Galvanometer

Galvanometers developed from the observation that the needle of a magnetic compass is deflected near an electric current carrying wire, first described by Hans Oersted in 1820. These were the first instruments used to detect and measure small amounts of electric currents. André-Marie Ampere gave mathematical expression to Orsted's discovery and named the instrument after the Italian electricity researcher Luigi Galvani.

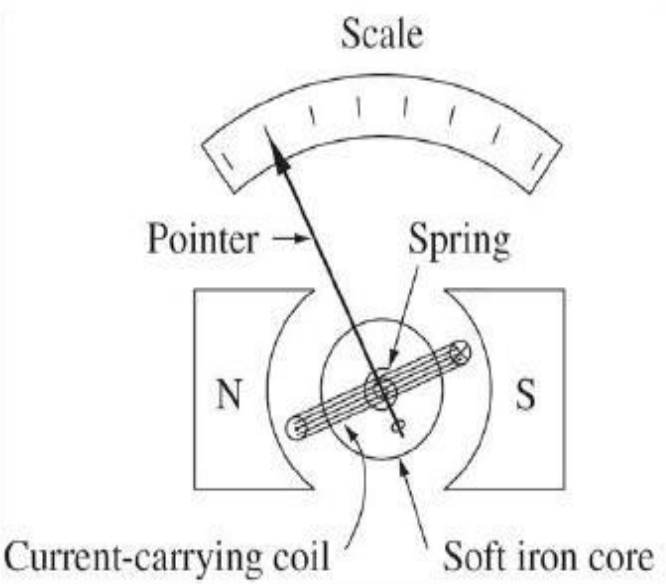

Fig. 1

A galvanometer is an electromechanical instrument which is used for the detection of electric currents through electric circuits. Being a sensitive instrument, galvanometer can't be used for the measurement of heavy currents. The primary purpose of galvanometer is the detection of electric current not the measurement of current. Galvanometer works on the principle of conversion of electrical energy into mechanical energy. When a current flows in a magnetic field it experiences a magnetic torque. If the needle attached to the coil in the field is free to rotate under a controlling torque, it rotates through an angle proportional to the current flowing through it. This is the principle of a permanent magnetic moving coil, PMMC).

A galvanometer consists of a coil, with many turns, free to rotate about a fixed axis, in a uniform radial magnetic field produced by a pair of magnetic north and south poles. (There is a cylindrical soft iron core which not only makes the field radial but also increases the strength of the magnetic field.) When a current flows

through the coil, a torque acts on it, which tends to rotate the needle, attached to the coil, from its rest position.

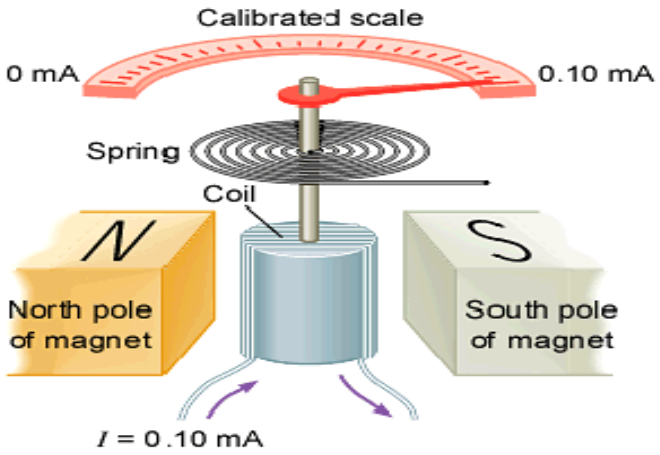

Fig. 2

This torque is given by $\boldsymbol{\tau} = NI\,\mathbf{A} \times \mathbf{B}$

Where N = number of turns in the coil,
I = current flowing through the coil,
A = area of the loop, and
B = magnetic field strength.

As the coil rotates it produces a twist in the suspension spring (Fig. 2). The twist in the spring produces an elastic restoring torque. The coil rotates until the elastic restoring torque due to the spring does not equal and cancels the deflecting magnetic torque, then it attains equilibrium.

Teachers may suggest students to make a brief idea about scientific instruments in physics depicting the advancements in the subject.