Rotary motion by turbulent flow - principle of the alternating current meter (Item No.: P1298700)

Curricular Relevance

Area of Expertise: Physics

Education Level: Age 16-19

Topic: Electricity

Subtopic: Electromagnetic induction

Experiment: Rotary motion by turbulent flow - principle of the alternating current meter

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

Additional Requirements:

Experiment Variations:

Keywords:

eddy currents, force, alternating field

Task and equipment

Introduction

A metal disc rotates on a bearing-mounted shaft in the presence to two out-of-phase alternating magnetic fields. Eddy currents are induced in the disc and forces are imparted onto this current-carrying conductor. Out-of-phase alternating fields also cause the rotational movement in an AC electricity meter.

Note

Required voltage: 25 V AC

Task

Observe the disc after switching on the current.

Equipment

Position No.	Material	Order No.	Quantity
1	Aluminium disk	06564-00	1
2	Iron core, U-shaped, laminated electric steel	06501-00	1
3	Pole pieces for U-cores	06493-00	1
4	Short-circuit ring	06565-00	1
5	Coil, 300 turns	06513-01	1
6	Bolt with pin	02052-00	1
7	Tripod base PHYWE	02002-55	1
8	Right angle clamp expert	02054-00	1
9	Support rod, stainless steel, l = 250 mm, d = 10 mm	02031-00	1
10	PHYWE variable transformer with digital display	13542-93	1

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Setup and procedure

Setup

Set-up the experiment as shown in Fig. 1.

Mount the aluminum disc rotatable onto the rod with pin. Take care that no clamping friction will occur.

The lower part of the disc has to be located between the pole pieces of the electromagnet. Put the short-circuit ring on the pole piece with slit.

Fig. 1

Procedure

When switching on the current, the disc will be penetrated by two phase-shifted magetic alternating fields: once of the field of the electromagnet and of the field induced of the alternating current into the short-circuit ring.

After application of the voltage, the disc begins to rotate.

Results and evaluation

A metallic disc, penetrated from two phase-shifted magnetic alternating fields, experiences a force. This way, a rorevolving disc can be forced to rotation.

Cause of the disc's rotation are the eddy currents induced in the disc. The eddy currents make the disc to a current flown conductor inside of a magnetic field which leads to an acting force.