

JACOB'S LADDER

A climbing electric arc has held the imagination of science-fiction fans as the symbol for an eerie laboratory!

JAMES, NICOLE, and DWIGHT PATRICK, Jr.

IN MANY SCI-FI AND HORROR FLICKS, ESPECIALLY THE STOCK "FRANKENSTEIN" variety, along with weird sound effects and the like, movie producers always feature the fantastic visual effects produced by Tesla coils, van de Graaff generators, and Jacob's Ladders. Of those three devices, the Jacob's Ladder is the easiest to build. With a low-current neon-sign transformer, a converted flyback transformer, converted auto spark coil, or other similar transformer, you can whip together your own Jacob's Ladder in less than an hour. Because the ladder is so simple, there's no need for a detailed parts list or a schematic. We tell you how to build one as we reveal the theory of operation.

Getting started

As we can see in Fig. 1, a Jacob's Ladder provides a fantastic visual effect. A beautiful electric arc hisses its way up two diverging wires, providing a fascinating and downright scary effect. The arc starts at the smallest distance between the vee electrodes (Fig. 1-a), and "walks" up the widening gap toward the top of the electrodes (Fig. 1-b).

Why does the arc walk up the vee electrodes? You would expect that when the arc starts to jump across the narrow gap at the bottom of the electrodes, that it would stay there where the electrical resistance between the electrodes is lowest. What actually happens is that the arc heats the air it passes through, causing it to rise. Because the heated air is ionized by the high-voltage arc, it provides a very low-resistance path, so the current path (the arc) rises with the warm air.

Eventually the arc reaches the top of the ladder (the electrodes) and bows upward creating an electrical path that gets longer and longer. At the point where the resistance at the bottom of the electrodes is less than that of the arc-path, the upper arc stops, and a new arc begins at the bottom of the ladder. Thus, what is seen is a continuous climbing arc that disappears at the top of the ladder and reappears at the bottom. It's all a lot of fun to watch, providing that you don't poke your finger between the electrodes or get your nose too close.

To build a Jacob's Ladder, you need a high-voltage source that

