The galvanometer (Item No.: P1398300)

Curricular Relevance

Area of Expertise: Physics
Education Level: Age 14-16
Topic: Electricity
Subtopic: Electromagnetism
Experiment: The galvanometer

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

Additional Requirements:

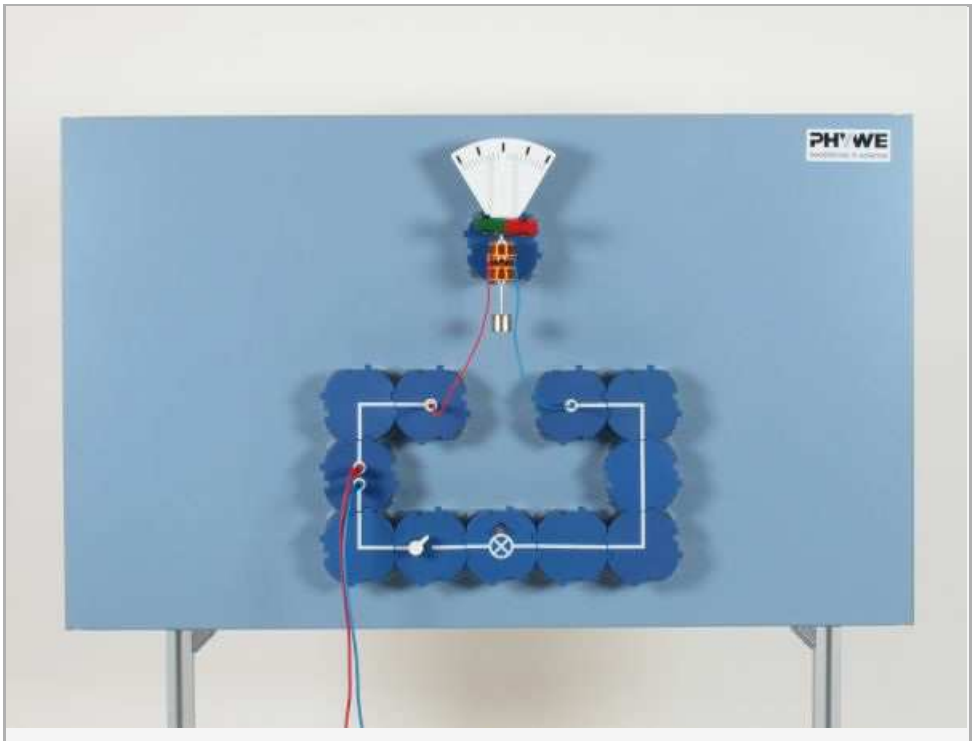
Experiment Variations:

Keywords:

Principle and equipment

Principle

A model of a galvanometer is to be used to demonstrate how moving-coil measuring instruments can be constructed and how they function.



Experimental set-up

Equipment

Position No.	Material	Order 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	13500-93	1
2	Demo Physics board with stand	02150-00	1
3	Coil f.galvanomtr.model,module DB	09477-00	1
4	Holder for U-magnet, module DB	09476-00	1
5	Switch on/off, module DB	09402-01	1
6	Socket for incandescent lamp E10 ,module DB	09404-00	1
7	Connector interrupted, module DB	09401-04	1
8	Junction, module DB	09401-10	2
9	Electr.symbols f.demo-board,12pcs	02154-03	1
10	Magnet holder,d=18mm	09476-10	1
11	Connector, straight, module DB	09401-01	2
12	Connector, angled, module DB	09401-02	4
13	Magnet, bar-shaped, d = 18 mm, l = 70mm	06318-00	1
14	Scale f.galvonomtr.model,mod. DB	09477-01	1
15	Pole shoes,1 pair (18x4x70)mm	09476-11	1
16	Filament lamp 6 V/3 W, E10, 10 pcs.	35673-03	1
17	Connecting cord, 32 A, 1000 mm, red	07363-01	1
18	Connecting cord, 32 A, 1000 mm, blue	07363-04	1

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Set-up and procedure

- Set up the experiment as shown in Fig. 1, assemble the galvanometer model in this way and connect the galvanometer connecting cables and adapter plugs as shown in Fig. 2

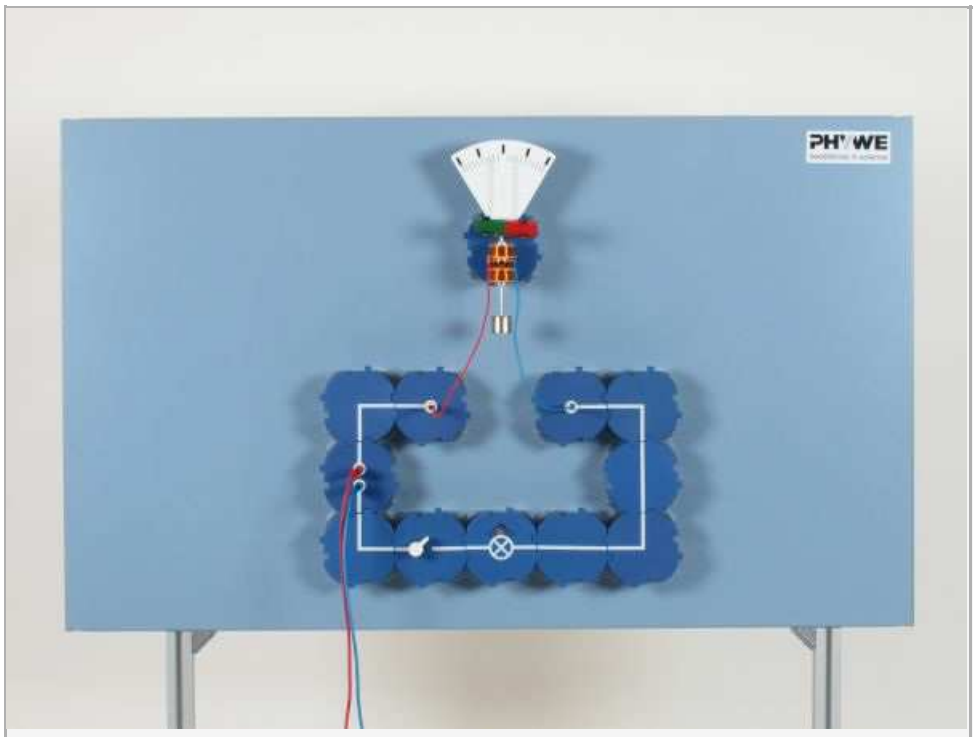

Fig. 1

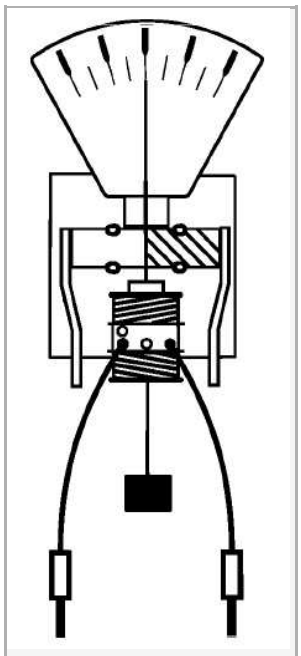

Fig. 2

- Close the switch and slowly increase the voltage to 6 V while observing the pointer and the lamp (1)
- Reduce the voltage to 0 V, again while observing the pointer and the lamp (1)
- Open the switch, reverse the connections of the connecting cables to the coil, and so reverse polarity of the measuring instrument
- Close the switch and, as previously, slowly increase the voltage to 6 V and then reduce it to 0 V while observing the pointer and the lamp (2)
- Re-piug the power supply voltage to 6 V- and observe the pointer and the lamp (3)

Observation and evaluation

Observation

1. With increasing voltage, the pointer deflection increases and the lamp begins to light up. The lamp goes out and the pointer deflection decreases when the voltage is reduced.
2. The pointer is deflected in the opposite direction. There is no change in the behaviour of the lamp.
3. The lamp lights up, but the pointer is not deflected.

Evaluation

A force is exerted by the coil that is carrying current in a magnetic field and a moment of rotation is so generated. This is the basis of the mode of action of a galvanometer. The galvanometer consists of a permanent magnet, which has a coil that is movable along an axis and holds a pointer in its magnetic field. When current is passed though the coil, then a magnetic field is built up inside it, which is stronger the greater the current. This magnetic field displaces the coil with pointer from its rest position, and the displacement is greater the higher the current, and to the left or the right according to the direction of the current.

The extension of the pointer from the axis of rotation is fitted with an equalizing weight, the weight force of which holds the pointer at a vertical rest position, and the distance of which from the axis of rotation can be adjusted, so that the restoring force for the pointer can be varied. Because of the construction, such electrical measuring instruments are called moving-coil measuring instruments. These cannot be used to measure alternating current or alternating voltage directly, but only when a rectifier is connected in series, or when they are in a middle zero position and the frequency of the alternating current is very low.

Remarks

The lamp used in the experiment serves to limit the current and to indicate the current intensity. In a discussion with the students, it could be worked out that it is not suitable as a measuring instrument, because firstly it does not light up at low current intensities, secondly it is difficult to differentiate between different higher current intensities by means of the brightness of the lamp, and thirdly as it does not provide any information on the direction of the current.

As voltage and current are proportional to each other, moving-coil instruments can not only be used for current measurements, but also for measurements of voltages.

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