

# UNIVERSAL STROBE goes PSYCHEDELIC

BY JAMES CUCCIA

- EXCITES DANCERS
- STOPS MOTION
- TAKES PICTURES
- TIMES ENGINES

#### EDITOR'S NOTE

Medical opinion concerning the use of strobe lighting in darkened rooms is "cautionary." Prolonged use may induce hallucinations or trigger undesired side-effects. It should not be used in the presence of anyone subject to epilepsy.

ONE OF THE MOST interesting of the new "turned on" type of lighting effects is strobe lighting. By using a strobe light system flashing at the proper rate in a semi-darkened room, a visual flicker effect similar to that found in old-time movies can be seen as people walk or dance in the light of the flash. Since the action seems to take place as a series of "still" frames, a very unreal atmosphere can be created.

The "Universal Psychedelic Strobe" described in this article will not only be the hit of your next party, but can also earn its keep by performing other, less glamorous duties. It will serve as an auto-

mobile timing light, a slave flash for your camera, or a general-purpose strobe light for stop-motion observation of moving mechanical elements.

**Construction.** The circuit (Fig. 1) can be built on a single printed board, such as the one shown actual-size in Fig. 2. The components are mounted on the board in accordance with the layout of Fig. 3. Carefully solder all components to the board using resin-core solder.

Be extra careful when mounting the flashtube as it is made of glass and can be broken if it is accidentally dropped, or hit with a metal tool. Orient the trigger coil (L1) so that the tab with the red dot points toward the flashtube. (The flashtube is mounted as shown in Fig. 4 with its trigger lead soldered directly to this coded tab to prevent a voltage breakdown on the printed board.) And be sure to observe the proper polarity when

mounting all semiconductors and electrolytic capacitors.

Then mount the finished wired board in a 3" x 5" x 2" metal enclosure using half-inch spacers. The flashtube should extend above the top of the enclosure, but not high enough to short the leads when the cover is attached. On-off switch S1 is mounted on one end of the box, while the a.c. power lead and audio cable extend from the other end. Note the location of R10 and drill a hole in the enclosure wall so that R10 can be screw-driver-adjusted from the outside.

Carefully measure the location of the flashtube, and, allowing some clearance on all sides, make a cut in the cover of the metal enclosure of a size that will permit the cover to pass easily over the flashtube. Obtain some form of metal reflector—the one shown in the author's prototype is a stainless steel half-quart container—and cut a slot in its bottom

### PARTS LIST

- C1—0.02- $\mu$ F, 50-volt disc capacitor
  - C2—30- $\mu$ F, 15-volt electrolytic capacitor
  - C3—1- $\mu$ F, 15-volt electrolytic capacitor
  - C4—0.02- $\mu$ F, 400-volt disc capacitor
  - C5—20- $\mu$ F, 350-volt electrolytic capacitor
  - C6—10- $\mu$ F, 150-volt electrolytic capacitor
  - C7—10- $\mu$ F, 15-volt electrolytic capacitor
  - D1, D2—1N34 diode
  - D3, D4, D5—1N4003 silicon diode or similar
  - FT1—Xenon flashtube (Southwest Technical Type 110)
  - L1—Trigger coil (Southwest Technical TL2)
  - Q1—2N4870 unijunction transistor
  - R1—100 ohms
  - R2—22,000 ohms
  - R3—10,000 ohms
  - R4—180 ohms
  - R5—220 ohms
  - R6—100,000 ohms
  - R7—120,000 ohms
  - R8—27,000 ohms
  - R9—20 ohms, 5 watts
  - R10—50,000-ohm potentiometer
- } All resistors  
}  $\frac{1}{2}$ -watt unless  
} otherwise stated

- S1—S.p.s.t. switch
- SCR1—2N3528 silicon-controlled rectifier
- T1—Interstage transformer, 2000 ohms, CT, to 10,000 ohms (Southwest Technical TT10-2 or similar)
- Misc.—Circuit board, metal enclosure, metal reflector, audio cable, power cable, spacers, wire, solder, etc.

NOTE: An etched and drilled PC board is available from Southwest Technical Products Corp., 219 W. Rhapsody, San Antonio, Texas 78216, for \$2.25; complete kit of parts, PC board, and enclosure for \$12.75 (less reflector).

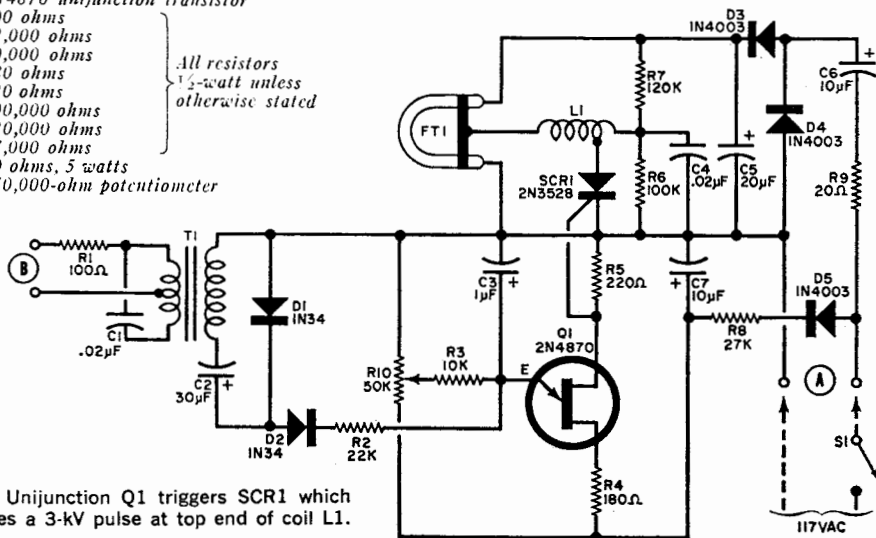


Fig. 1. Unijunction Q1 triggers SCR1 which produces a 3-kV pulse at top end of coil L1.

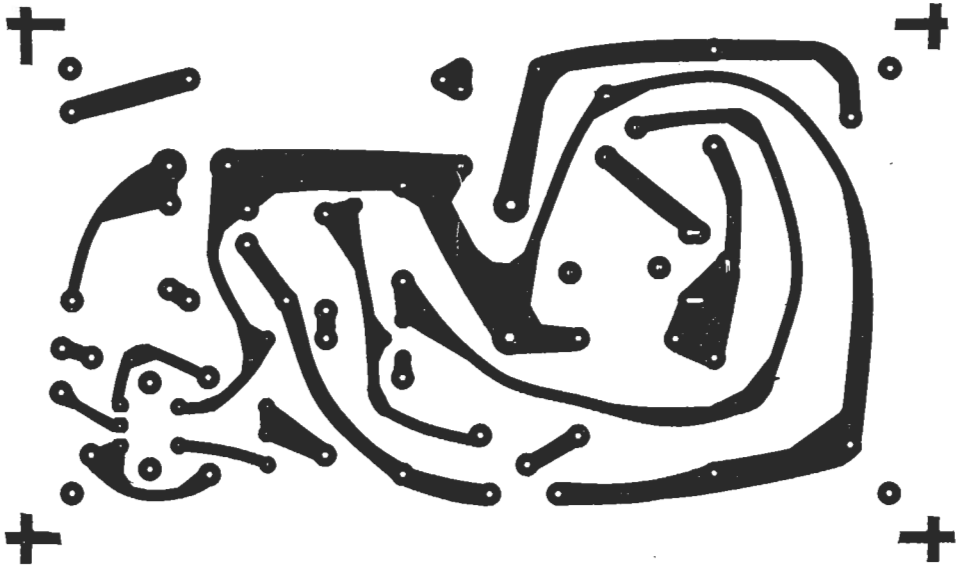


Fig. 2. Actual-size printed circuit board. You can make the board yourself or purchase it (see Parts List). If you make your own board, drill the holes as shown.

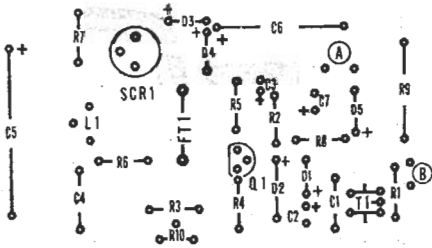
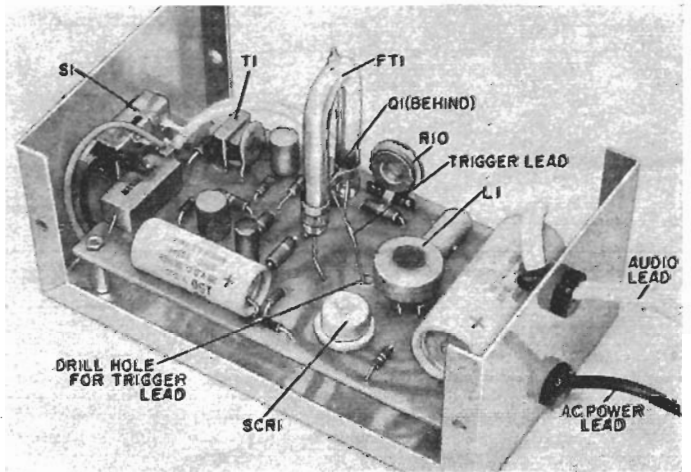


Fig. 3. Component mounting for the strobe. The terminals marked "B" are for the audio input, those marked "A" for power input.

Fig. 4. The finished strobe before the top cover and reflector are assembled. Note that a hole must be drilled in the PC board to accommodate the lamp trigger.



Be especially careful when installing the strobe tube as it is fragile and it cannot withstand mechanical shock.

### HOW IT WORKS

The heart of the strobe is a low-cost xenon flashtube that can be operated from a 250- to 300-volt d.c. voltage source. This voltage is produced by a voltage doubler consisting of *D3*, *D4*, *C5*, and *C6*, with *R9* limiting the surge current flow. However, the flashtube will not fire until its trigger electrode is provided with a 3000-volt pulse, which is generated in a "flyback" type pulse generator consisting of auto transformer *L1* and *SCR1*.

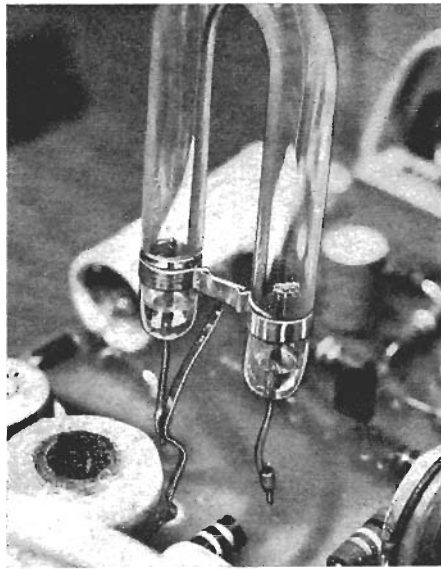
When the power is first turned on, the SCR is in its non-conducting state; thus *C4* is allowed to charge up to the power supply potential. If the gate of the SCR is furnished with a positive-going trigger pulse, the SCR goes almost instantaneously into conduction and allows *C4* to discharge through the lower end of inductor *L1*. The auto transformer action of *L1* produces a 3- to 4-kV pulse at its high-voltage end which triggers the flash tube on.

The SCR is triggered by unijunction transistor *Q1*. This UJT is connected as a conventional relaxation oscillator in which *C3* discharges through the UJT every time the voltage across *C3* exceeds the firing potential of the UJT. The rate of charge of *C3* is determined by potentiometer *R10* and series resistor *R3*. As *R10* is set to a higher voltage, capacitor *C3* reaches the required firing voltage faster, making the UJT oscillate at a faster rate. The positive-going pulses generated at the UJT *B1* lead put the SCR into conduction.

Once the SCR conducts, the voltage at its anode momentarily drops to zero, allowing the SCR to switch to its non-conducting state, and be ready for the next gate trigger pulse. Supply voltage for the UJT is obtained from a separate power source (consisting of diode *D5*, resistor *R8*, and filter capacitor *C7*) to prevent the sudden current surge produced by the flashtube from firing the transistor.

To make the flash rate follow a given audio level, transformer *T1* isolates the strobe from any external grounds (remember that it is a line-operated device), and couples the UJT circuit into an audio amplifier. The audio signal applied to *T1* is rectified by diodes *D1* and *D2*, and the resulting d.c. is applied through *R2* to the emitter of the UJT. Capacitor *C3* is also charged by a voltage generated by the input signal. If *R10* is set properly, every time that the d.c. on the emitter reaches the required firing voltage, the UJT triggers, producing a flash.

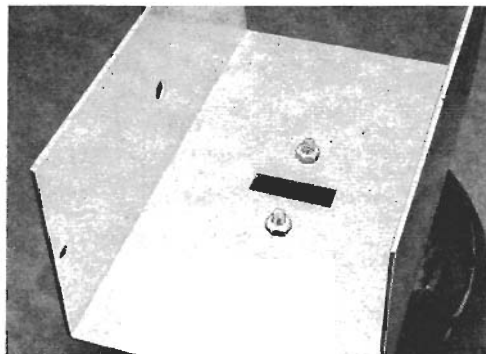
Cut a slot in both cover and reflector so that tube can easily slip through. Be careful also when installing cover or the tube, or its leads, may be damaged.



surface similar in size to that made in the enclosure cover. Bolt the reflector to the metal cover, carefully aligning the two slots. Now, still being very careful, mount the cover-reflector combination on the remainder of the enclosure.

**Operation.** Point the strobe reflector so that it will not flash directly into your eyes. Connect the power lead to a source of 117 volts a.c. and turn on *S1*. A slight rotation of *R10* should start the flash operating. The frequency of the flash is dependent on the setting of *R10*.

To make the strobe follow a musical beat, connect the audio leads in parallel  
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with a loudspeaker voice coil, turn down the audio output, and adjust *R10* until the flash just stops firing. As the volume is turned up, the flash will start to follow the major beat of the music, producing one flash for each beat. When an audio amplifier is played at very loud volume, it may be necessary to bridge the audio output with a potentiometer to provide the strobe with enough signal to fire, but not enough to overload.

To use the strobe as an auto timing light, ground one of the audio leads to the engine and connect a 5-megohm resistor in series with the other one. Solder a small piece of insulated wire to the far end of the resistor, and wrap several turns around the number-one spark plug lead. Set *R10* until the flash just stops when the engine is not running. Now start the engine. Every time the number-one plug fires, it will cause the strobe to fire. If the strobe does not fire, it may be necessary to connect the far end of the resistor directly to the spark plug.

To use the strobe as a slave flash unit for your camera, connect one audio input to one side of the camera switch, and the other audio input to a 1½-volt flashlight cell in series with the other side of the camera switch. Set *R10* so that the strobe doesn't self-trigger. Every time the camera switch is operated the unit will flash. If the flash does not put out enough light for some photography purposes, the value of *C5* can be increased somewhat. This capacitance value should not be changed if the unit is being employed as a psychedelic strobe, as the higher light output will shorten the flashtube life.

To use the strobe as a mechanical motion stopper, *R10* can be adjusted until the motion being observed seems to be stopped. If major use of this mode of operation is desired, it is possible to remove *R10* from the circuit board and to replace it with a conventional potentiometer mounted on the metal enclosure as the speed control; the potentiometer shaft should have a pointer knob attached to it and a dial can be made and calibrated against known speeds. —30—