in the rails oppose the motion of the train.

- As there are no mechanical linkages, the braking effect is smooth.

Electromagnetic damping in galvanometers

- Certain galvanometers have a fixed core made of nonmagnetic metallic material.
- When the coil oscillates, the eddy currents generated in the core oppose the motion and bring the coil to rest quickly.

Induction furnace

- Induction furnace can be used to produce high temperatures and can be utilized to prepare alloys, by melting the constituent metals.
- A high frequency alternating current is passed through a coil which surrounds the metals to be melted.
- The eddy currents generated in the metals produce high temperatures sufficient to melt it.

Electric power meters

- The shiny metal disc in the electric power meter (analogue type) rotates due to the eddy currents.
- Electric currents are induced in the disc by magnetic fields produced by sinusoidally varying currents in a coil.

Metal detectors

- The simplest form of a metal detector consists of an oscillator producing an alternating current that passes through a coil producing an alternating magnetic field.
- If a piece of electrically conductive metal is close to the coil, eddy currents will be induced in the metal, and this produces a magnetic field of its own.

Speedometer

- In the speedometer an aluminum drum rotates according to the speed of the vehicle.
- The aluminum drum is carefully pivoted and a magnet is placed inside it.
- As the vehicle moves the magnet rotates, the eddy currents are produced in the aluminum drum.
- These eddy currents try to reduce the relative motion and hence the cylinder also rotates with the magnet.
- The pointer of the speedometer moves according to the rotation of the drum.

Inductance

- Inductance is the property of a coil by which a change in current through it induces an e m f in both the conductor itself and in any nearby coil by mutual inductance.
- The flux through a coil is proportional to the current.

$$\Phi_B \alpha I.$$

- For a closely wound coil of *N turns, the same magnetic flux is linked* with all the turns.
- The product of magnetic flux and number of turns of a coil is called flux linkage.

$$\text{Flux linkage} = N\Phi_B$$

- Thus

$$N\Phi_B \propto I$$

- The constant of proportionality, in this relation, is called *inductance.*
- Inductance depends only on the geometry of the coil and intrinsic material properties.
- Inductance is a scalar quantity.
- The dimensions of inductance are $[M L^2 T^{-2} A^{-2}]$.