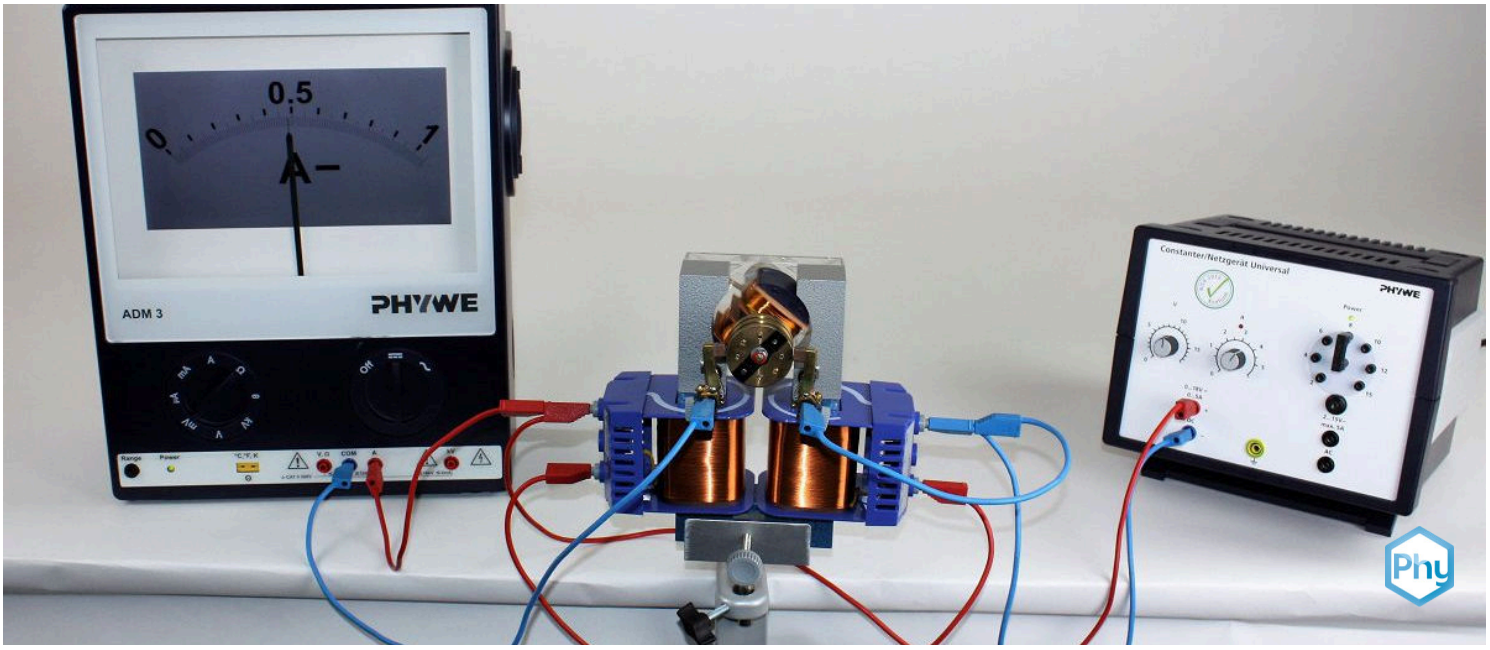
The shunt motor (DEMO)



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

This content can also be found online at:

http://localhost:1337/c/617aac338e47ed0003a82b8e

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Teacher information

Application

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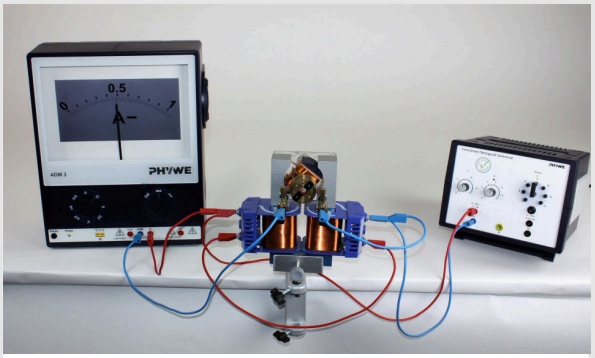

Test setup

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 parallel, then it is a shunt motor.

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

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Other teacher information (1/2)

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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 parallel. The T-armature also forms a magnetic field, which is reversed at the right time with the aid of a commutator.

Other teacher information (2/2)

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Learning

Students should understand how a shunt motor works.

Tasks

Investigate how a shunt motor works and how the motor speed can be affected.

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Student Information

Motivation

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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 parallel, then it is a 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 shunt motor is clarified.

An electric car

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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, 1200 turns	06515-01	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	3

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Structure (1/2)

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- 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 grinding brushes [4] of the motor attachment against the interrupted copper ring [7]. Pull the knurled screws [5] slightly upwards and tighten them 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.

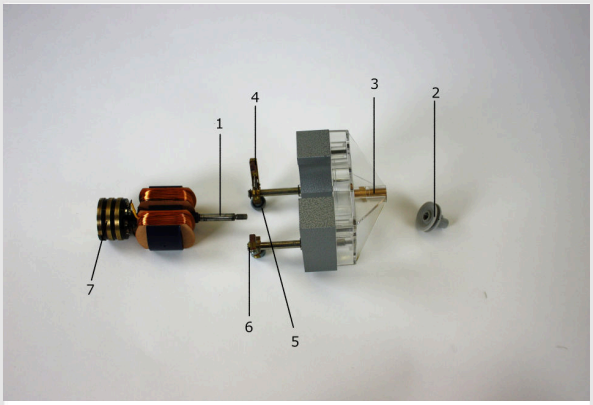

Fig. 1

Structure (2/2)

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- 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 the two field coils in series.
- Connect armature coil and meter in series.
- Connect field coils and armature coil (with meter in series) in parallel.

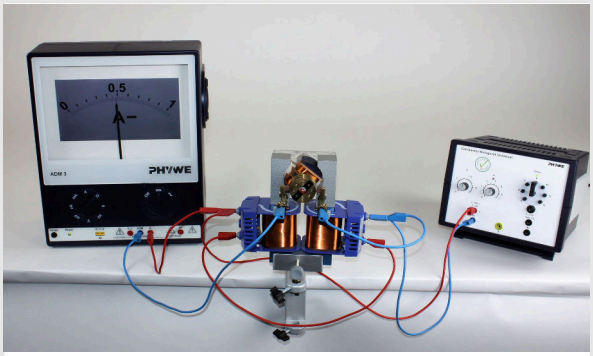

Fig. 2

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Procedure

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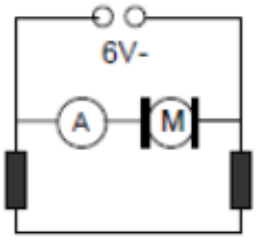

Fig. 3

- 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.

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Report

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Task (1/6)

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

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

Task (2/6)

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By reversing the polarity of the operating voltage...

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

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Task (3/6)

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

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

Task (4/6)

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Under increased load...

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

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Task (5/6)

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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 _____ runs. Armature coils and _____ are connected _____ in a shunt motor (Fig. 3).

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

Check

Task (6/6)

PHYWE

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.

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

Check

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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: Shunt motor	0/6
Slide 17: Behaviour during polarity reversal	0/5

Total score 0 / 15

Show solutions Repeat

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