15. To be as general as possible, we refer to the individual emf's as $\mathcal{E}_1$ and $\mathcal{E}_2$ and wait until the latter steps to equate them ($\mathcal{E}_1 = \mathcal{E}_2 = \mathcal{E}$). The batteries are placed in series in such a way that their voltages add; that is, they do not "oppose" each other. The total resistance in the circuit is therefore $R_{\text{total}} = R + r_1 + r_2$ (where the problem tells us $r_1 > r_2$), and the "net emf" in the circuit is $\mathcal{E}_1 + \mathcal{E}_2$. Since battery 1 has the higher internal resistance, it is the one capable of having a zero terminal voltage, as the computation in part (a) shows.

(a) The current in the circuit is

$$i = \frac{\mathcal{E}_1 + \mathcal{E}_2}{r_1 + r_2 + R} ,$$

and the requirement of zero terminal voltage leads to

$$\mathcal{E}_1 = ir_1 \implies R = \frac{\mathcal{E}_2 r_1 - \mathcal{E}_1 r_2}{\mathcal{E}_1}$$

which reduces to $R = r_1 - r_2$ when we set $\mathcal{E}_1 = \mathcal{E}_2$.

(b) As mentioned above, this occurs in battery 1.