

# Build Your Own Strobe

Like to scratchbuild electronics? Here's a \$25 strobe project for your aircraft.

BY JIM WEIR



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**W**hat is a strobe? It is nothing more than a man-made lightning bolt held captive in a glass tube. To the electronics industry, it's simply a high-voltage plasma discharge in a low-pressure gas container. Simplicity itself.

Photographers were among the first consumers to benefit from strobes—for lighting their subjects. Who uses flashbulbs anymore? Pilots have found an equally beneficial use for electronic strobes: fending off other airborne objects. With the latter use in a homebuilt aircraft in mind, let's proceed.

But before we do, a word of *Caution!*—The voltages and currents we design into our captive lightning bolt are *dangerous!* You can kill yourself playing around with this design, and if I have to tell you what parts are dangerous, you are *not qualified to build this circuit.* Sign the liability waiver here.

The first problem is one of power. We need about 300 volts at some decent current to make this little rascal flash. While we cannot really build a simple supply to flash the tube directly, if we charge a capacitor slowly (a couple of seconds or so) to 300 volts and *then* fire the trigger on the flash tube, the charge stored in the capacitor will be more than enough to provide a brilliant flash discharge. Then recharge the capacitor, flash the tube, recharge the capacitor, flash the tube, and so forth.

Getting 300 volts DC from a 12-volt battery isn't too difficult if you chop the 12 volts DC into 12 volts AC, use a transformer to boost the 12 volts AC into 300 volts AC, and then rectify the AC into 300 volts DC. While all this may sound hard, follow along and let's see if we can't make this task a little easier.

One-quarter of an LM324 quad op-amp is used as a 10 kHz oscillator. This frequency was chosen for a couple of reasons. First, the transformer and chopper transistors are most efficient at this frequency, and second, this frequency is well above the range most people can hear easily and will not

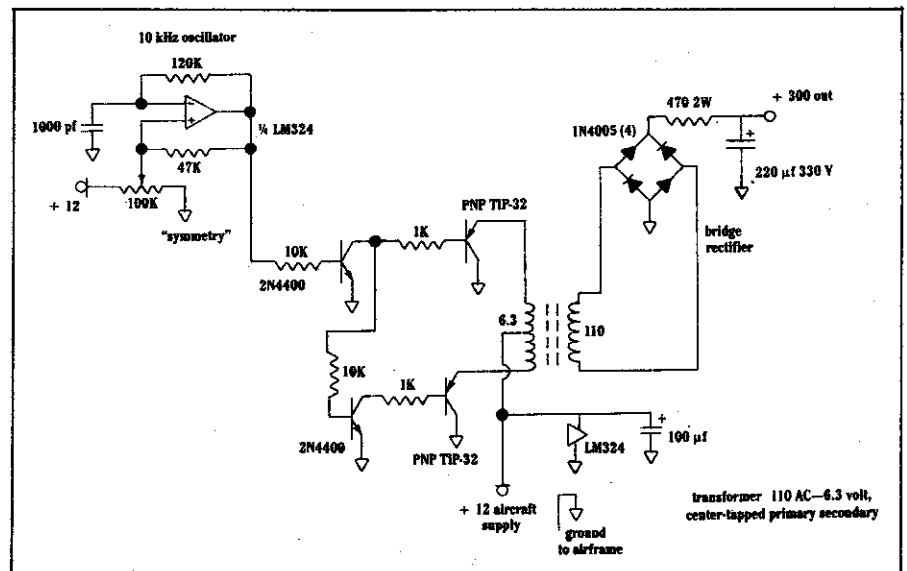


Figure 1. 12-to-300-volt power inverter.

squeal in your audio system if there is any leakage. The output of this op-amp is a 10-kHz square wave with an amplitude of 12 volts peak-to-peak.

This square wave is used to turn the top 2N4400 driver transistor on, which then turns on the top TIP-32 transformer driver. When the square wave turns off, the bottom 2N4400 is turned on through the base resistor of the top TIP-32, and thus the bottom TIP-32 is turned on also. This action of first the top two transistors turning on, then the bottom two transistors, then the top two . . . chops the input 12 volt DC into AC for the transformer.

We are going to cheat on the transformer. While the rating on the transformer may read that it is a 110-to-6.3-volt device, if we jam 12 volts into the 6 volt winding, we will get 220 volts out the other end. Not only that, but those are *sine wave* ratings and we are driving the thing with a square wave. The bottom line is that if you build the circuit as shown, 300 volts peak-to-peak will appear at the transformer secondary. Four diodes convert this AC to DC, and the 220 µF capacitor is charged to

this voltage through the 470 ohm 2 watt resistor slowly to 300 volts.

This charged capacitor is placed directly across the flashtube, but unless we have some way of starting the lightning bolt in the tube, this is not enough voltage to jump between the electrodes in the ends of the tube. What we need to do is start a tiny little thread of lightning in the tube, and then the heavy electrical discharge of the capacitor will follow this leader and create the brilliant flash. (Really, folks, it is just like lightning.)

There is a device called a *trigger transformer* that will take a 150 volt pulse and convert it into a 4000 volt pulse. This 4000 volt pulse will be more than enough to start the lightning leader in the tube, but where to get 150 volts? How about a voltage divider across the 300 volt supply? Charge a 0.1 µF capacitor with the slowly rising 300 volt supply divided in two and then bang-discharge it with a microsecond pulse from an SCR.

A second section of the LM324 quad op-amp is used as a 5-second oscillator. Once every 5 seconds this oscillator provides a millisecond pulse that turns on the SCR, discharges the 0.1 µF capacitor, provides a 150 volt

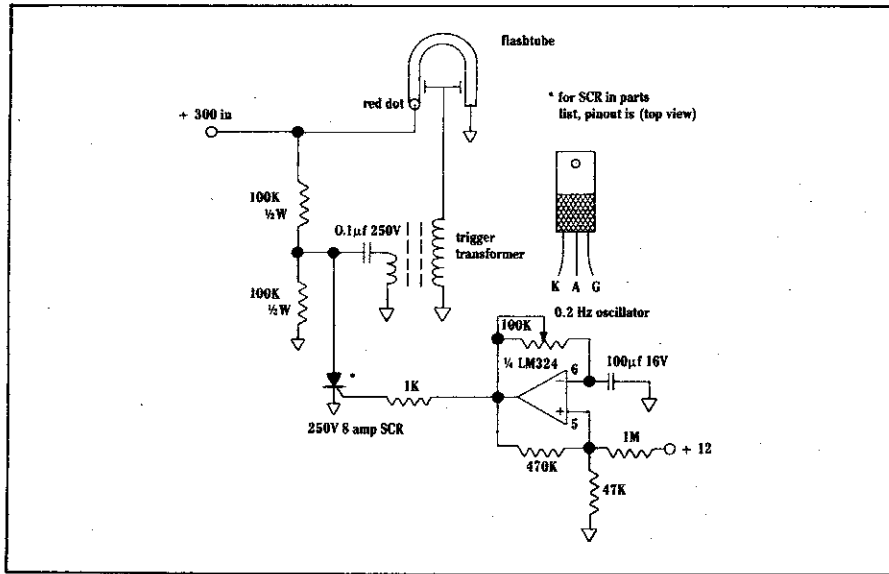


Figure 2. Strobe lamp and trigger.

pulse to the trigger transformer, flashes the tube, and then resets and waits for the power supply to build up the voltage to 300 volts again.

If I may, I am going to run a commercial here for a company in which I have absolutely no interest other than wishing them well (after all, I met the company owner at an airport—they can't be all bad with a pilot at the helm).

Mouser Electronics of Santee, California, is an excellent source of electronic components for experimenters. The company publishes a free thick catalog and has a toll-free 800 phone line. However, Mouser is not equipped to handle your technical questions (it is

an industrial electronic component supplier) and is from time to time reluctant to sell onesy-twosies of its parts. Try, if at all possible, to get a decent order quantity together (say, \$100 or more) so that you don't louse up the system for the rest of us who are buying quantities of these components. Call Mouser at 800/346-6873.

Special parts are shown on the critical parts list. Others—resistors, capacitors, perfboard, op-amp IC—are available through local electronic supply stores including Radio Shack. □

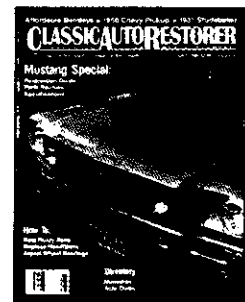
**Radio Systems Technology**, which produces avionics in kit form. A free catalog is available from RST **Grass Valley, CA 95945; call 916/272-2203.**

### Strobe critical parts list

| Name                           | Mouser P/N | \$ each |
|--------------------------------|------------|---------|
| Flashtube                      | 36FT106    | 3.70    |
| Trigger Transformer (4 kV)     | 42FM403    | 1.71    |
| SCR                            | 519-S4008L | 1.46    |
| PNP Power Transistor (2)       | 511-TIP-32 | 0.48    |
| Rectifier Diode (4)            | 333-1N4005 | 0.15    |
| Filament Transformer 110/6.3ct | 41FD300    | 3.85    |

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