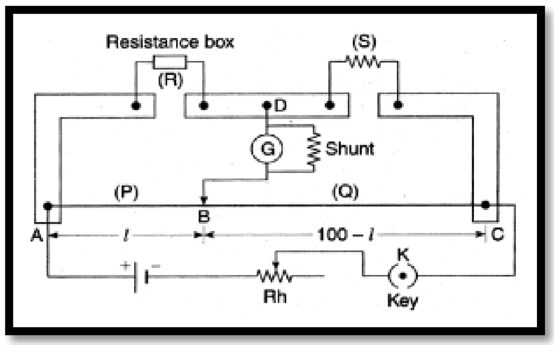
CURRENT ELECTRICITY

METER BRIDGE

METRE-BRIDGE:

Meter-bridge is a sensitive device based on the principle of Wheatstone-bridge, for the determination of the resistance of a conductor (wire). Its sensitivity is much more than that of the post-office box



Meter-bridge is shown in figure AC is one meter long wire of manganin or constantan which is fixed along scale on a wooden base. The area of cross-section of the wire is same at all places. The ends A and C of the wire are joined to two L-shaped copper strips carrying binding-screws as shown. In between these strips, leaving a gap on either side, there is a third copper strip having three binding screws. The middle screw D is connected to a sliding jockey B through a shunted - galvanometer G. The knob of the jockey can be made to touch at any point on the wire.

To measure the unknown resistance, the connection as shown in figure are made.

A resistance R is taken out from the resistance box and the key K is closed. Now the jockey is slide along the wire and a point is determined such that, on pressing the jockey on the wire at that point there is no deflection in the galvanometer G. In this position the points B and D are at the same potential. The point B is called 'null-point'. The lengths of both the parts AB and BC of the wire are read on the scale. Suppose the resistance of the length AB of the wire is P and that of the length BC is Q. Then, by the principle of Wheatstone-bridge. We have,

$$\frac{P}{Q}=\frac{R}{S}$$

Let the length AB be l cm. Then the length BC will be = (100 - l) cm.

$\therefore$ Resistance of AB, i.e. $P=\frac{\rho l}{A}$ and resistance of BC, Q = ρ (100 - l)/A.

where ρ is the specific resistance of the material of the wire and 'A' is the area of cross-section of thewier. Thus

$$\frac{P}{Q}=\frac{l}{(100-l)} \qquad \text{... (1)}$$

Substituting this value of $\frac{P}{Q}$ in eq. (i), we get

$$\frac{l}{(100-l)}=\frac{R}{S} \text{ or } S=\frac{R(100-l)}{l}$$

R is the resistance taken in the resistance box and l is the length measured. Hence, the value of resistance S can be determined from the above formula.

A number of observations are taken for different resistances in the resistance box and for each observation the value of S is calculated.

Finally, the experiment is repeated by interchanging the unknown resistances S and the resistance box. The mean of the values of S is then obtained.

Ex. In a meter bridge experiment, the value of unknown resistance is 2Ω. To get the balancing point at 40 cm distance from the same end, then what will be the resistance in the resistance box?

Sol. Apply condition for balance wheat stone bridge,

$$\frac{P}{Q}=\frac{\ell}{100-\ell}=\frac{P}{2}=\frac{100-40}{40}$$

$$P=3\Omega$$