To Convert The Given Galvanometer (Pf Known Resistance & Figure Of Merit) Into a Voltmeter Of Desired Range & To Verify the Same

Aim

To convert the given galvanometer (of known resistance and figure of merit) into a voltmeter of desired range and to verify the same.

Apparatus

A Weston type galvanometer, a voltmeter of 0-3 volts range, range a battery of two cells or battery eliminator, two (10,000 Ω and 200 Ω) resistance boxes, two one way keys, a rheostat, connecting wires and a piece of sand paper.

Theory

The series resistance required for conversion,

$$R = \frac{V}{I_g} - G \qquad \text{...(2)}$$

where V is the range of conversion.

Circuit diagram

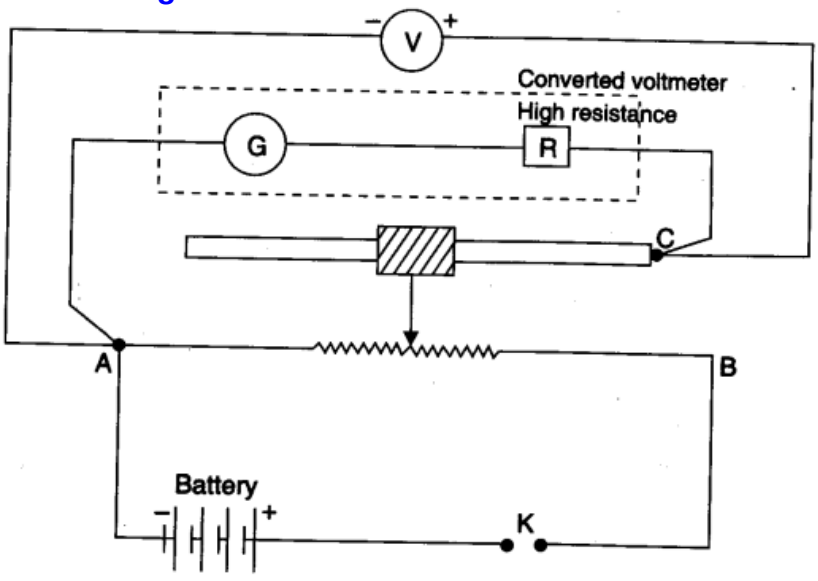

Fig. Circuit diagram for verification for voltmeter.

Procedure

1. Calculate the value of series resistance R to be connected in series with the galvanometer for the given range V (say 3 volts).
2. Connect a resistance box in series with the galvanometer and take out the plugs of resistance R. Now the given galvanometer is ready for use as a voltmeter of range V volts.
3. For verification make the connections as shown in the circuit diagram. Here AB is a rheostat being used as a potential divider. A and B are the fixed terminals and C is the variable terminal of the rheostat.
4. Take out the plugs of calculated resistance R from the resistance box. Insert the key K and adjust the movable contact of the rheostat so that deflection in the galvanometer becomes maximum.
5. Note the readings of voltmeter and galvanometer. Convert the galvanometer reading into volts.
6. Find the difference, if any, between the readings of voltmeter and galvanometer. The difference gives the error.
7. Move the variable contact C of the rheostat and take at least five observations covering the whole range of the voltmeter i.e., 0-3 volts.
8. Record your observations.

Calculations

Resistance of the given galvanometer, $G = ...$

Figure of merit, $k = ...$

Number of divisions in the galvanometer scale, $n = ...$

Current for full scale deflection, $I_g = nk = ...$

Range of conversion, $V = ...$

Resistance to be placed in series with the galvanometer, $R = \frac{V}{I_g} - G = ...$

Verification

Least count of the galvanometer converted into voltmeter = $\frac{V}{n}$ = ...

Table for verification for converted voltmeter

Serial No. of Obs (1)	*Reading of converted galvanometer into voltmeter*		*Standard voltmeter reading* V_2 (V) (3)	*Difference (Error)* $V_2 - V_1$ (V) (4)
	Deflection θ (2a)	*P.D. in volts* $V_1 = \theta \times L.C.$ (V) (2b)		
1.				
2.				
3.				
4.				

Result

As the difference in actual and measured value of potential difference (as recorded, in column 4) is very small, the conversion is perfect.

Precautions

1. All the connections should be neat, clean and tight.
2. The e.m.f. of the cell or battery should be constant.
3. The ammeter used for verification should preferably be of the same range, as the range of conversion.
4. The diameter of the wire to be used for shunt resistance, should be measured accurately.
5. Length of shunt wire used should be neither too small nor too large.
6. The resistance box should be a high resistance one.
7. The voltmeter used for verification should preferably be of the same range, as the range of conversion.
8. Value of required series resistance should be calculated accurately.