Electromagnetic Fields – Laboratory 04

Motors I

#	Student ID	Student Name	Grade (10)	Instructor signature
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Experiment 01: LORENTZ FORCE

Objective

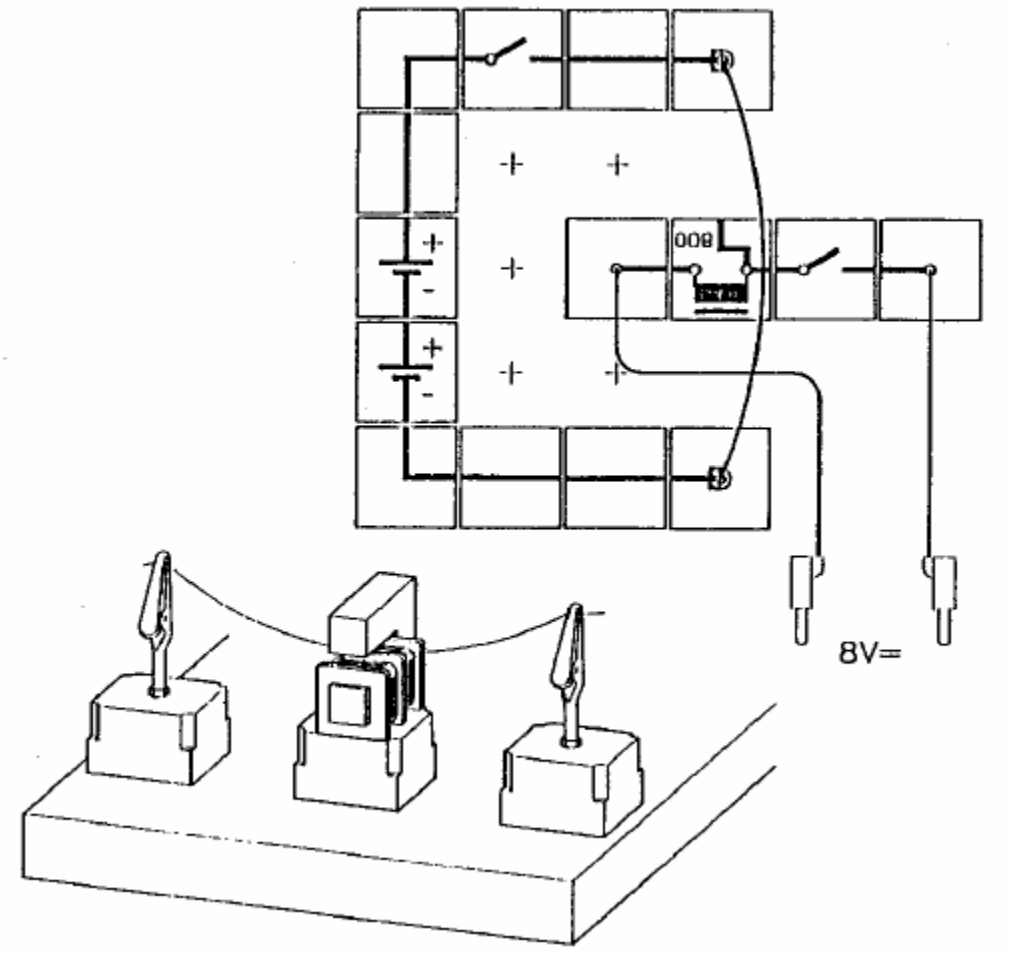
The effect of a magnetic field on a conductor through which electrical current flows is to be investigated. The magnetic field is produced by an electromagnet

Theory Overview

the Lorentz force is the combination of electric and magnetic force on a point charge due to electromagnetic fields. If a particle of charge q moves with velocity v in the presence of an electric field E and a magnetic field B, then it will experience a force

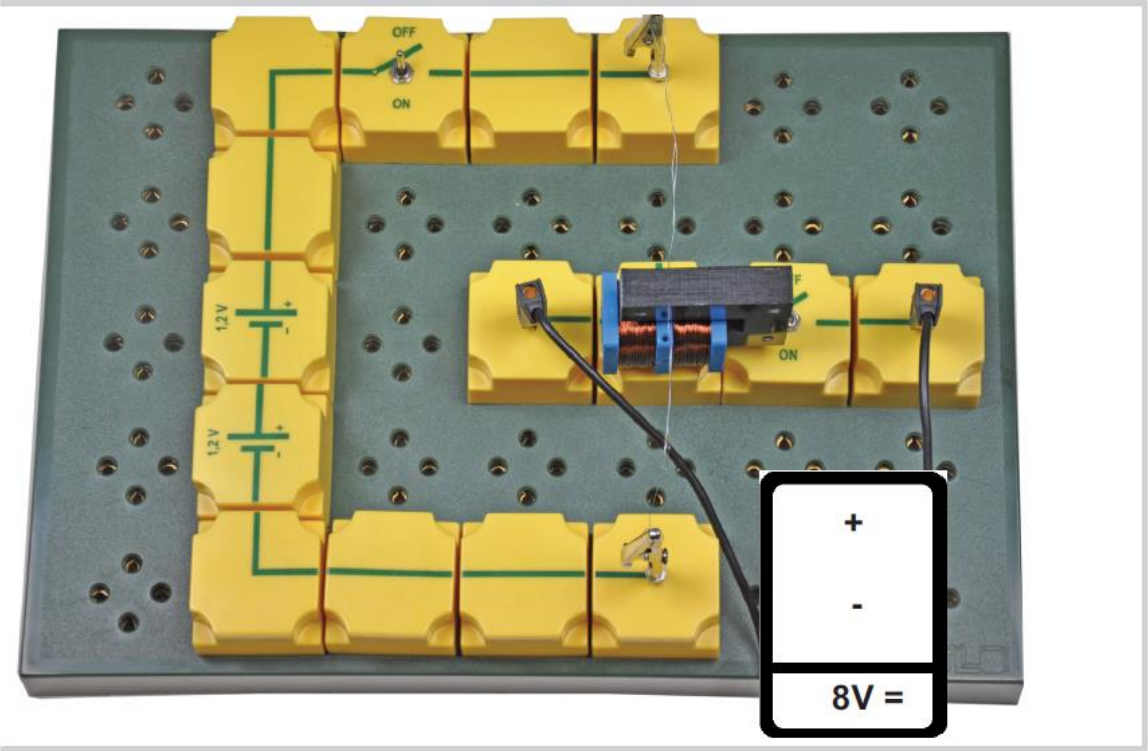
$$\mathbf{F} = q\left[\mathbf{E} + (\mathbf{v} \times \mathbf{B})\right]$$

A conductor through which electrical current flows is deflected in a magnetic field.
The power which afffects the conductor is called Lorentz` force.
Its direction is perpendicular to the direction of the electrical current and to the direction of the magnetic field.



Procedure

Arrangement of the wiring according to the illustration.
The metal filament is clamped between the two crocodile clips with plug pins.
The crocodile clips are inserted in the PIBconnections.
The two PIB-batteries serve as a voltage source for the metal filament.
The coil with 800 turns is equipped with the U-shaped core.
The metal filament hangs loosely between the iron core and the coil.
The second circuit which provides the electromagnet with current is connected to the electrical power supply.
8 volts DC is applied. The two switches are first open...



First the switch in the electrical circuit with the electromagnet is closed.
Then the second switch is closed. The metal filament immediately starts moving.
The switch is quickly reopened, otherwise the battery soon becomes expended.
Remember the direction of movement of the metal filament.
The direction of movement changes by commutating the voltage at the metal filament (insert PIB-battery reversely).
The direction of the magnetic field can be affected by commutating the electrical circuit by the coil.

Questions and Conclusions

1. The direction of movement of the conductor carrying electrical current can be determined by hand rule. Discuss, verify that the wire pending direction meet the force direction of hand rule.

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2. Is reversing the battery polarity, effect the pending direction of the wire? Verify your answer practically.

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Experiment 02: PRINCIPLE OF THE ELECTRIC MOTOR

Objective

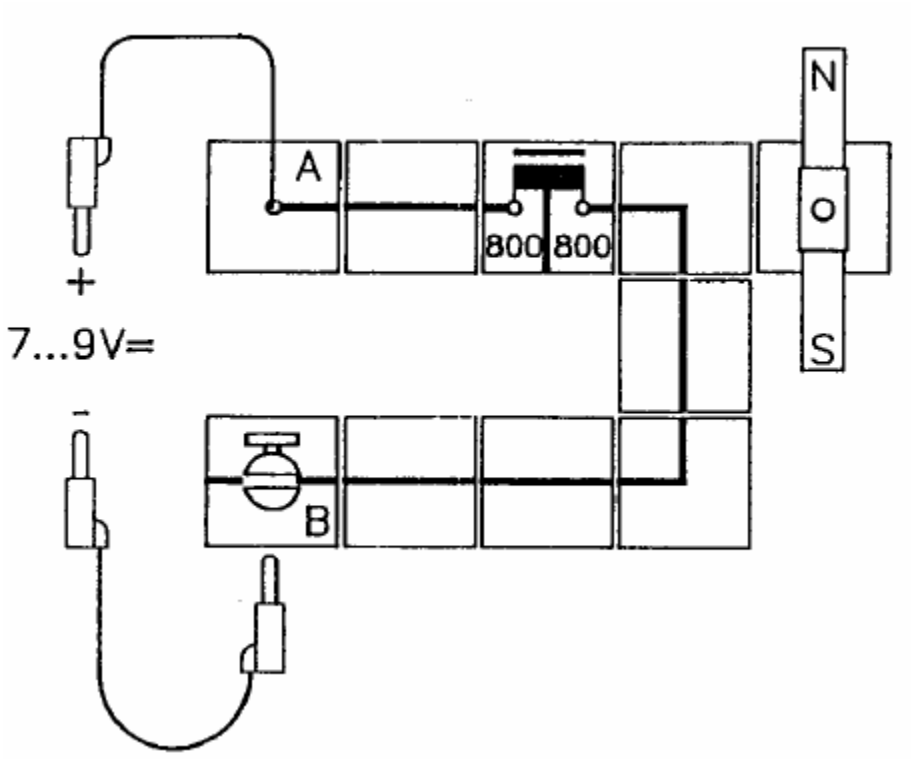
An electric motor is based on the interaction of two magnetic fields, of which one is caused electrical current. The experiment shows why electrical current is to be commutated to achieve a circular movement.

Theory Overview

The electric motor is a device which converts electrical energy to mechanical energy. There are mainly three types of electric motor. 1) DC Motor 2) Induction Motor 3) Synchronous Motor, etc,...

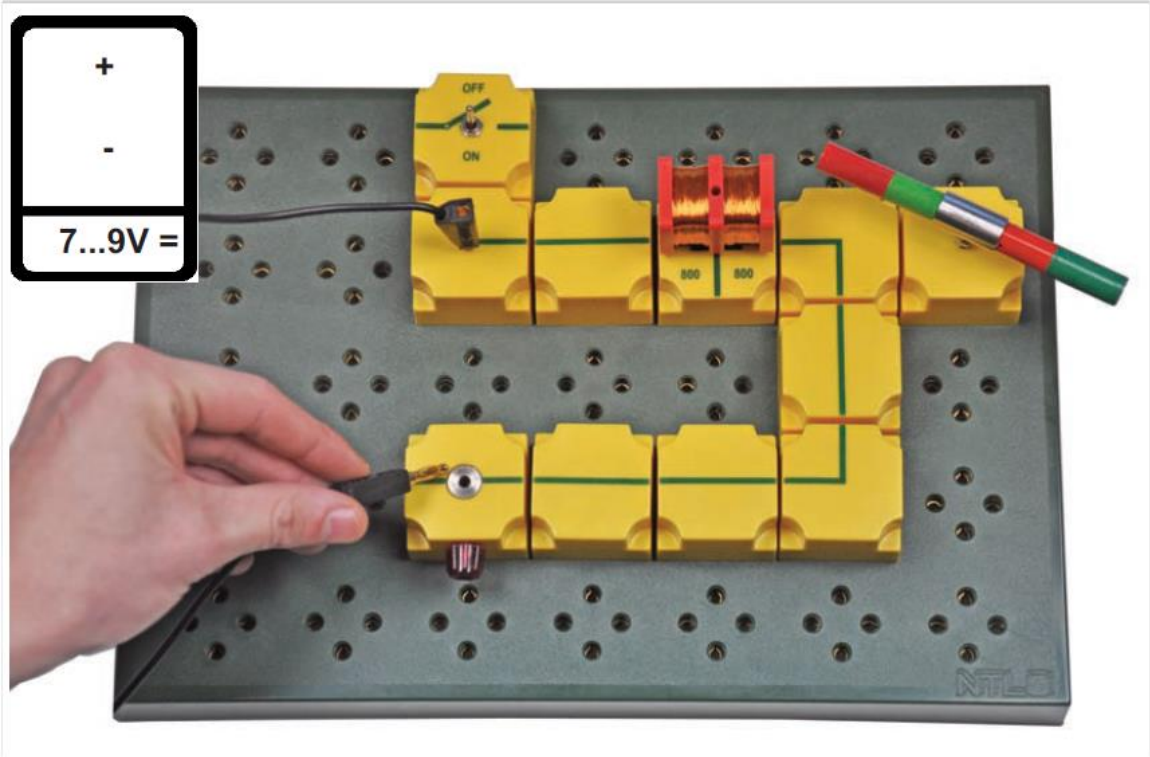
All of these motors work in more or less same principle. Working of electric motor mainly depends upon the interaction of magnetic field with current.

Procedure



Arrangement accoding to the illustration.
The cylindrical solid iron core is inserted in the PI-coil with 2 x 800 turns.

The block with socket containing the plug pin with needle is placed on the right side of the wiring.
The bearing bush is put on the needle by means of two cylindrical magnets.
The positive pole of the power supply is connected with the socket A.
Instead of connecting the negative pole, it is moved towards the PIB-adapter bush by hand.
The neutral position of the cylindrical magnet always has to be arranged according to the illustration.



1. About 8 volts DC is applied by closing the contact at B.

The north pole of the cylindrical magnet is attracted by the iron core of the coil.
The circuit is interrupted again

2. The cylindrical magnet is set in neutral position; the circuit is closed at B only for a short time.

Only before the north pole of the magnet has reached the coil, the circuit is interrupted again.
The magnet keeps moving due to its inertia.
When the north pole is near its neutral position again, the contact is closed.
The north pole is reat tracted. The magnet rotates once (360°) because the circuit is interrupted.
It would be even better not to interrupt the circuit, but to exchange the polarity of the applied current instead.

Questions and Conclusions

1. Is reversing the battery polarity, effect the rotation direction of magnet? Verify your answer practically.

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