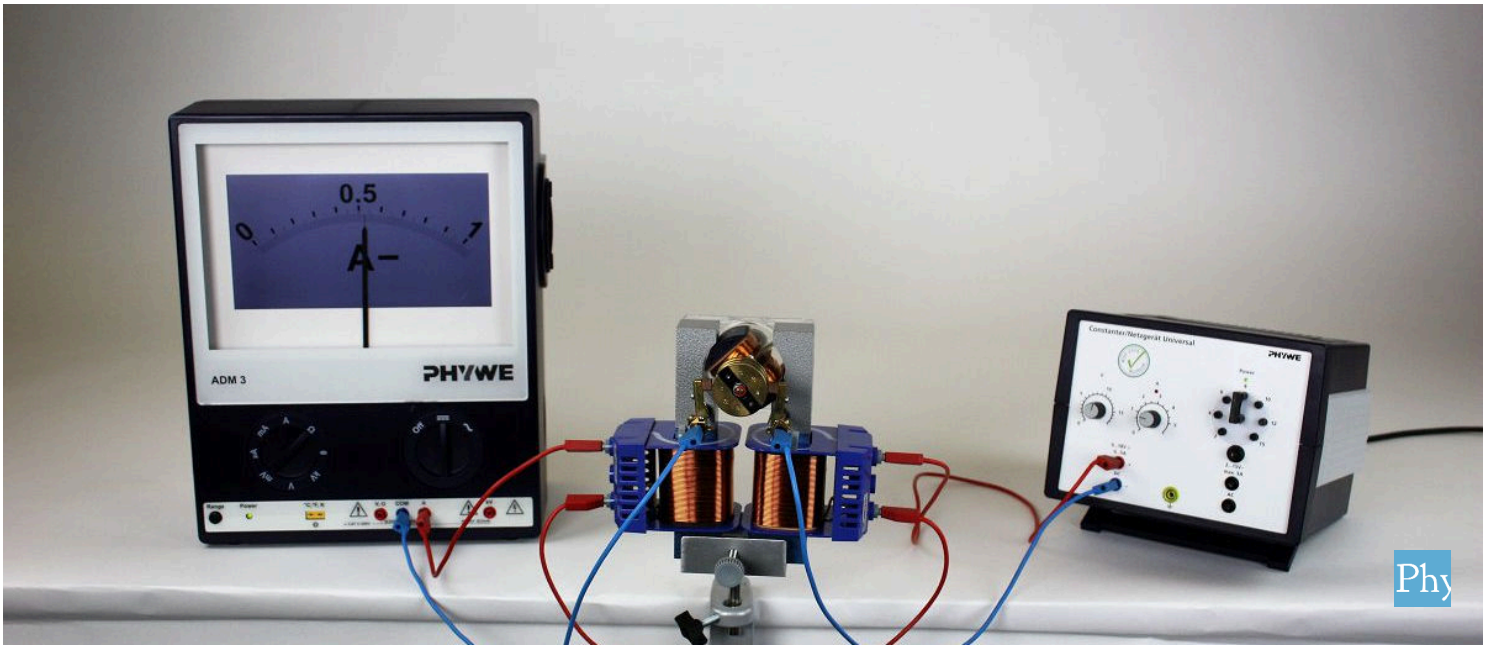
The main closing motor (DEMO)



Physics > Electricity & Magnetism > Electromagnetism & Induction

Physics > Electricity & Magnetism > Electric generator, motor, transformer

Difficulty level	Group size	Preparation time	Execution time
medium	1	10 minutes	20 minutes

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

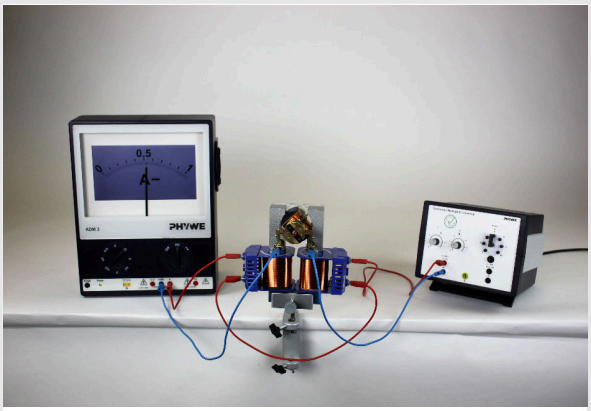
info@phywe.de
www.phywe.de

PHYWE
excellence in science

Teacher information

Application

PHYWE
excellence in science



Test setup

Electric motors are installed in many machines. Be it the electric car or the electric toothbrush. An electric motor can be operated with an electromagnet as well as a permanent magnet. If armature coils and field coils are connected in series, then it is a main shunt motor.

The properties of this motor are investigated by observing the direction of rotation and measuring the current. In this experiment, the principle of the main shunt motor is clarified.

PHYWE excellence in science
Robert-Bosch-Breite 10
37079 Göttingen
Tel.: 0551 604 - 0
Fax: 0551 604 - 107
info@phywe.de
www.phywe.de

Other teacher information (1/2)

PHYWE excellence in science

Previous

No prior knowledge is required.

Principle

The attraction and repulsion of magnetic fields causes the motor to rotate. The external magnetic field is generated by the coils connected in series. The T-armature also forms a magnetic field, which is reversed at the right time with the help of a commutator.

Other teacher information (2/2)

PHYWE excellence in science

Learning

Students should understand how a main shunt motor works.

Tasks

Investigate how a main shunt motor works with direct current.

PHYWE excellence in science

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

PHYWE excellence in science

Student Information

Motivation

PHYWE excellence in science

Electric motors are installed in many machines. Be it the electric car or the electric toothbrush. An electric motor can be operated with an electromagnet as well as a permanent magnet. If armature coils and field coils are connected in series, then it is a main shunt motor.

The properties of this motor are investigated by observing the direction of rotation and measuring the current. In this experiment, the principle of the main shunt motor is clarified.

An electric car

PHYWE excellence in science

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Equipment

Position	Material	Item No.	Quantity
1	PHYWE Power supply, universal DC: 0...18 V, 0...5 A / AC: 2/4/6/8/10/12/15 V, 5 A	13504-93	1
2	PHYWE Demo Multimeter ADM 3: current, voltage, resistance, temperature	13840-00	1
3	Bench clamp	02012-00	1
4	Plate holder, opening width 2 - 35 mm	06509-00	1
5	Iron core, U-shaped, laminated	06501-00	1
6	Coil, 300 turns	06513-01	2
7	Motor set	06550-00	1
8	Rotor coil, Double-T armature	06554-00	1
9	Cord pulley	06558-01	1
10	Connecting cord, 32 A, 750 mm, red	07362-01	3
11	Connecting cord, 32 A, 750 mm, blue	07362-04	2

PHYWE excellence in science
Robert-Bosch-Breite 10
37079 Göttingen
Tel.: 0551 604 - 0
Fax: 0551 604 - 107
info@phywe.de
www.phywe.de

Structure (1/2)

PHYWE excellence in science

- Assemble the motor attachment as shown in Fig. 1.
- Slide the axle [1] of the double T-anchor into the bearing bore [3] of the motor attachment and screw it tight with the cord washer [2].
- Place the brushes [4] of the motor attachment against the interrupted copper ring [7], tighten the knurled screws [5] slightly upwards so that the spring of the lever arms is tensioned. This presses the brushes firmly onto the copper ring. The electrical contact between armature coils and connection sockets [6] is established.

Fig. 1

Structure (2/2)

PHYWE excellence in science

- Complete the structure according to Fig. 2 and Fig. 3.
- Clamp the iron core with holder in the table clamp.
- Place the coils and motor attachment on the iron core.
- Set the DC voltage at the power supply unit to 0 V-.
- Connect field coils and armature coil in series and connect the motor to the power supply via the meter.

Fig. 2

PHYWE excellence in science

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Procedure

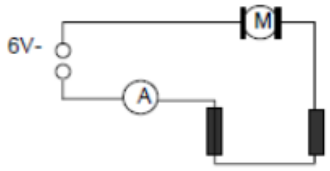


Fig. 3

- Set the voltage to approx. 6 V-, you may have to "start" the motor by turning it.
- Change the voltage. Observe speed and meter.
- Set the voltage to 0 V-. Reconnect the operating voltage at the power supply unit. Increase the voltage and observe the direction of rotation.
- Set the voltage to 0 V-. Reverse the polarity of the voltage at the terminals of the armature coil. Increase the voltage and observe the direction of rotation.
- Load the motor by finger pressure on the pulley. Observe speed and meter.

Report

Robert-Bosch-Breite 10
37079 Göttingen
Tel.: 0551 604 - 0
Fax: 0551 604 - 107
info@phywe.de
www.phywe.de

Task (1/6)

PHYWE excellence in science

How does the speed of the motor and the amperage change as the voltage increases?

- The speed and the current increase.
- The speed changes little, the current increases.
- The speed and the current change little.
- The speed increases, the current changes little.

Task (2/6)

PHYWE excellence in science

By reversing the polarity of the operating voltage...

- ... the direction of rotation changes.
- ... the engine stops.
- ... the direction of rotation remains constant.

PHYWE excellence in science

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Task (3/6)

PHYWE excellence in science

If the direction of current changes only in the armature coil,...

- ... the direction of rotation remains constant.
- ... the direction of rotation changes.
- ... the motor stops turning.

Task (4/6)

PHYWE excellence in science

Under increased load...

- ... the speed of the motor increases and the current decreases.
- ... the speed of the motor increases and the amperage increases.
- ... the speed of the motor decreases and the amperage decreases.
- ... the speed of the motor decreases and the amperage increases.

PHYWE excellence in science

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Task (5/6)

Drag the words into the correct boxes!

If an _____ is used to operate an _____, it must generate a sufficiently large _____ in the vicinity of the armature. Therefore a U-shaped iron core with two field coils is used, between whose poles the armature runs. The _____ and field coils are connected in _____ in a main shunt motor (Fig. 3).

- electromagnet
- series
- magnetic field
- electric motor
- armature coils

Check

Task (6/6)

Drag the words into the correct boxes!

When the polarity of the _____ is reversed, both the field of the armature coil and that of the _____ are reversed, so that the _____ remains the same. If, on the other hand, only the _____ of the armature coil changes, then only this magnetic field changes its _____ and thus also the direction of rotation.

- field coils
- direction
- sense of rotation
- operating voltage
- current direction

Check

Robert-Bosch-Breite 10
37079 Göttingen
Tel.: 0551 604 - 0
Fax: 0551 604 - 107
info@phywe.de
www.phywe.de

Slide	Score/Total
Slide 12: Engine speed	0/1
Slide 13: Reversing the polarity of the operating voltage	0/1
Slide 14: Current direction of the armature coil	0/1
Slide 15: Behaviour under load	0/1
Slide 16: Main shunt motor	0/5
Slide 17: Behaviour during polarity reversal	0/5

Total score 0/14

Show solutions Repeat

PHYWE excellence in science

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de