Determination of Low Resistance by Potentiometer

Apparatus: 2Ω resistance, 2V Power Supply, 6V Power Supply, Galvanometer, Resistance Box, low resistance, potentiometer (ten wire).

- Basic Principle of Potentiometer:

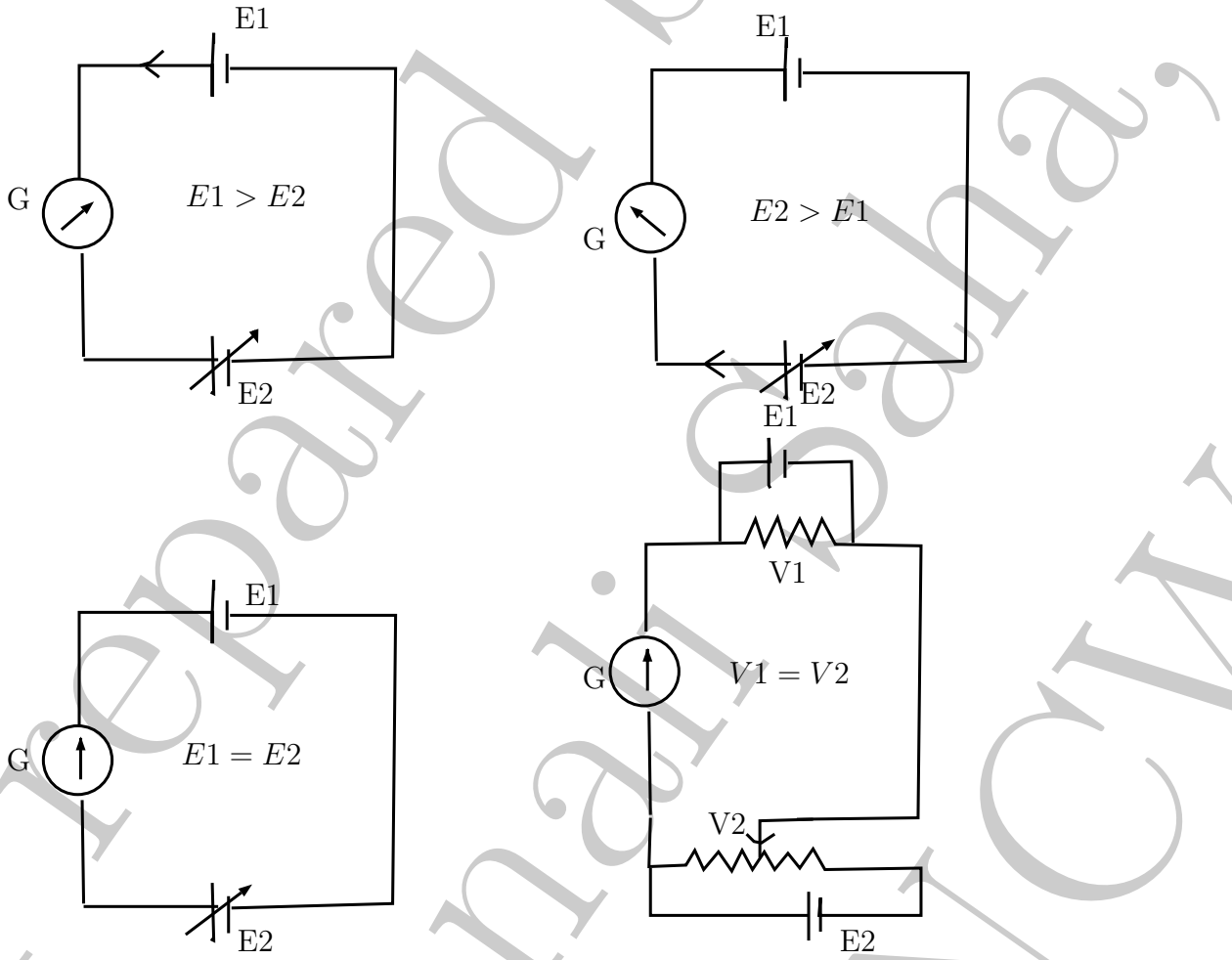

Figure 1: Basic principle of potentiometer

This way of obtaining balanced condition by varying one supply voltage and keeping the other fixed is employed in potentiometer. The potential drop accross a resistance can be balanced by changing the position of the Jockey (movable terminal of potentiometer) along the length of the potentiometer wire, provided the potential drop across two fixed end of the potentiometer is higher than that of the resistance.

- Experimental Procedure

1. Make the circuit connection as shown (solid line) in figure 2.
2. Adjust the value of R such that galvanometer's deflections in first wire and tenth wire are in opposite direction.

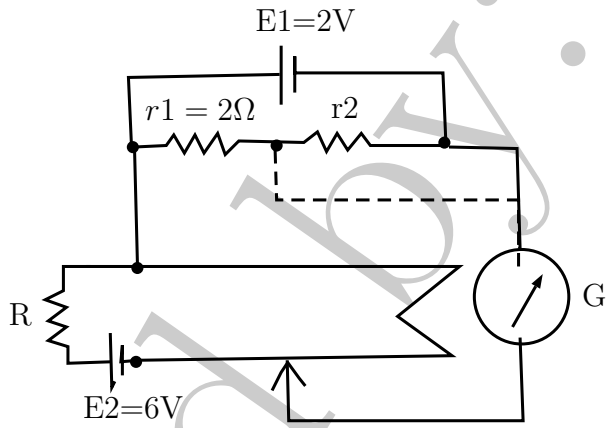

Figure 2

3. Keep the value of R fixed.
4. Note the position of the null point. Let the length is l_1.
5. Now make the circuit connection as shown (dotted line) in figure 2.
6. Note the position of the null point. Let the length is l_2.
7. Since the current supplied by $E1$ is fixed, so the ratio $\frac{r_1}{r_1+r_2} = \frac{l_1}{l_2}$.
8. Putting the value of r_1 one can get r_2.
9. Repeat the steps 2 to 8 for another two values of R and take the mean.

Table 1: Data for determination of unknown low resistance

Resistance in series with potentiometer (R)	Position of Null point when p.d is balanced across r_1: (l_1)	Position of Null point when p.d is balanced across $r_1 + r_2$; (l_2)	The Ratio: $\frac{l_2}{l_1}$	Value of unknown resistance $r_2 = (\frac{l_2}{l_1} - 1)r_1$	Mean

- Discussion:

  Low resistance may be measured by a simple direct deflection method by recording the galvanometer deflection for the potential difference generated across a standard resistance in series with the low resistance under consideration. By comparing it with that for the standard resistance alone, the value of the low resistance may be determined. As the same current flows through the resestances so ratio of deflection will be equal to the ratio the resistances. But in this method, the contact resistance arising from the galvanometer connection may cause an appreciable error.

  In the method of null point detection, which is used in potentiometer and carey foster bridge no current flows through galvanometer at null condition, so error in measurement arises from contact resistance can be avoided.

The advantage of this method of determining low resistance over the method of Carey Foster bridge is that here precision is higher though the circuit is little bit more complicated. By adjusting the resistance in series with potentiometer, we can adjust the position of null point at larger value of l, which will increase the accuracy of measurement by decreasing proportional error.