OBJECTIVE

To verify the laws of combination (series and parallel) of resistances using a metre bridge (slide wire bridge).

APPARATUS

A metre bridge, a Leclanche cell (battery eliminator), a galvanometer, a resistance box, a jockey, two resistance wires or two resistance coils known resistances, a set square, sand paper and connecting wires.

CIRCUIT DIAGRAMS (*Fig. 3.10 and Fig. 3.11*)

(*i*) *In series*

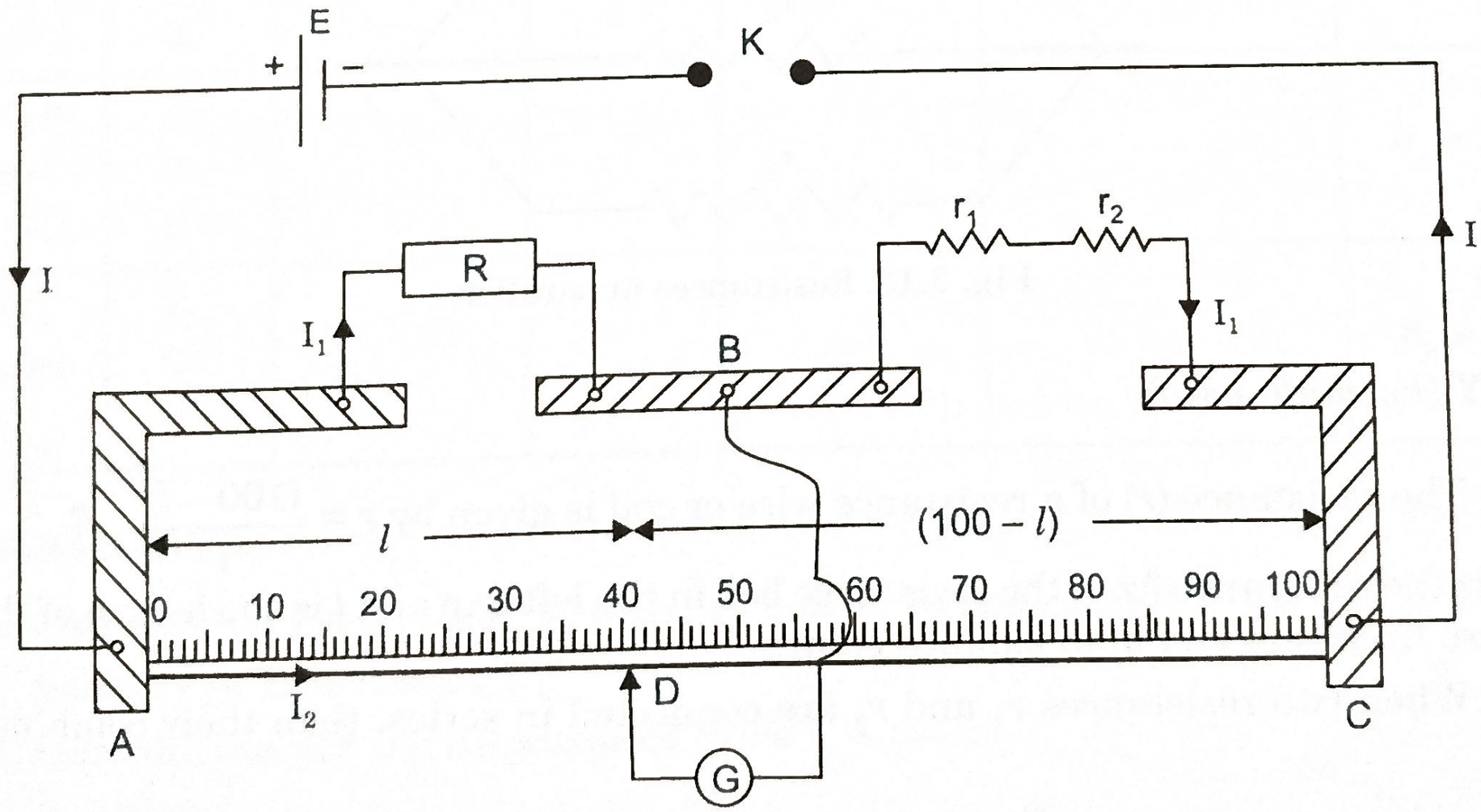

Fig. 3.10. Series combination of resistances.

(ii) In parallel

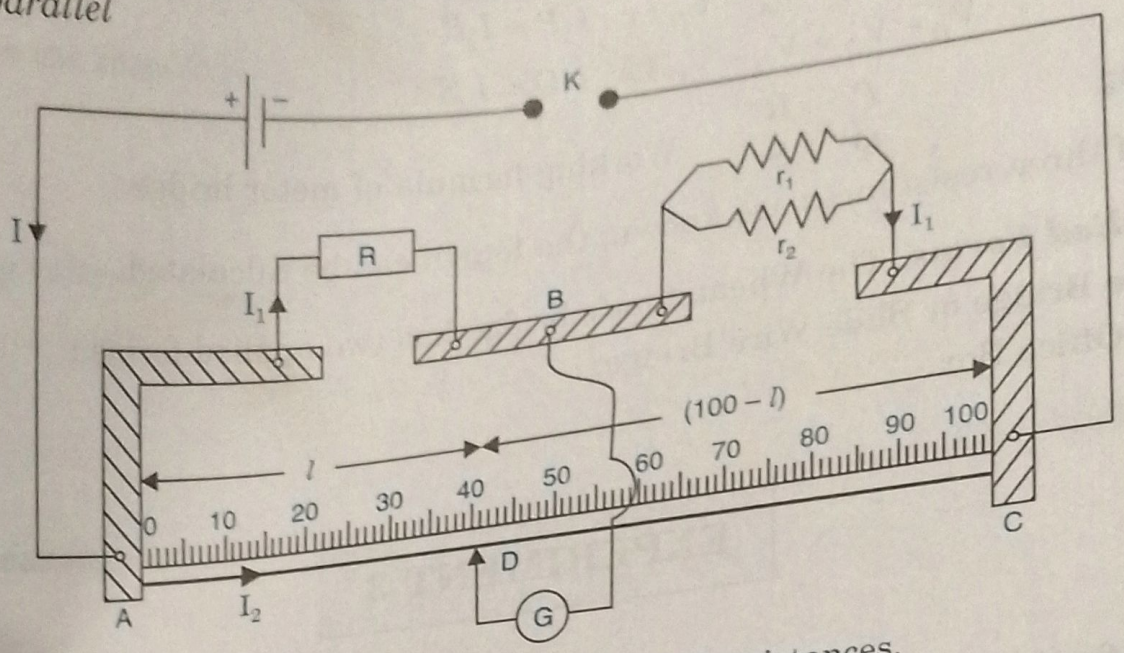

Fig. 3.11. Parallel combination of resistances.

(iii) Resistances in series

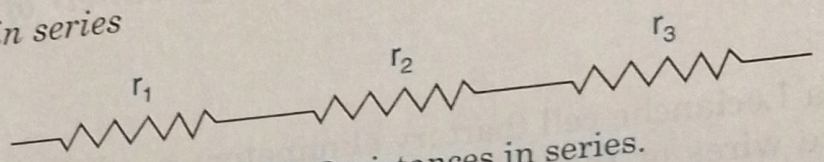

Fig. 3.12. Resistances in series.

(iv) Resistances in parallel

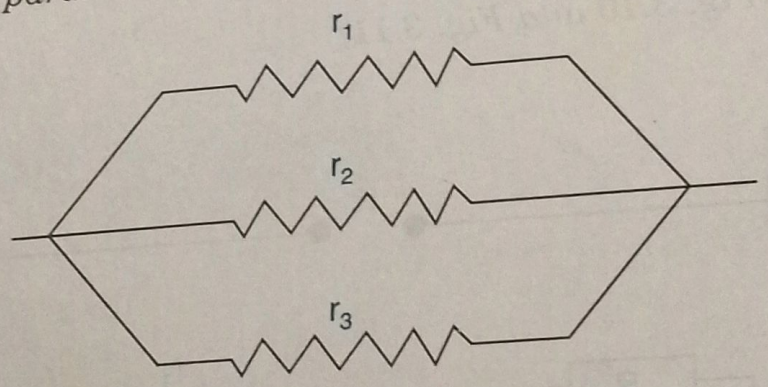

Fig. 3.13. Resistances in parallel.

THEORY (*Formula used*)

(*i*) The resistance (r) of a resistance wire or coil is given by $r = \frac{(100 - l)}{l} \cdot R$

where R is the resistance from the resistance box in the left gap and l is the length of the metre bridge wire from zero end upto balance point.

(*ii*) When two resistances r_1 and r_2 are connected in series, then their combined resistance

$$R_s = r_1 + r_2$$

(*iii*) When r_1 and r_2 are connected in parallel, then their combined resistance

$$R_p = \frac{r_1 r_2}{r_1 + r_2}$$

PROCEDURE (*Stepwise*)

1. Mark the two resistance coils as r_1 and r_2.
2. To find r_1 and r_2 proceed same way as in Experiment 1. (If r_1 and r_2 are not known.)
3. Connect the two coils r_1 and r_2 in series as shown in Fig. 3.09 in the right gap of metre bridge and find the resistance of this combination. Take at least three sets of observations.
4. Connect the coils in parallel in the right gap as shown in Fig. 3.10. Find the resistance of the combination. Take at least three sets of observations.
5. Record your observations as follows.

OBSERVATIONS

1. Table for length (l) and unknown resistance (X)

Resistance coil (1)	*Serial No. of Obs.* (2)	*Resistance from the resistance box R (ohm)* (3)	*Length AD = l (cm)* (4)	*Length DC = 100 – l (cm)* (5)	*Resistance* $r = \left(\frac{100-l}{l}\right).R$ (6)	*Mean resistance (ohm)* (7)
r_1 only	1. 2. 3.					r_1 = ...
r_2 only	1. 2. 3.					r_2 = ...
r_1 and r_2 in series	1. 2. 3.					R_s = ...
r_1 and r_2 in parallel	1. 2. 3.					R_p = ...

CALCULATIONS

1. Calculation for r_1 only, r_2 only, r_1 and r_2 in series and r_1 and r_2 in parallel.

Same as in Experiment 1.

2. Calculation for verification of laws

(*i*) *In series*

Experimental value of R_s = ... ohm

Theoretical value of $R_s = r_1 + r_2$ = ... ohm

Difference (if any) = ... ohm

(*ii*) *In parallel*

Experimental value of R_p = ... ohm

Theoretical value of $R_p = \dfrac{r_1 r_2}{r_1 + r_2}$

= ..... ohm

Difference (if any) = ... ohm

RESULT

1. Within limits of experimental error, experimental and theoretical values of R_s are same. Hence, law of resistances in series is verified.
2. Within limits of experimental error, experimental and theoretical values of R_p are same. Hence, law of resistances in parallel is verified.

PRECAUTIONS (*to be taken*)

Same as in Experiment 1.

SOURCES OF ERROR

Same as in Experiment 1.