportional

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Task (4/5)

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Drag the words into the correct boxes!

The _____ has 2 times 300 turns. From point 2, this should produce an _____ 60 times higher than the _____ with _____ turns. However, the induced voltage is much higher. The reason for this is the _____ of the double-T armature.

- iron core
- double-T armature
- induction voltage
- 10
- rotor coil

Check

Task (5/5)

PHYWE

Drag the words into the correct boxes!

The _____ is _____ with a higher _____, as well as with a higher supply voltage, since you have to crank _____.

- clearly noticeable
- mechanical energy
- number of turns
- more forcefully

Check

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