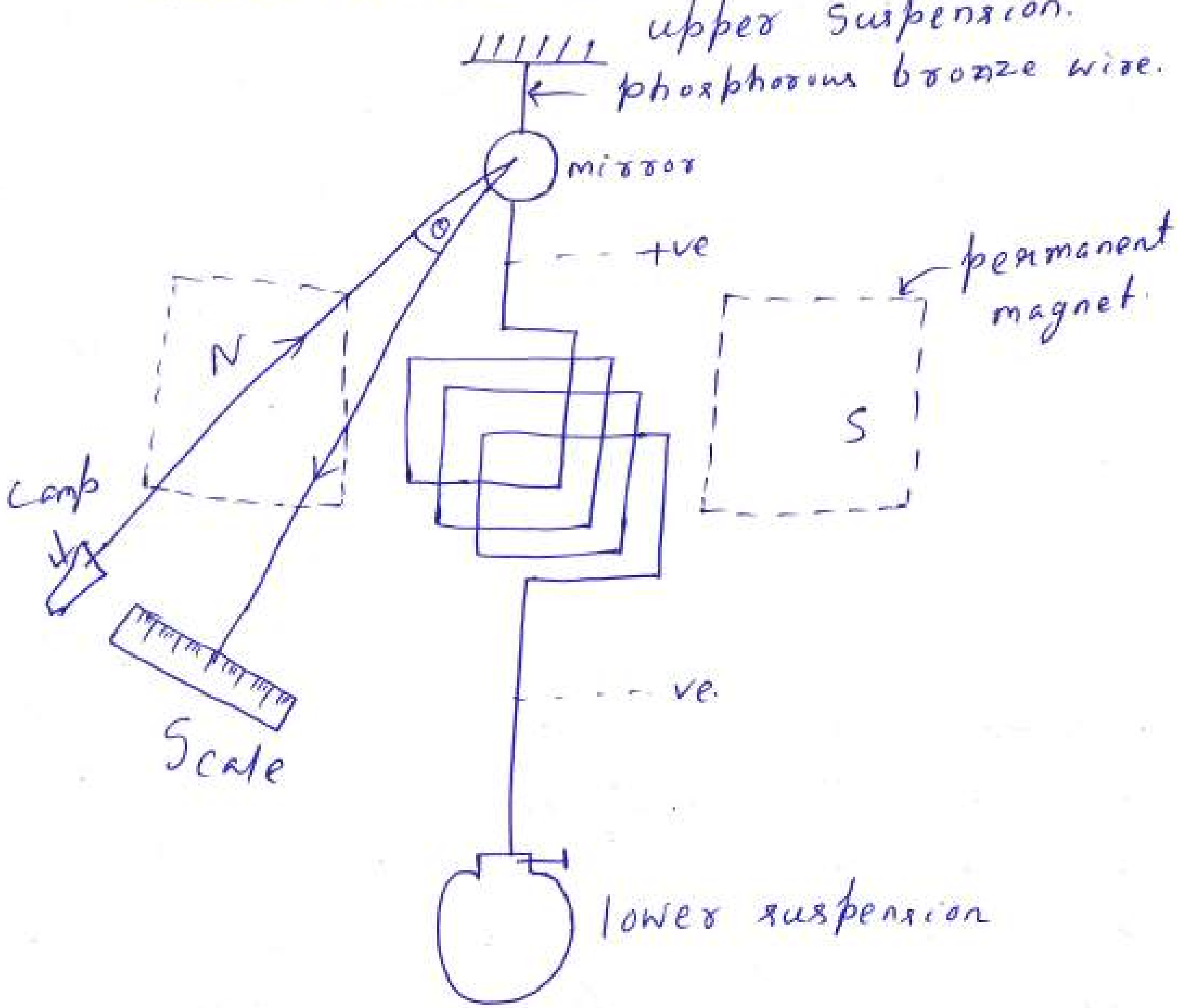
D-Arsonal galvanometer



Galvanometer is a special type of ammeter used for measuring μA or mA. This is a sophisticated instruments. This works on the principle of PMMC meter. The only difference is the type of suspension used for this meter.

It has a sophisticated suspension called taut suspension, so that moving system has negligible weight.

Lamp and glass scale method is used to obtain the deflection. A small mirror is attached to the moving system. Phosphorus bronze is used for suspension.

When D.C. voltage is applied to the terminal of moving coil, current flows through it. When current carrying coil is kept in the magnetic field produced by P.M., it experiences a force. The light spot on the glass scale also move. This deflection is proportional to the current through the coil. This instrument can be used only with D.C. like PMMC meter.

The deflecting Torque

$T_d = BINA$.

$$T_C = K_S \theta = S\theta$$

$\Rightarrow$ At balance $T_C = T_D \Rightarrow S\theta = GI$

$$\therefore \theta = \frac{GI}{S}$$

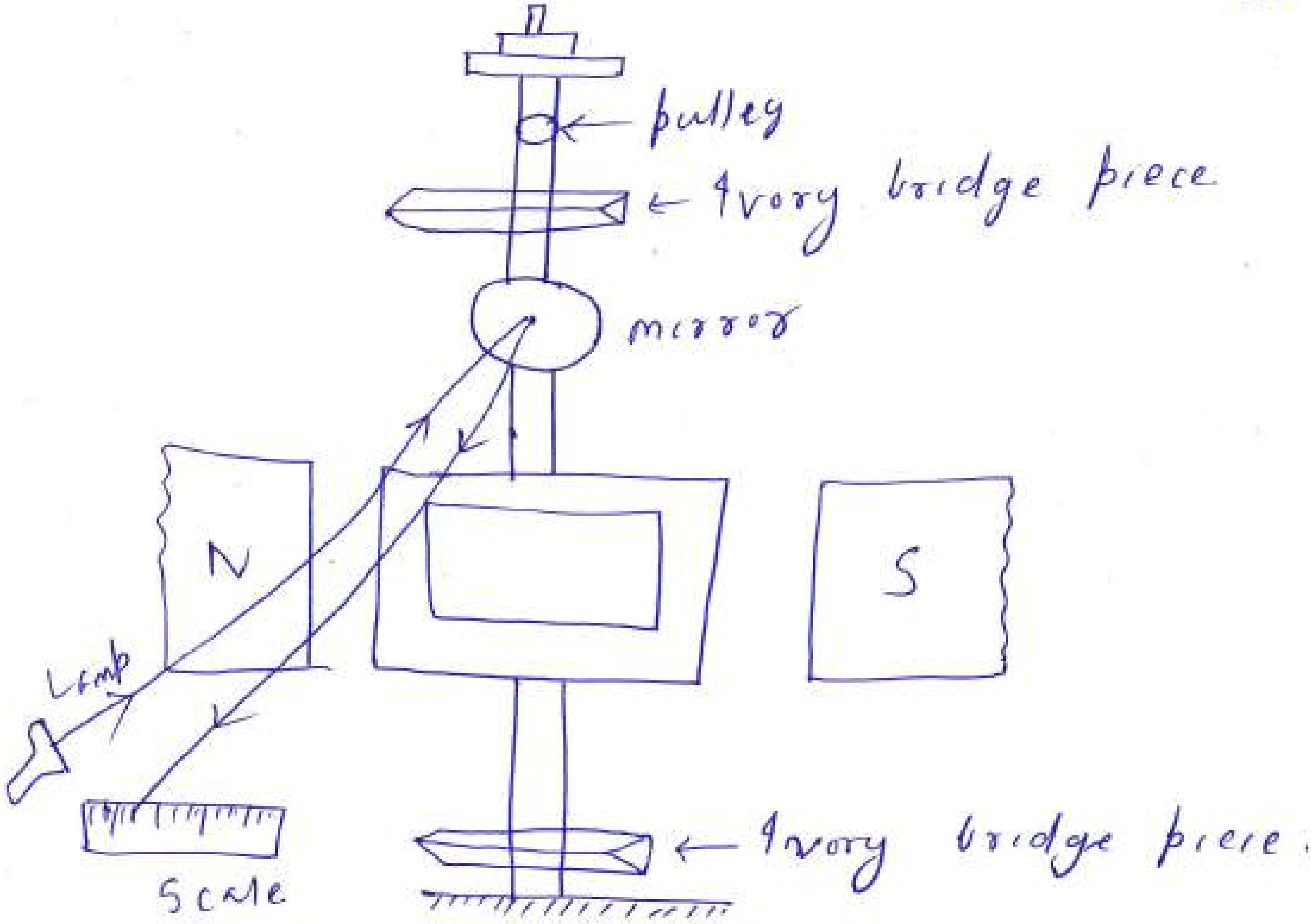
where G = Displacement constant of Galvanometer

S = Spring constant

Vibration Galvanometer

The construction of this galvanometer is similar to the PMMC instrument except for the moving system. The moving coil is suspended using two ivory bridge pieces. The tension of the system can be varied by rotating the screw provided at the top suspension. The natural frequency can be varied by varying the tension wire of the screw or varying the distance between ivory bridge piece.

When A.C current is passed through the coil an alternating torque or vibration is produced. This vibration is maximum if the natural frequency of moving system coinside with supply frequency. Vibration is maximum, science resonance takes place. When the coil is vibrating, the mirror oscillates and the dot moves back and front. This appears as a line on the glass scale. Vibration galvanometer is used for null deflection of a dot appears on the scale. If the bridge is unbalanced, a line appears on the scale



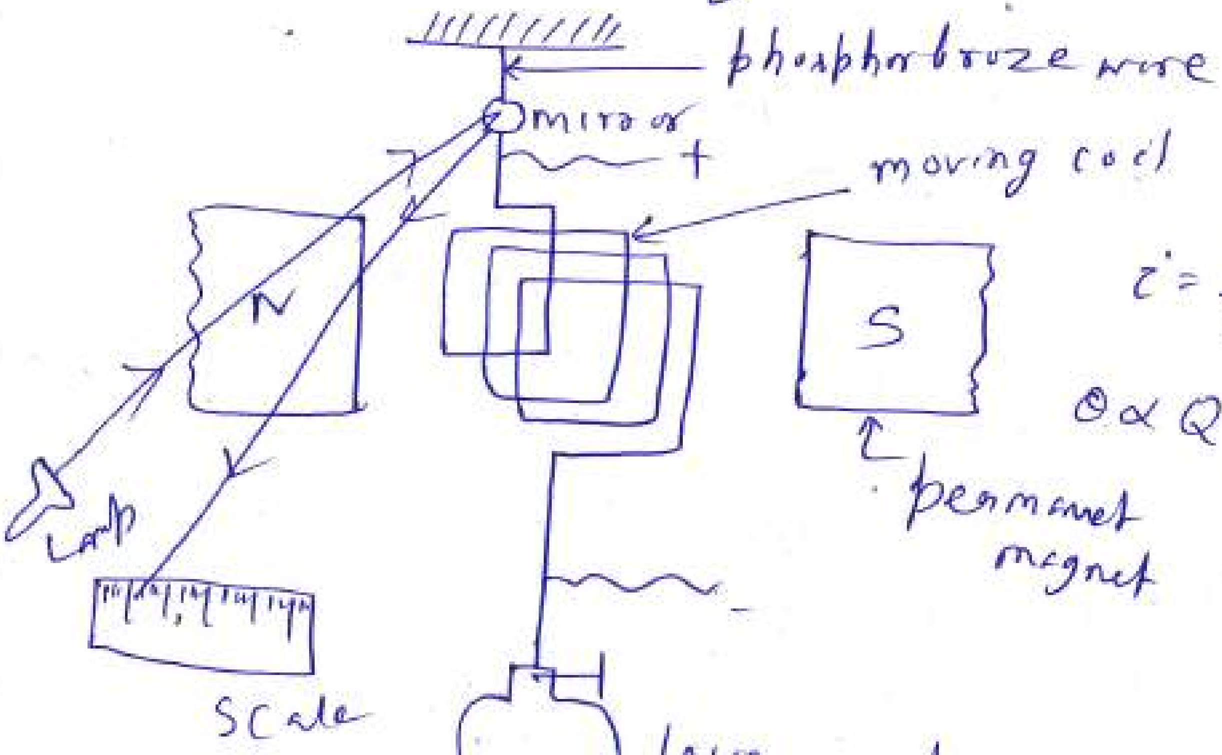
Vibration galvanometer

Ballastic Galvanometer

This is a sophisticated instrument. This works on the principle of PMMC meter. The only difference is the type of suspension is used for this meter. Lamp and glass scale method is used to obtain the deflection.

A small mirror is attached to the moving system. Phosphorous bronze wire is used for suspension

When D.C. voltage is applied to the terminals of moving coil, current flows through it. When a current carrying coil kept in the magnetic field, produced by permanent magnet, it experiences a force. The coil deflects and mirror deflects. The light spot on the glass scale also move. This deflection is proportional to the current through coil.



$i = \frac{Q}{t}$, $Q = it$
$= \int i\,dt$
$\theta \propto Q$, deflection $\propto$ charge.

Instrument Transformers

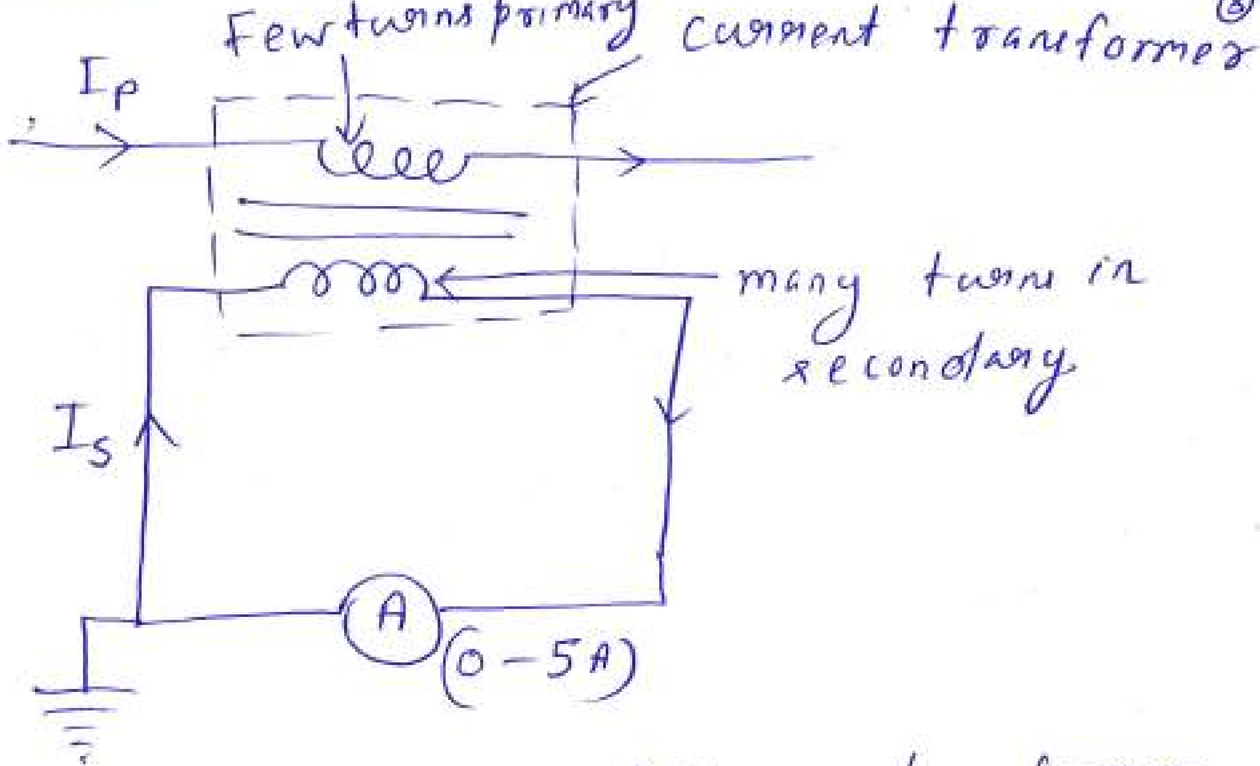
For measuring a large current on a d.c. current, we use low range ammeter with a suitable shunt. The measurement of high d.c. voltage is made using a low-range voltmeter with a multiplier. In order to measure high alternating currents and voltages, we employ specially designed transformers, called Instrument transformers. These transformers facilitate the a.c. measurement with low range a.c. Instruments. There are two types of instrument transformers

(1) current transformer

(2) Potential transformer.

(1) Current transformer :- (C.T.)

A current transformer (C.T.) is used to measure high alternating current in a power system.



The primary of this transformer has a few turns of thick wire where as the secondary has many turns of very fine wire as shown in figure. It is simply a well-designed step-up transformer. Since voltage is stepped up, the current is stepped down which can be measured with a low-range a.c. ammeter

The primary of the current-transformer is connected in series with the line whose current is to be measured as shown in the figure. The secondary of the transformer is connected across a low-range (0 – 5 A) a.c. ammeter.

$$N_p I_p = N_s I_s.$$

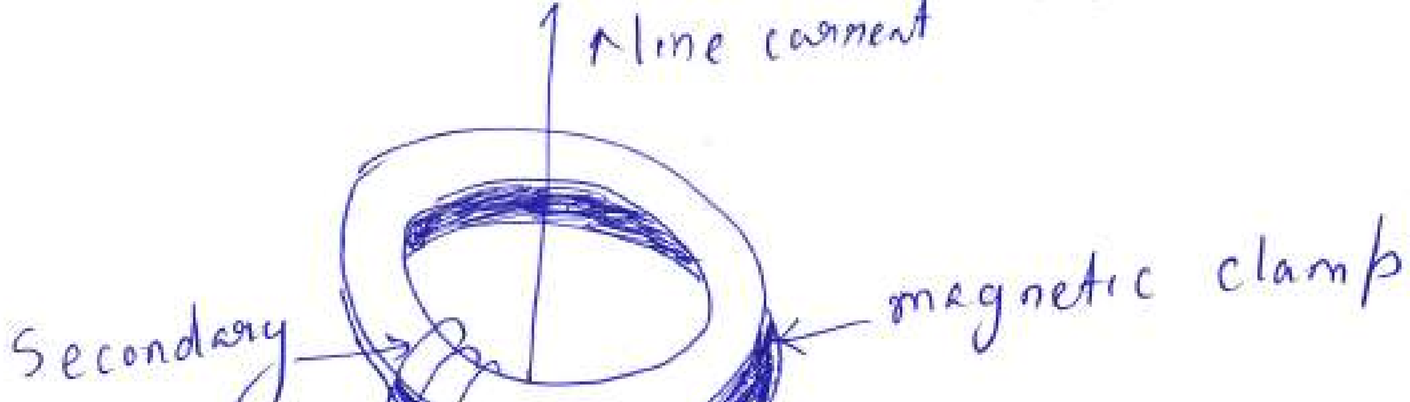
$$\Rightarrow \frac{I_p}{I_s} = \frac{N_s}{N_p}$$

The primary to secondary current ratio (I_p/I_s) is called C.T. ratio (current transformation ratio.)

$$\frac{I_p}{I_s} = \text{C.T. ratio}$$

$$\Rightarrow I_p = I_s \times \text{C.T. ratio.}$$

line current (I_p) = A.C. ammeter reading × C.T. ratio

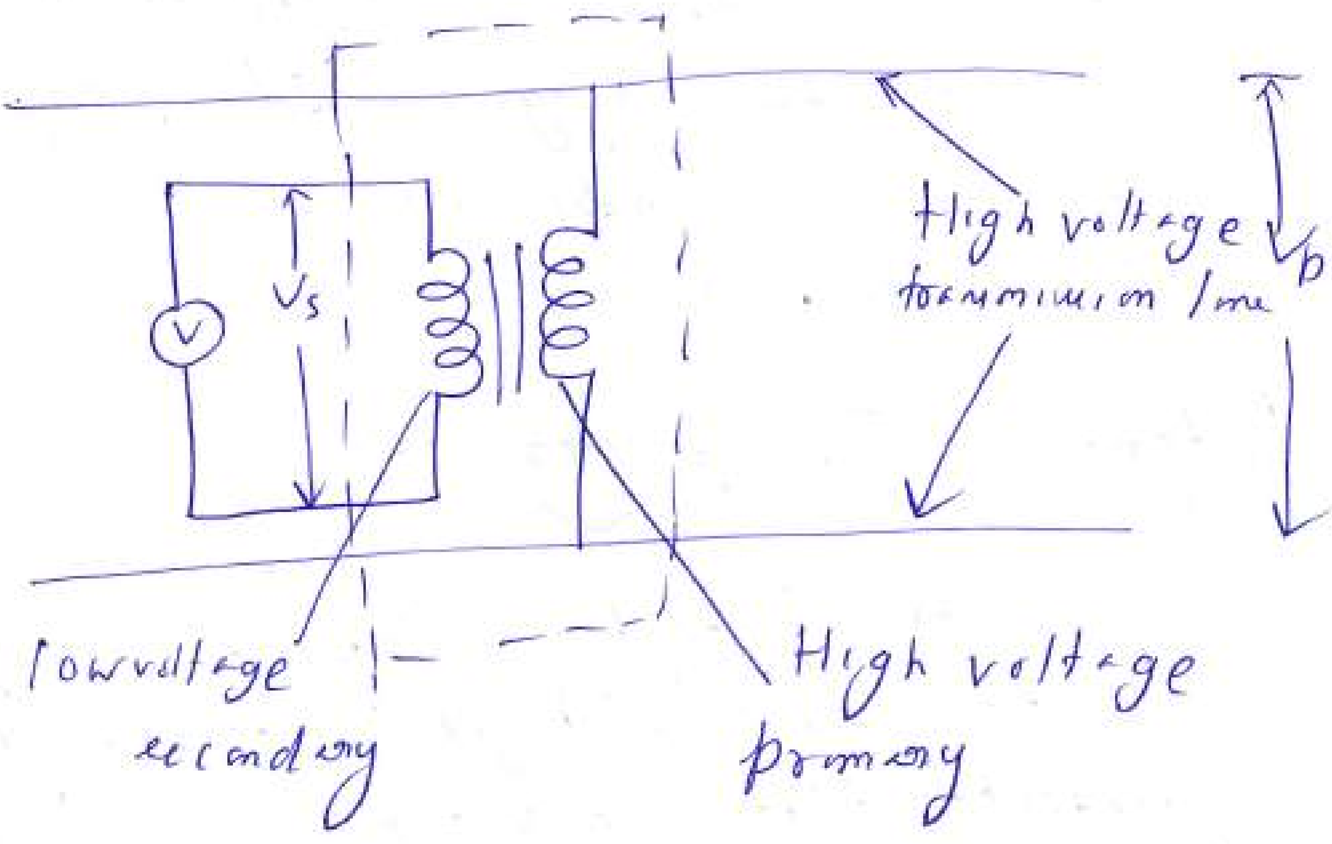


One most commonly used C.T. is the clamp-on type. as shown in the figure. It consists of a ring-shaped laminated core which carries the secondary winding. The current carrying conductor itself acts as a one turn primary that simply passes through the centre of the ring. The position of the primary is unimportant as long as it is more or less centred. This current transformer has the arrangement to open and close the ring-shaped core so that current can be measured without opening the line.

Potential Transformer (P.T.)

A potential Transformer is used to measure high alternating potential difference (voltage) in a power system.

The primary of this transformer has many turns while the secondary has few turns as shown in figure. It is simply a well-designed step-down transformer. The stepped down voltage is measured with a low range a.c. voltmeter. The magnetic core of a potential Transformer usually a shell-type construction for better accuracy



The primary of the potential transformer is connected across the high voltage line whose voltage is to be measured. A low range (0–110V) a.c voltmeter is connected across the secondary. The line voltage (V_p) and a.c voltmeter reading (V_s) :-

$$\frac{V_p}{V_s} = \frac{N_p}{N_s}$$

V_p/V_s is known as P.T. ratio.

$$\frac{V_p}{V_s} = \text{P.T. ratio}$$

$$V_p = V_s \times \text{P.T. ratio.}$$

⇒ line voltage (V_p) = A.C. voltmeter reading × P.T. ratio.