FACULTY OF ENGINEERING & TECHNOLOGY

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INTRODUCTION TO ELECTRICAL MEASURING INSTRUMENTS

Electrical Measuring Instruments

1. Indicating instruments

Indicating instruments indicate, generally the quantity to be measured by means of a pointer which moves on a scale. E.g. ammeter, voltmeter, wattmeter etc.

2. Recording instruments

- These instruments record continuously the variation of any electrical quantity with respect to time.
- These are indicating instruments but so arranged that a permanent continuous record of the indication is made on a chart or dial.
- The recording is generally made by a pen on a graph paper which is rotated on a dice or drum at a uniform speed.
- The amount of the quantity at any time (instant) may be read from the traced chart.
- Any electrical quantity like current, voltage, power etc., (which may be measured lay the indicating instruments) may be arranged to be recorded by a suitable recording mechanism.

3. Integrating instruments

- These instruments record the consumption of the total quantity of electricity, energy etc., during a particular period of time. That is, these instruments totalize events over a specified period of time.
- No indication of the rate or variation or the amount at a particular instant are available from them.
- Some widely used integrating instruments are: Ampere-hour meter, kilowatt-hour (kWh) meter, kilovolt-ampere-hour (kVARh) meter.

Electromechanical indicating instrument

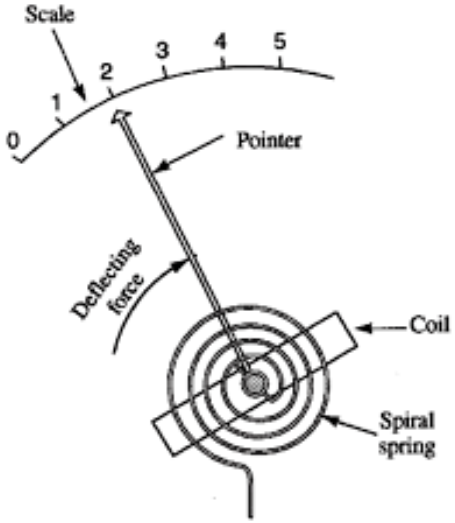
For satisfactory operation electromechanical indicating instrument, three forces are necessary. They are

1. Deflecting force
2. Controlling force
3. Damping force

1. Deflecting force

When there is no input signal to the instrument, the pointer will be at its zero position. To deflect the pointer from its zero position, a force is necessary which is known as deflecting force. A system which produces the deflecting force is known as a deflecting system. Generally a deflecting system converts an electrical signal to a mechanical force.

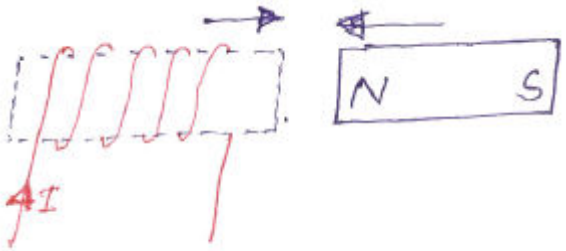
When a current passes through the coil (Fig.1.2), it produces a imaginary bar magnet. When a soft-iron piece is brought near this coil it is magnetized. Depending upon the current direction the poles are produced in such a way that there will be a force of attraction between the coil and the soft iron piece. This principle is used in moving iron attraction type instrument.



Pointer scale

▪Magnitude effect

When a current passes through the coil as shown in figure, it produces a imaginary bar magnet. When a soft-iron piece is brought near this coil it is magnetized. Depending upon the current direction the poles are produced in such a way that there will be a force of attraction between the coil and the soft iron piece. This principle is used in moving iron attraction type instrument.



If two soft iron pieces are place near a current carrying coil there will be a force of repulsion between the two soft iron pieces. This principle is utilized in the moving iron repulsion type instrument.

▪Force between a permanent magnet and a current carrying coil

When a current carrying coil is placed under the influence of magnetic field produced by a permanent magnet and a force is produced between them. This principle is utilized in the moving coil type instrument.