3B SCIENTIFIC® PHYSICS

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Induction apparatus 1000968

Operating instructions

02/16 SP/ALF

1 Operating voltage terminals
2 Pole changeover switch
3 Basic instrument
4 Frame with coil
5 Magnet plate
6 Conveyor belt

1. Description

The induction apparatus allows demonstration and investigation of an induced voltage resulting from the motion of a coil wound onto a frame passing over a plate of magnets. By varying the coil frame's speed and the number of turns in the coil itself, the law of induction can be quantifiably verified by experiment. The rolling motion of a current carrying conductor can also be demonstrated in the magnetic field of the magnet plate of this apparatus.

The coil is moved at a constant speed over the magnet plate by a motor driving a belt. This produces a constant induction voltage. The direction of the coil's movement can be reversed using a switch and the speed can be varied via the operating voltage. The transparent design of the magnet plate and the frame with coil allows the equipment to be used in combination with an overhead projector.

2. Contents

1 Basic instrument
1 Frame with coil
1 Plate of magnets
1 Brass tube
1 Fleece

3. Technical data

Frame with coil:	185 x 125 mm²
Coil taps:	800, 1600. 2400 turns
Total dimensions:	585 x 200 x 55 mm³
Operating voltage:	2 – 12 V DC
Connection terminals:	4-mm safety sockets
Weight:	3 kg approx.

4. Sample experiments

4.1 General instructions

The following equipment is also needed for the experiments:

1 DC-Power Supply, 0 – 20 V @230	1003312
or	
1 DC-Power Supply, 0 – 20 V @115	1003311
1 Analogue-Multimeter Escola 30	1013526

- Before beginning an experiment, the metal tracks on the plate of magnets, as well as the brass tube must be rubbed with the fleece to ensure good electrical contact.
- Set up the induction apparatus either on top of an an overhead projector or on a bench.

4.2 Movement of a current-carrying conductor in a magnetic field

- Remove the magnet plate from the induction apparatus.
- Place the brass tube across the magnet plate so that the left and right-hand ends of the tube touch the metal rails.
- Connect the magnet plate to the mains adaptor, and feed 1 to 2 A into the sockets.

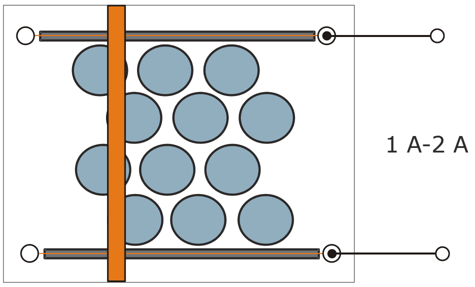

Fig. 1 Motion of a current-carrying conductor in a magnetic field

The brass tube starts to roll over the magnet plate by the Lorentz force acting on the current conducting electrons in the tube. If the poles of the voltage source are reversed the direction of the tube's motion is also reversed.

4.3 Electrical induction with a flat coil

- Place the frame with coil on the induction apparatus.
- Connect the induction apparatus to the power supply.
- Connect the multimeter to the coil. Set the zero point at the middle of the scale and select the 100 mV measurement range.
- Slowly increase the operating voltage until the conveyor belt slowly moves at a constant speed.
- Observe the induced voltage.

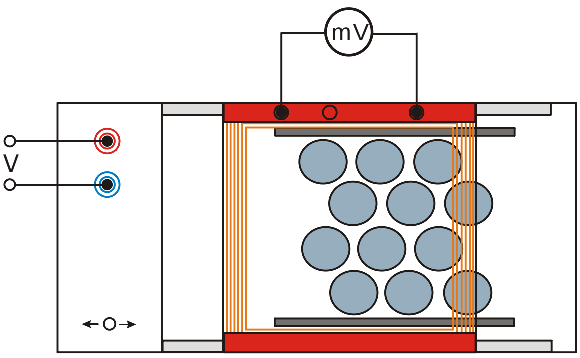

Fig. 2 Electrical induction using a flat coil

The voltmeter indicates a DC voltage. If the direction of the conveyor belt is reversed, a voltage of similar magnitude arises with the opposite polarity.

If the whole coil is located above the magnetic field, there is no voltage induced. The coil surface is smaller than the surface of the magnet plate, thus the magnetic flux remains constant.

4.4 Dependency of the induced voltage on the number of turns and the speed of the induction loop

- Set up the experiment as specified in 4.3.
- Connect the multimeter initially to the tap socket for 800 turns and measure the induced voltage.
- Repeat the experiment at the same applied voltage with 1600 and 2400 turns, and measure the corresponding induced voltages.
- Compare the induced voltages.

The induced voltage is proportional to the number of turns.

- Connect the multimeter to the tap socket for 2400 turns.
- Set the applied voltage to 4 V and measure the induced voltage. Observe the speed of the flat coil.
- Repeat the experiment at voltages of 6 V, 8 V and 10 V.
- Compare the induced voltages.

The induced voltage is proportional to the speed of the coil.

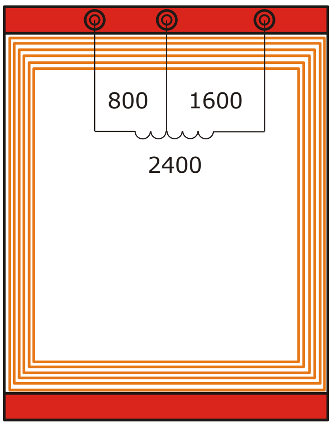

Fig. 3 Coil taps