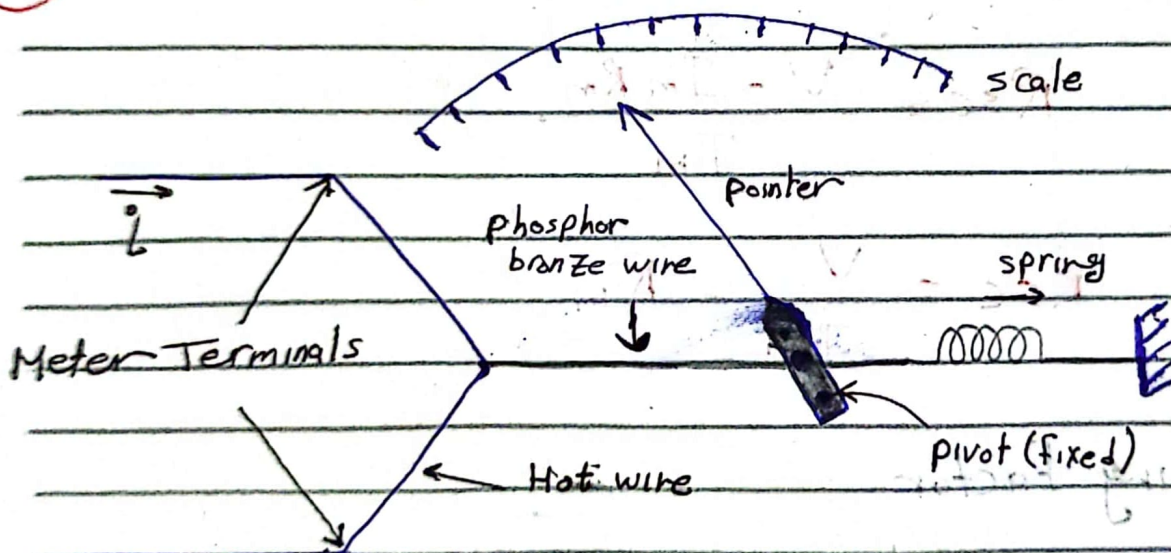


## Electro-Thermal and Rectifier-type instruments

### ① Electro-Thermal Instruments

These instruments are free from errors due to frequency, wave-form and external magnetic fields when used on ac and so can be used for measurements of current at extremely high frequencies.

### ② Hot wire instruments



Hot wire instruments consists of phosphor bronze alloy wire.

The principle of working of these instruments depends upon the increase in length of wire due to heating effect when the current is passed through the wire.

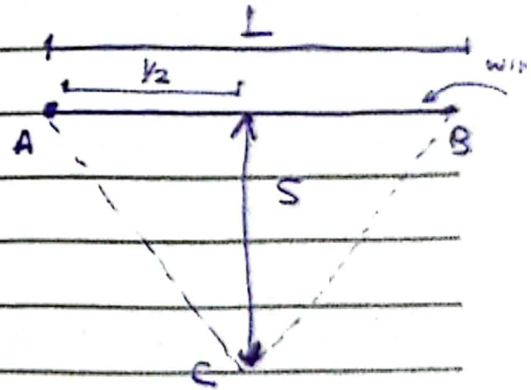
The increase in length of wire is proportional to the square of the current passed through the wire.

Let the length of hot wire be  $L$  and increase in length of wire due to flow of current of  $I$  through it be  $dL$ . Then the sag in wire is

$$S = \sqrt{(L \times dL)/2} \Rightarrow \sqrt{\frac{L dL}{2}}$$

The magnification factor is

$$M = \frac{S}{dL} = \sqrt{\frac{L}{2 dL}}$$



Ranges

Ammeter  $\rightarrow$  without use of shunt 0-1 A  
 with " " " 0-5 A

Voltmeter  $\rightarrow$  up to 400 V



### (B) Thermo - Couple Instruments.

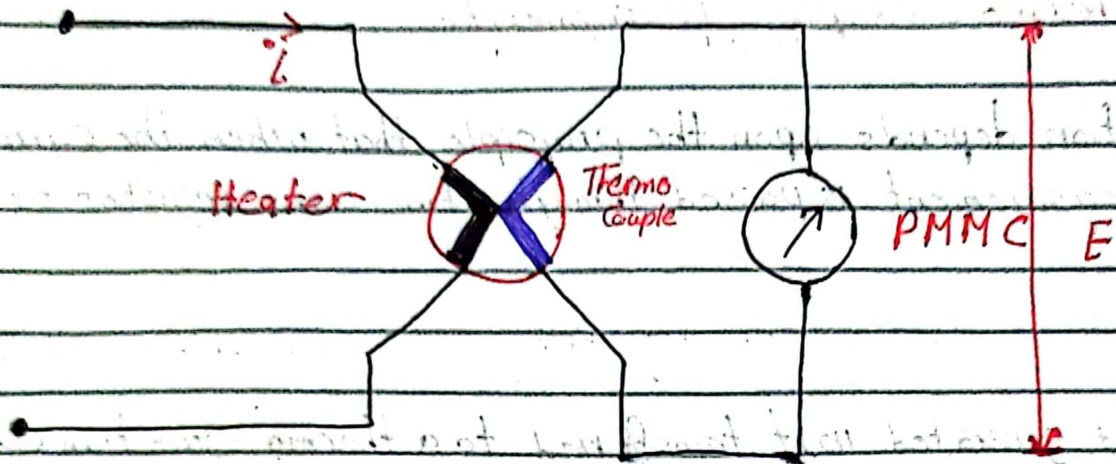
The action depends upon the principle that when the current and measurement is passed through a fine wire resistor or heater

The heat generated in it transferred to a thermo - Junction connected to an indicating device, initially a sensitive PMMC instrument

An Emf known as thermo-emf, is developed and indicated on the indicating device.

⇒ The essential components of a thermocouple instrument - are:

- (i) The heater element.
- (ii) A thermo element having its hot junction in thermal contact with the heater element and its cold junction at or near room temperature
- (iii) a sensitive permanent magnet moving coil instrument whose deflection results from the E.m.f developed by the thermo - Couple.





## Rectifier-type instruments

The basic arrangement of a rectifier type of instrument using a full wave rectifier circuit

If this instrument is used for measuring AC quantity then first the ac signal is converted to dc with the help of the rectifier.

Then this dc signal is measured by the PMMC meter.

$R_s$  → is used to limit the value of the current in order that it does not exceed the current rating of the PMMC meter.

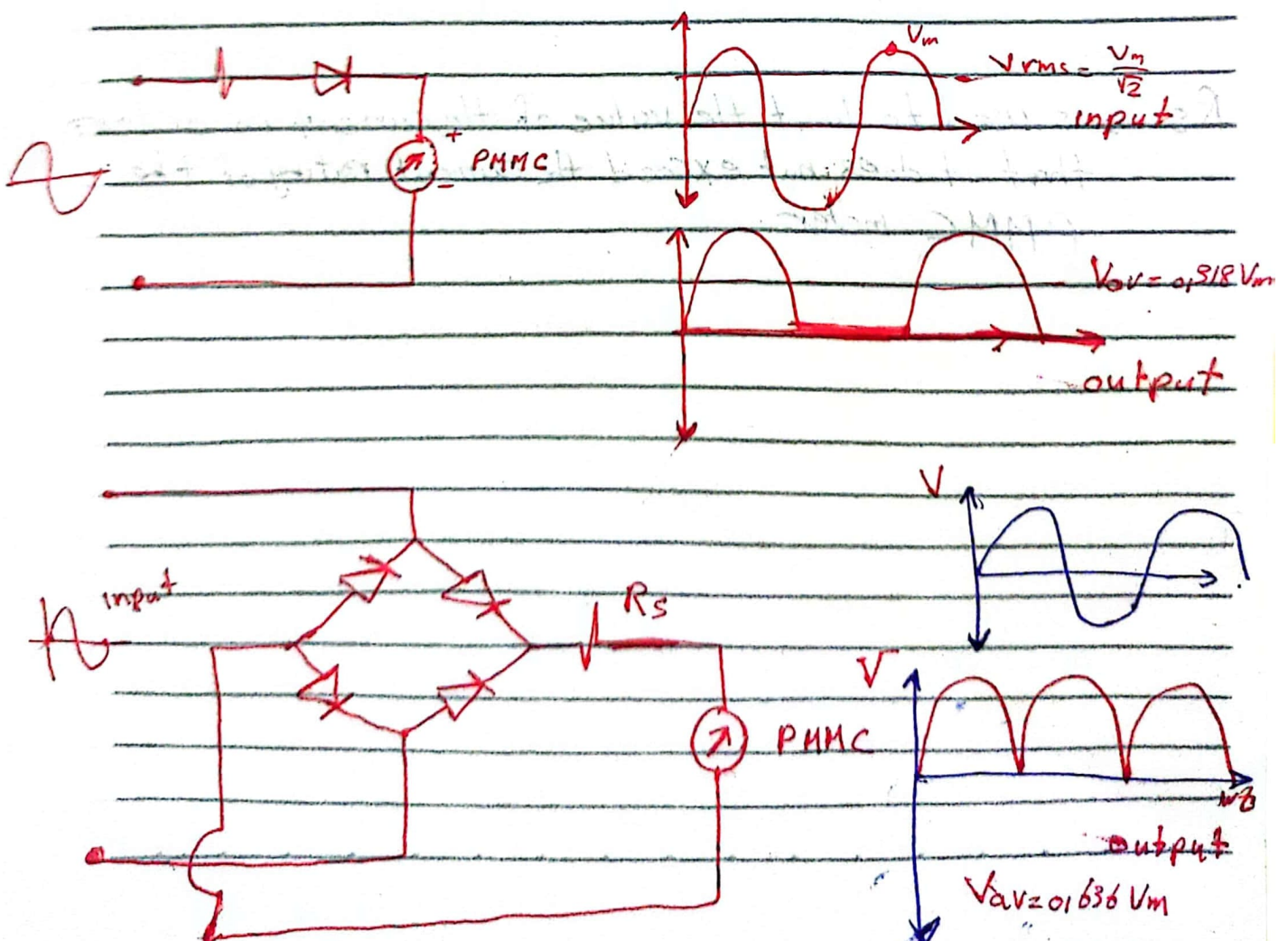
These types of instruments are used for light current work where the voltage is low and resistance high.

The dc sensitivity of a rectifier-type instrument

$$S_{dc} = \frac{1}{I_{fs}} \Omega/V$$

where  $I_{fs}$  is the current required to produce full scale deflection.

### Half wave and full wave Rectifier Circuit





The sensitivity of a half wave rectifier instrument with ac is 0,45 times its sensitivity with dc

and the deflection is 0,45 times that produced with dc of equal magnitude  $V$

$$S_{ac} = 0,45 S_{dc}$$

The deflection is 0,9 times in a full wave rectifier instrument with an ac than that produced with dc of equal magnitude  $V$

Sensitivity of a full wave rectifier instrument with an ac is 0,9 times its sensitivity with dc

$$S_{ac} = 0,9 S_{dc}$$