HENSCHKE
Physics Educational Tools

Dr. Martin Henschke Gerätebau
Dieselstr. 8, 50374 Erftstadt, Germany
www.henschke-geraetebau.de/english/

Instruction Sheet
Lorentz motor armature

Martin Henschke, 2004-08-12

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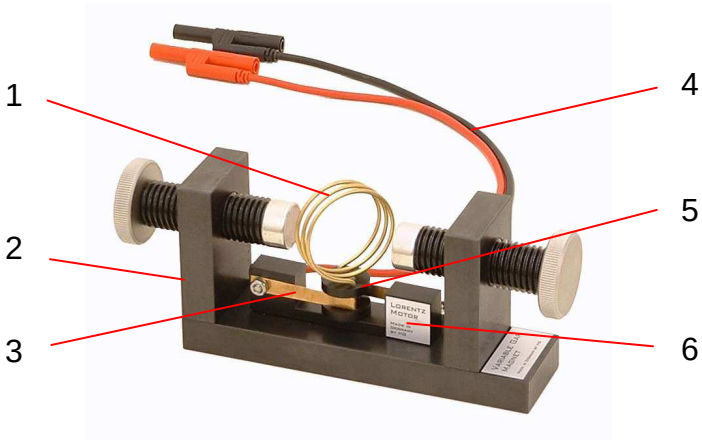

Fig. 1: Components
1 Coil with 3 turns
2 Magnet #650269 (not included in scope of delivery)
3 Sliding contacts
4 Connection leads
5 Coil mount
6 Support bracket with rating plate
7 Shaft (not visible)

The Lorentz motor is used to demonstrate Lorentz force which acts upon a current-carrying conductor.

1. Safety instructions

When using the magnet #650269 it is imperative that the safety instructions applicable for this device be strictly adhered to. For example, warning against use by persons with cardiac pacemakers!

Danger of electric shocks! The power supply unit is use may not exceed a maximum output voltage of 40 V.

The maximum current should not exceed 6 A, as otherwise the coil (1) and the slide contacts (3) will start heating up too excessively – risk of burns!

2. Description, technical data

The Lorentz motor armature consists of a coil with approx. 40 mm diameter and 3 turns (1). The ends of the coil are plugged into a coil mount (5), which can rotate freely on a shaft with

an 8 mm diameter. A current can then flow continuously through the coil via the two slide contacts (3) when the perceived axis through the coil is located almost perpendicularly to the magnetic field.
The permanently attached connection leads (4) are equipped with commercially available lab safety plugs with 4 mm diameter. In one of the leads there is also a series resistor with approx. 0.16 ohms (not visible in Fig. 1) designed to limit the maximum motor current to such an extent as to avoid any disturbance to electronic control performed by standard power supplies.

3. Operating principle

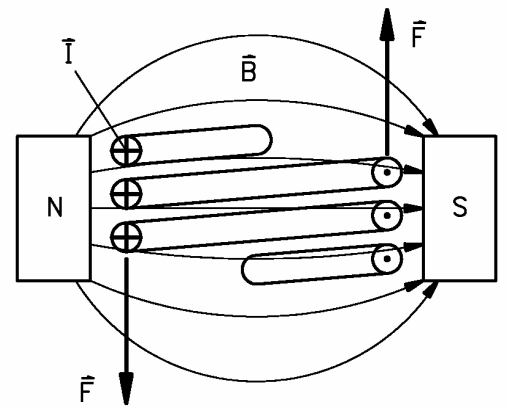

Fig. 2: Operating principle of the Lorentz motor. The three variables - current *I*, magnetic field strength *B* and force *F* are all perpendicular to each other. The direction of the force is given by the left-hand rule.

4. Operation and maintenance

The motor armature is inserted into hole of the magnet #650269 together with the shaft protruding downwards from the support bracket (6). Then the poles of the magnets are arranged so that between the two poles and the coil there is a an air gap of approx. 3 mm on both sides.

The laboratory power supply unit used should be equipped with current and voltage limitation and must be short-circuit proof. Before connecting the motor armature the voltage limitation must be set to approx. 6 V and the current limitation set to around 6 A.

After connecting the motor armature to the mains power supply the coil may need to be turned by hand slightly until it rotates on its own. The rotation direction is predetermined here by the current direction and cannot be freely selected as is the case with “standard” motors equipped with twopart armatures (compare the operating principle in Fig. 2).

Maintenance: Sparking may arise at the points of contact between the slide contacts and the coil, thus leading to attendent corrosion. This causes the motor resistance to rise and the armature may no longer be able to turn smoothly. If this is the case, the slide contacts and the coil ends can be scraped clean using fine sandpaper (600 grain) or a key file. To do this it is practical to remove the coil with the coil mount from the shaft by slightly bending the slide contacts outwards (facilitated by pushing a piece of cardboard between the slide contact and the coil mount).
If necessary, for example, if the armature tends to vibrate during operation, apply a drop of non-acidic resin-free oil (e.g. sewing machine oil) to the bearing between the coil mount (5) and shaft.