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then each source can be treated as if it acts independently of the others.

Hence, we can calculate the effect of one source at a time and then superimpose *i.e.*, algebraically add the results of all the other sources.

Following steps are taken while applying this theorem to the solution of networks which contain more than one voltage or current source :

1. First, all sources except the one under consideration are removed. While removing these voltage sources, their internal resistances (if any) are left behind. While removing current sources, they are replaced by an **open** circuit since their internal resistance (by definition) is infinite (Art. 4.4).

2. Next, currents in various resistors and their voltage drops due to this single source are calculated.

3. This process is repeated for other sources taken one at a time.

4. Finally, *algebraic* sum of currents and voltage drops over a resistor due to different sources is taken. It gives the actual value of current and voltage drop in that resistor or component.

Example 4.1. *Using Superposition theorem, calculate current in each branch of the network shown in Fig. 4.1 (a).*

Solution. We will find two sets of branch currents : one when 6 V battery is not there and the other, when 12 V battery is not there. Let the different branch currents be I_1, I_2 and I as shown in Fig. 4.1 (*a*). In Fig. 4.1 (*b*), 6 V battery has been removed and then replaced by short circuit (since its internal resistance is zero). Various branch currents are as under :

$R_{BD} = 4 \| 4 = 2\,\Omega$. Hence, total circuit resistance is $= 6 + 2 = 8\,\Omega$. Therefore, $I_1' = 12/8$ 1.5A. At point *B*, this current divides equally into two parts.

$$I_1' = 0.75 \text{ A and } I_2' = 0.75 \text{ A}$$

In Fig. 4.2 (*a*) 12 V battery has been removed and replaced by short circuit (since its internal resistance is zero).

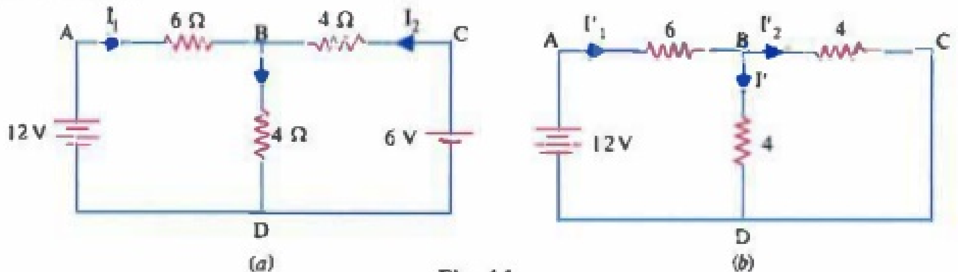

Fig. 4.1

Here, $R_{BD} = 6 \| 4 = 2.4\,\Omega$, total resistance, $R = 4 + 2.4 = 6.4\,\Omega$. Hence, $I_2'' = 6/6.4 = 0.94$ A. This current divides at point *B* in the inverse ratio of the resistances of the two parallel paths.

$I_1'' = 0.94 \times 4/10 = 0.38$ A; $\quad I'' = 0.94 \times 6/10 = 0.56$ A

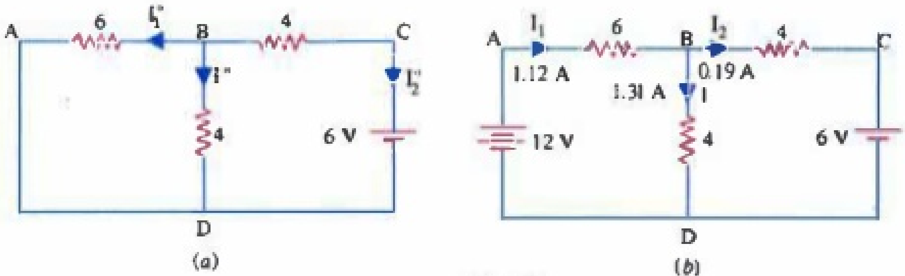

Fig. 4.2

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