

BUILD A ZIRCONIUM ARC PROJECTOR

This lamp has a wide range of applications, all the way from demonstrating optical phenomena to enlarging photographs

by HAROLD PALLATZ

YOU CAN MAKE YOURSELF A COMPLETE Zirconium arc projection system with a few low-cost, readily available parts. With your completed system you can make a number of experiments not feasible with other types of lights. For example, you can project images such as pinheads, tiny parts or color slides directly on a screen *without using a lens*. You vary the size of the projected image just by changing the distance of the object to the light source. It will be in sharp focus for the entire distance.

The high brilliance light (white light) is actually an arc formed between two zirconium electrodes. The reason for its ability to project "lens-less" images is its tiny area. The 2-watt lamp has a diameter of 0.005 inch, while the 10-watt lamp has a 0.016-inch diameter (at 29,300 candles per in).

Construction hints

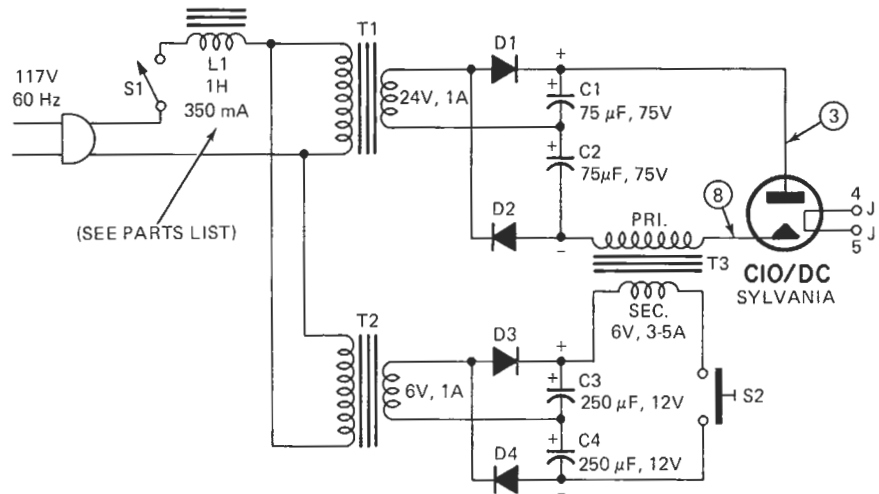
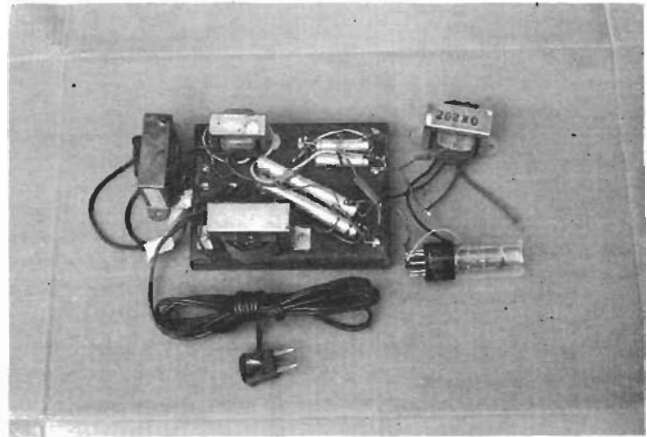
You will need a low-voltage power supply, a pulse starter circuit and some means of limiting the maximum operating current.

A 24-volt transformer forms part of a voltage-doubler circuit to provide 48 volts at less than 0.5 ampere for the arc current. It is limited with an ozone lamp ballast in the primary. You can substitute a 40-watt lamp or a 1-henry choke. Thus even under short-circuit conditions, less than one ampere dc current will flow.

The pulse transformer consists of a standard 6-volt transformer connected backwards. A momentary application of dc to the filament winding produces the necessary thousand volts to start the lamp. You might find that the lamp will start easier with a particular polarity on the filament. This is because either a positive or a negative pulse will then be developed across the arc. Do not apply the dc to the filament more than a fraction of a second at a time, to prevent overheating.

We used the 600-volt diodes specified in the schematic because they were handy. You can get by with lower-rated (say 300-volt) types.

ARC PROJECTOR in breadboard form and **SIMPLE SCHEMATIC** at right and below, respectively. The type **C10/DC** lamp is available from Edmund Scientific Co. The catalog No. is 41,548 and price is \$30.80.



PARTS LIST

C1, C2—75 μ F, 75V, electrolytic
C3, C4—250 μ F, 12V, electrolytic
D1, D2, D3, D4—Silicon, 600V PIV at 1A
L1—4W ozone lamp ballast; or 1H, 350-MA

choke; or 40W, 115V lamp.
T1—115V pri, 24V, 1A sec
T2—115V pri, 6V, 1A sec
T3—115V pri, 6V, 3-5A sec

Put it to work

Sometimes a new lamp will require many pulses to activate it. Once started the light will be unusually steady and constant in intensity. Do not look directly into the light—as its high brilliance can affect the eyes. Zirconium lamps are made by Sylvania Electric. We used a type C10/DC rated 10 watts, 21 volts operating (recommended power supply is 50 volts dc or more). A 1,000V pulse at 0.5A operating current

is required.

An unusual optical experiment you can perform is image reversal. Place a slide or other object between the light source and a lens. Move the lens back and forth. At some positions the image will be right side up. As the lens is moved, the image will be seen to turn upside down. An intense spot of light at a considerable distance can be obtained by placing a lens in front of the lamp and bringing the arc into focus. **R-E**