Task

To construct a model of a galvanometer (current measuring instrument) and use it to investigate how a galvanometer works.

Equipment

Plug-in board	06033.00	1
On/off switch	39139.00	1
Lamp holder E10	17049.00	1
Coil, 400 turns	07829.01	1
Galvanometer movement	07875.00	1
Galvanometer scale	07876.00	1
Notch bearing with plug	07877.00	1
Connecting cable, 25 cm, red	07313.01	2
Connecting cable, 25 cm, blue	07313.04	2
Connecting cable, 50 cm, blue	07314.04	2
Power supply, 0...12 V-,6 V~, 12 V~	13505.93	1
Filament lamp, 4V/0.04 A, E10, 1 pc.	06154.03	1

Set-Up and Procedure

— Assemble the galvanometer model as shown in Fig. 2; ensure that the axis of the pointer is exactly positioned in the notch bearing, and that the pointer is at the centre of the scale (should this not be the case, re-adjust the compensating weight).
— Fit the notch bearing of the galvanometer on the plug-in board (top row) and connect up the circuit as shown in Fig. 1 (Ⓐ is the symbol for the galvanometer; this is connected here via the sockets of the coil).
— Set the power supply to 0 V and switch it on.
— Close the switch and very slowly increase the voltage, until the pointer reaches full deflection; following this, increase the voltage further up to a max. of 4 V while observing the filament lamp.
— Reduce the voltage to 0 V, observing the pointer and filament lamp while doing so; note your observations under (1).
— Open the switch and change over the connecting cables attached to the coil, i.e. reverse the poles of the model measuring instrument.
— Close the switch and then, as previously, increase the voltage and reduce it to 0 V while observing the pointer deflection and the lamp.
— Note your observation under (2) and switch off the power supply.

Fig. 2

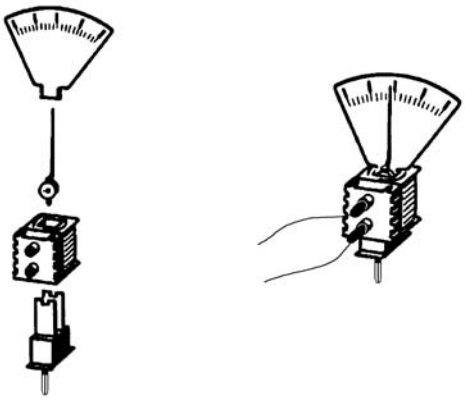
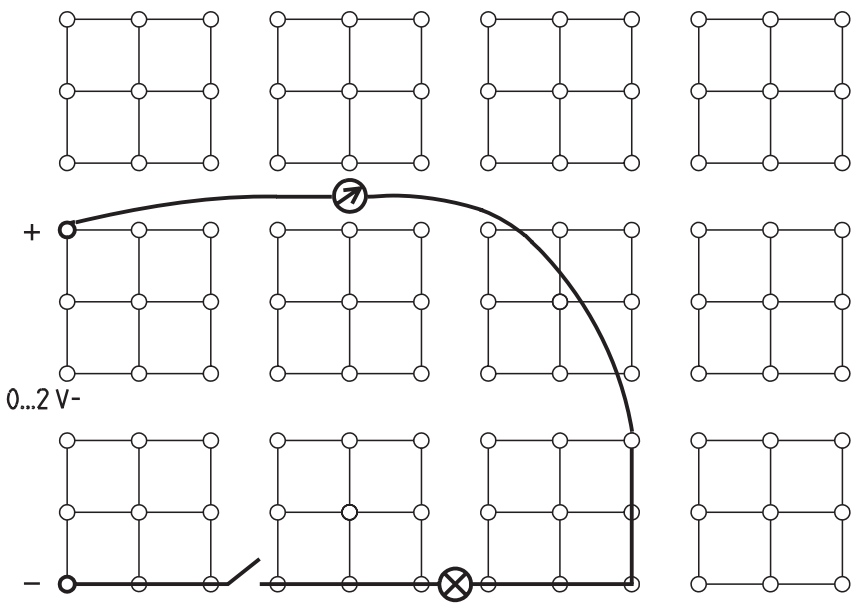


Fig. 1



Observations

(1)

(2)

Evaluation

1. How can you recognize, during this experiment, if an electric current is flowing?

2. Which effect of electric current is exploited in this type of galvanometer?

3. Why not simply use a filament lamp to measure electric current?

4. Try to describe the construction and function of the galvanometer used in this experiment.

(How does an instrument for measuring current function?)

The students have already learned how to handle ammeters and voltmeters, without knowing how they function. Now, in this experiment, they are to work out the construction and working principles of a galvanometer.

Notes on Set-Up and Procedure

To save time, the needle of the galvanometer should be pre-adjusted in the preparation for the experiment so that the students must only slightly re-adjust it when they set up the experiment.

Observations

(1) The deflection of the pointer increases with increasing voltage and almost reaches (or exceeds) full-scale deflection before the filament lamp starts to weakly glow.

(2) The pointer is deflected in the opposite direction. There is no change in the behaviour of the filament lamp.

Evaluation

1. One can recognize if an electric current is flowing by the deflection of the pointer and in part by the glowing of the wire of the filament lamp.
2. The magnetic effect of electric current is exploited here.
3. The filament lamp does not light up at all under small currents. In addition, when it lights up under stronger currents, it is difficult to recognize differences in its brightness.
4. The galvanometer consists of a coil, in which a turnable measuring mechanism is held. The measuring mechanism is made up of permanent magnet which is connected to a pointer. When current passes through the coil, a magnetic field is formed within it, which is stronger the stronger the current. This magnetic field deflects the permanent magnet of the measuring mechanism with pointer from its rest position, the further the greater the current, and to the right or left according to the direction of the current. A turnable platelet on the axis allows the rest position of the pointer to be varied. A compensating weight is attached to the prolongation of the pointer past the axis of rotation, the weight of which holds the pointer in the rest position. The distance of this weight from the axis can be varied to vary the restoring force on the pointer.

Remarks

In actual measuring instruments, the permanent magnet is mostly fixed and the current-carrying coil arranged movably in the field of this permanent magnet. This has the advantage, that the moment of inertia of the measuring mechanism can be kept low, whereby the pointer more quickly reaches the position for the reading and can be more easily damped.

To complete this experiment, the students could additionally connect a multi-range meter in the circuit, to determine the relationship between current strength and the deflection of the pointer. With galvanometers based on a coil with 400 turns, 10 scale divisions correspond roughly to 10 mA.

(How does an instrument for measuring current function?)

Room for notes