

# many hands make light work

# 104

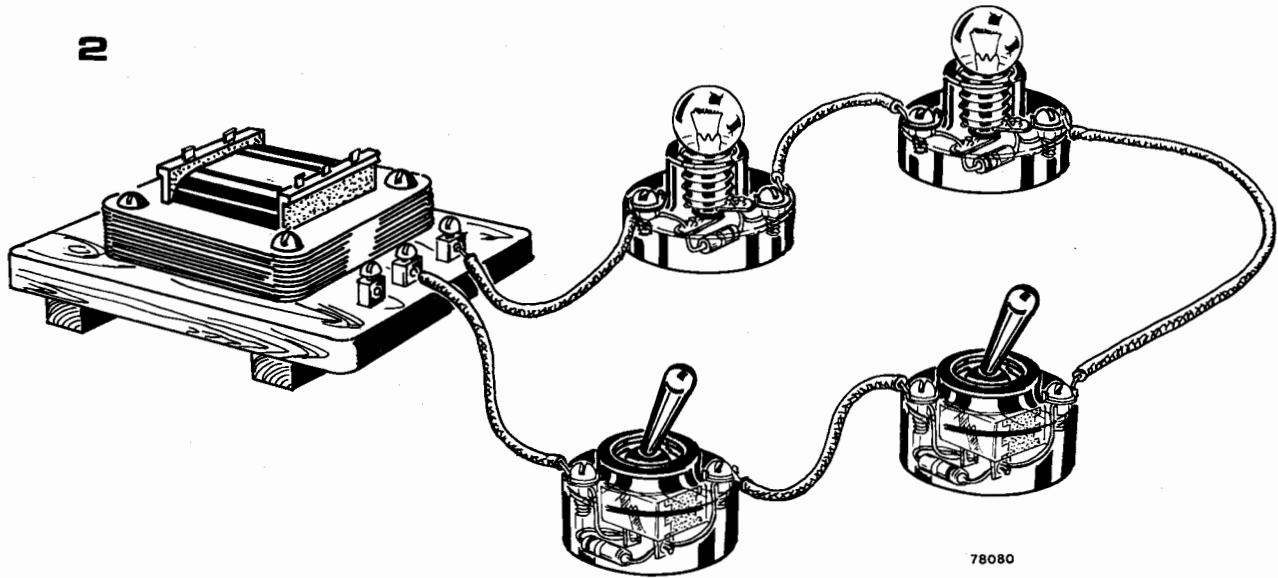
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This simple circuit can be used as a party trick which should completely flummox anyone who has little knowledge of electronics. At first

sight the circuit appears to consist of two switches and two lamps connected in series, with a power supply connected across the whole

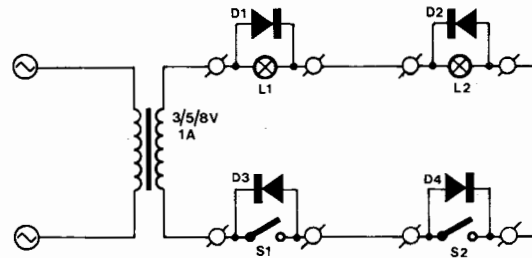
chain. When both switches are closed both lamps light, as would be expected. However, when one switch





extinguished. If the other switch is opened then the second lamp goes out, whilst both switches must be open to extinguish both lamps. Furthermore, if either lamp is removed from its holder the other lamp, if lit, will remain lit. The circuit (figure 1) is extremely simple, consisting only of a transformer and four diodes in addition to the lamps and switches. When S1 and S2 are both open then D4 is reverse-biased on the positive half-cycle of the mains waveform, whilst D3 is reverse-biased on the negative half-cycle, so no current can flow in either direction. If S1 is closed then D3 is shorted out and current can flow anticlockwise round the loop (during the negative half-cycle) through D4, D2 and L1, lighting L1. A small current also flows through L2 due to the forward voltage of D2, but not enough to light it. If S2 is closed then D4 is shorted out and current can flow clockwise round the loop through D3, D1 and L2. When both switches are closed then both lamps light.

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D1... D4=1N4001  
L1... L2=6V/0.3A

Figure 2 shows a suggested layout for the circuit, which should be mounted on a board with the connecting wire clearly visible so that there can be no suspicion of skulduggery. If batten-mounting MES lampholders are used then diodes D1 and D2 can be concealed in their bases, and if surface-mounting toggle switches are used diodes D3 and D4 can be concealed inside them.

A variation on this construction is to mount D1 and D2 inside the screw bases of the lamps, though this calls for a little care in dismantling the

lamps without damaging them. If either lamp is then unscrewed the other lamp will extinguish, further confirming the illusion that the circuit is simply a series connection. Furthermore, if the lamps are changed over then L2 will still be controlled by S1 and L1 by S2, even though they are now in different sockets.

As the circuit may be used by children the accent should be on safety, with a double-bobbin transformer such as a bell transformer being used.