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(The following article is based on information contained in the book "Applications of Neon Lamps and Gas Discharge Tubes" by Edward Bauman, published by Carlton Press. Copies of the book may be obtained from Signalite, Inc., 1933 Heck Avenue, Neptune, New Jersey 07753. Price is $2.95 plus 25 cents for handling and postage. For New Jersey residents, the 3% state sales tax must also be included.)

USING NEONS IN TIMING CIRCUITS

By Edward Bauman and
John Cawley
Signalite Incorporated

The bistable characteristics and high leakage resistance of neon glow lamps are particularly useful for timing applications. The basic circuit for a neon-timer is a resistance-capacitor network similar to that for a relaxation oscillator. (See Figure 1) The input voltage charges the ca-

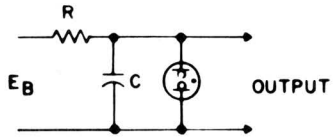
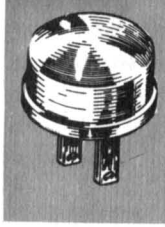


Figure 1: Basic circuit for neon lamp timer.

pacitor until it reaches the breakdown voltage of the lamp, at which time the lamp fires, discharging the capacitor. Depending on the values



Yours free . . . for telling us how you use or would like to use neon glow lamps

You can get a free Signalite Owl Eye Nite Lite simply by sending us an application for neon glow lamps, a problem or solution on their use. Each reader will receive the Nite Lite whether or not his letter is used in the Application News. In addition we welcome longer articles for feature treatment which we will also place in a leading technical magazine in your name.

chosen for the resistor and the capacitor, this period may be as short as .5 seconds or as great as about 40 minutes.

The basic circuit for the design of an electric timer is shown in Figure 2. In this circuit there are no restrictions to the values chosen for R and

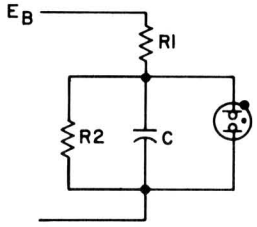


Figure 2: Equivalent time delay network.

C except leakage resistance and economics. For this circuit to operate reliably, leakage resistance, R_2, shall be at least 100 times greater than resistor R_1 used in the time constant. The leakage resistance referred to can be defined as the equivalent of the parallel combination of the leakage resistance of the neon lamp, the capacitor and the circuit wiring.

In order to design an electronic timer, three factors must be known. These are: 1) the time delay required; 2) the applied voltage of the circuit E_B; and 3) the breakdown voltage rating of the neon lamp V_B. This latter is necessary because variations in breakdown voltage will result in variations in the time delay. It should be obvious, also, that the closer the tolerance is held on the breakdown voltage of the lamp, the more accurate the time delay will be. In all cases the breakdown voltage of the lamp should be equal to or less than 63% of the applied voltage E_B during which time the voltage rise is linear with respect to time.

The calculations for designing a timer are relatively simple and straightforward. The first step is to determine K_1 from the following expression:

$$K_1 = \frac{V_B}{E_B} \quad (1)$$

This value is then used to determine K_2 from the graph in Figure 3. K_2 may be expressed as follows:

$$K_2 = \frac{T}{RC} \quad (2)$$

Where T is time in seconds, R is expressed in ohms, and C is expressed in Farads. Solving for RC:

$$RC = \frac{T}{K_2} \quad (3)$$

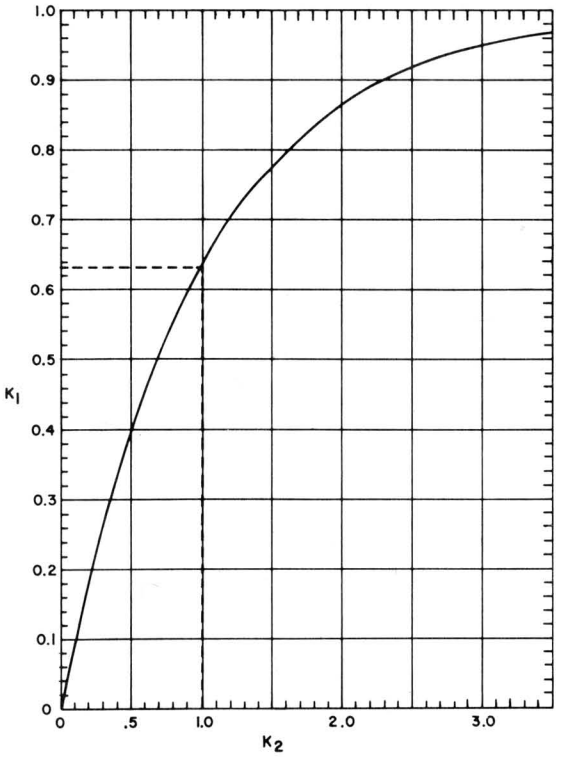


Figure 3: K_1 versus K_2

This provides the RC factor which can be used with the nomograph in Figure 4 to determine specific values for R and C.

These calculations are all based on the premise that the applied voltage is direct current. If, instead, half wave rectified alternating current is used and the rectifier has extremely low reverse leakage, the time delay can be increased approximately three times over the direct current delay for the same value of RC and the same neon lamp.

One of the important side advantages of the neon timer is the ease with which the output of the lamp can be put to work for a wide variety of uses. These additional uses of output in no way affect the operation of the lamp in the timing circuit since, after the lamp has ignited, it is conducting current. This current can be used to perform another function, such as the operation of a relay or some other form of readout. It may also be used to generate a pulse through, for example, a capacitor Also, when ignited, the neon lamp produces light output which can be used as an indicator or can be used to operate another circuit through a photocell.

Example:

Let us assume we wish to construct a timer with a period of .5 cycles per second. The supply voltage, E_B, is 90 volts and the neon lamp is the close tolerance AO 59-6 with a breakdown voltage, V_B, of 70 volts and a maintaining voltage, M_V, of 56-57 volts.

Substituting these values in the following formula:

$$K_1 = \frac{V_B - M_V}{E_B \quad M_V}$$

$$K_1 = \frac{70 - 56.5}{90 - 56.5}$$

$$K_1 = .4$$

Since this is less than 0.63 we then refer to the chart in Figure 3 where we find that a factor of $K_1 = .4$ yields a value of .5 for K_2. Inserting these values in the formula:

$$RC = \frac{K_2}{f}$$

$$RC = \frac{.5}{.5}$$

$$RC = 1$$

From the nomograph we can then determine values for the resistor and capacitor. In this example our components are:

R = 1 megohm
and C = 1 microfarad

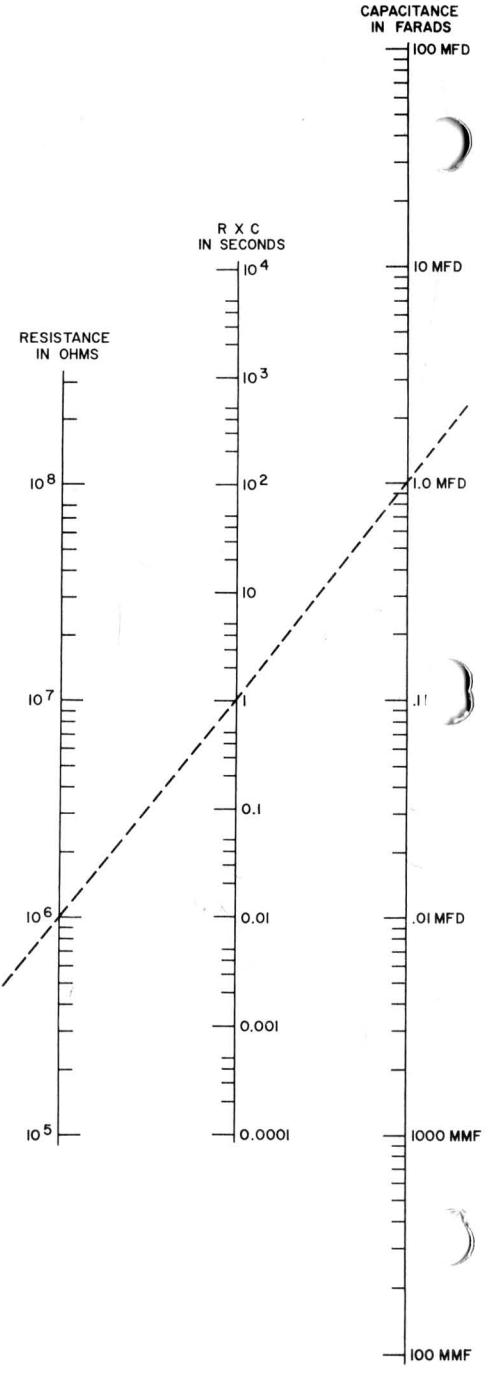


Figure 4: RC nomograph.

Figure 5 shows a typical circuit for using the output of the neon lamp in the timing circuit to operate a relay directly After the capacitor C charges to the lamp's breakdown voltage rating, the lamp ignites and conducts power at its design rating directly to the relay. The relay is then energized and locks itself up through its own contacts. The timer, including the timing circuit, is reset by means of a reset switch which causes the voltage on the condenser to be reduced to zero and breaks the current to the relay which returns the timer to reset. The cycle may also be reset by removing the applied voltage E_B.

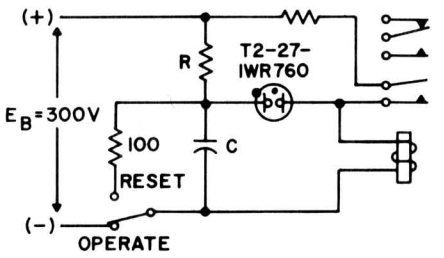


Figure 5: Use of neon-timer output to operate relay.

Use of the light output of the timer neon lamp with a cadmium sulfide or calcium selenide photocell is shown in Figure 6. When the lamp ignites, its light falling on the photocell reduces the resistance, permitting the applied voltage to operate the relay. As above, a contact on the energized relay locks the relay on. Again, the circuit is reset with an interrupter switch.

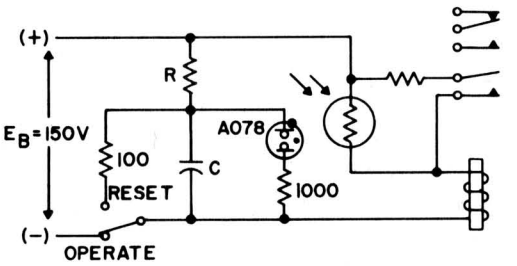


Figure 6: Use of neon-timer light output to operate photocell.

The voltage output of the timer neon lamp can operate a subminiature thyratron or three-element neon lamp as shown in Figure 7 The output pulse of the neon lamp is coupled to the trigger electrode of the thyratron causing it to turn on. Once the thyratron is ignited, it will stay on. With the components shown, a load as high as 1/2 watt can be handled. This particular thyratron also has a high light output for further photocell operation or visual indication that the circuit has operated. Again the circuit is reset with an interrupter switch.

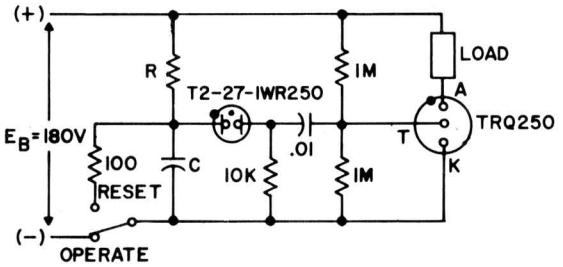


Figure 7: Use of neon-timer output to pulse thyratron.

Operation of a transistor directly from the output of the neon lamp is diagrammed in Figure 8. The transistor is used to pull in the relay

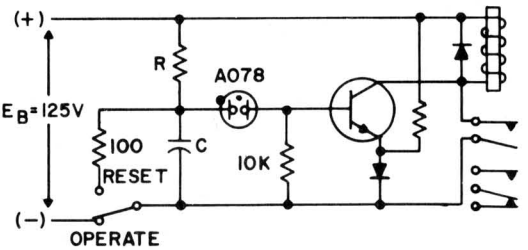


Figure 8: Use of neon-timer to operate transistor.

A circuit in which a silicon controlled rectifier is operated directly from the output of the timer neon lamp is shown in Figure 9. This circuit is essentially the same as the one shown in Figure 5 except that the SCR has been substituted for the relay

The pulse output has many applications in electronic design. Figure 10 illustrates the use of a pulse output from the timer circuit through the neon lamp to operate a transistorized flip-flop circuit.

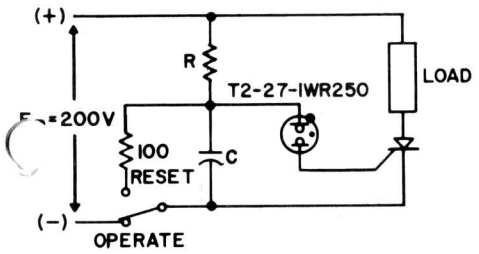


Figure 9: Use of neon-timer to operate SCR.

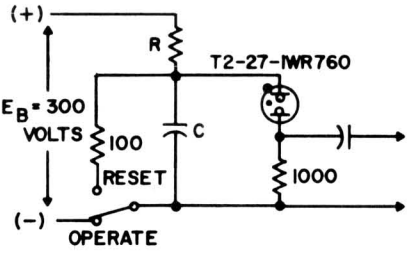


Figure 10: Use of neon-timer to pulse flip-flop.

The basic circuit for providing a pulse output from the timing circuit is shown in Figure 11. With the values shown here this will provide a pulse of 100 volts minimum. As with all of the circuits discussed here, no values have been given for R and C since these two components are selected on the basis of the time delay desired.

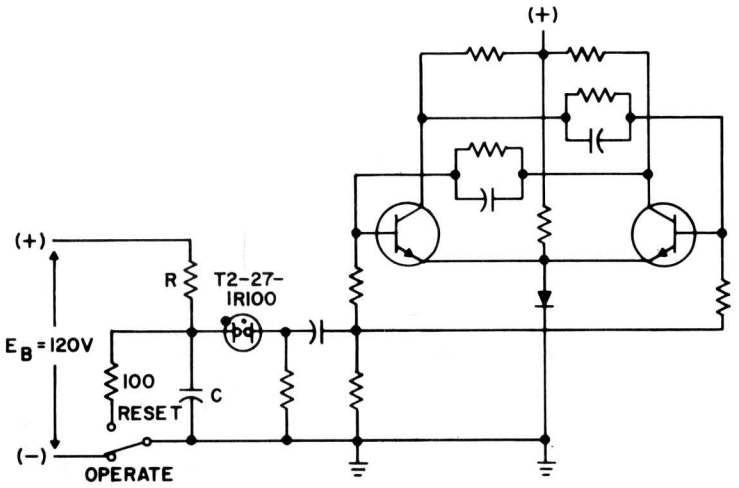


Figure 11: Neon-timer pulsing circuit.

The few illustrations shown here are intended to demonstrate the principles of applying the electronic timing circuit to a variety of applications. It should be understood that many variations on these circuits may be made, and many other specific applications may be designed.

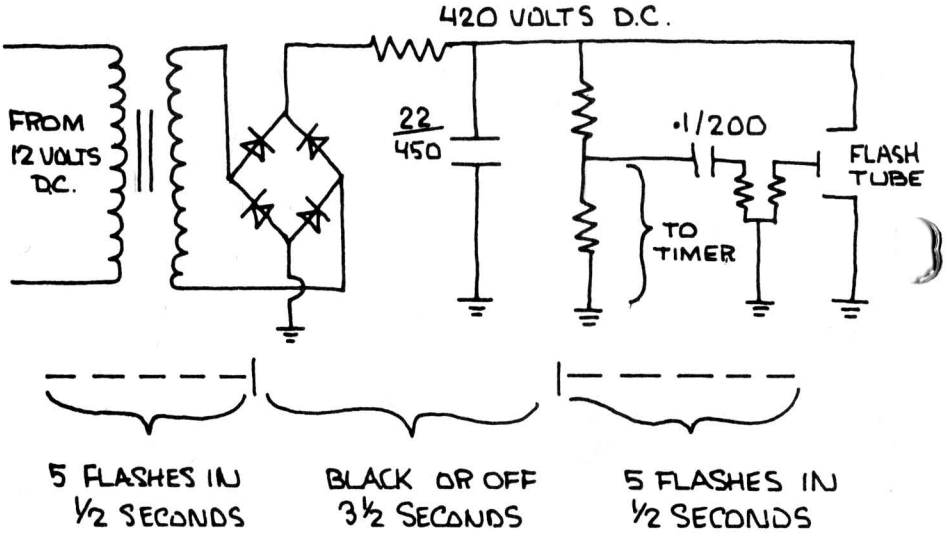
CAN YOU SOLVE THIS? ?????

Sir:

I have a problem with a (strobe light) and thought that the use of your glow lamps could solve it.

I have to flash a Xenon glass flash tube, the circuit is enclosed, five times in one-half a second, then a pause for 3½ seconds, then 5 flashes in one-half second, continuous duty.

I would appreciate knowing if your bag of tricks would include a circuit using neon glow lamps and SCR etc. for the above problem.



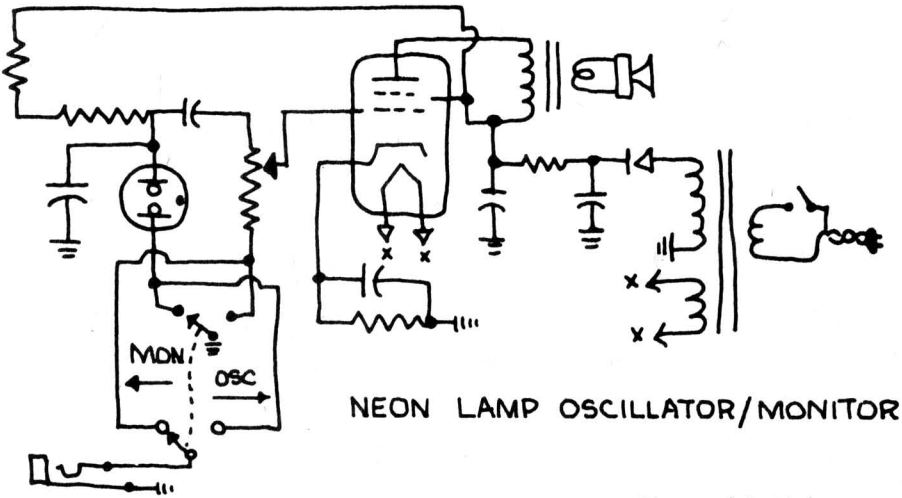
Sincerely,
Nathan Eisenstat

VERSATILE NEONS GREAT FOR HAMS

Gentlemen:

In the Signalite Application News, Vol. 4, No. 3, you asked for neon lamp applications. I have used a neon lamp in a code monitor at my amateur radio station (W2QUV) for several years. I needed a device to use across a keying line where approximately -100 volts exists (Blocked-grid keying). The following circuit was employed. Please note that when in the "Monitor" position, the device functions as a "side-tone" generator for the transmitter; moving the switch to the "oscillator" position converts it to a code practice oscillator.

Also, of course, a neon lamp is a handy RF indicator. I keep one on the antenna tuner to indicate when the transmitter is on.



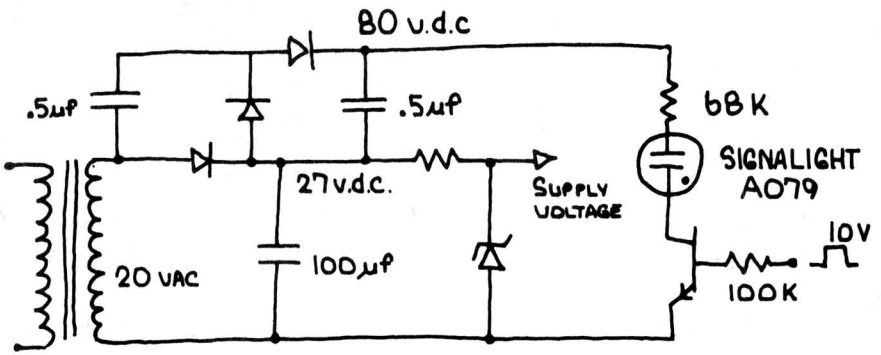
NEON LAMP OSCILLATOR/MONITOR

Howard S. Liebman

SIMPLE VOLTAGE TRIPLER

Dear Mr. Bauman:

In many transistorized circuits it is desirable to use neons as indicator lights, but the absence of a high voltage prevents their use. The solution to this problem is the use of a simple voltage tripler which can be used in conjunction with the circuit power supply



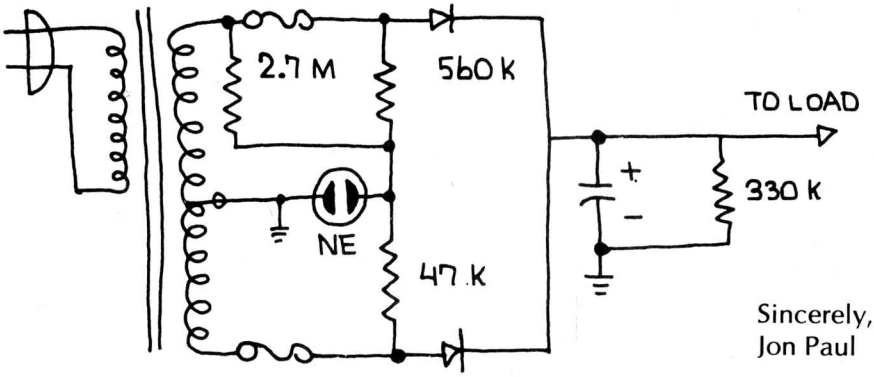
W. G. Mondshine
E & M Instrument Co., Inc.

BRIDGE CIRCUIT INDICATES BLOWN FUSE

Dear Mr Bauman:

Here is an application for glow lamps which you might be interested in. The circuit is a blown fuse indicator.

For devices using tubes, if either fuse, or both, blow, the bridge circuit formed by the center tapped transformer and the resistors becomes unbalanced and the lamp lights. Note that the lamp may be located on the front panel with the fuses located inside the case.



Sincerely,
Jon Paul

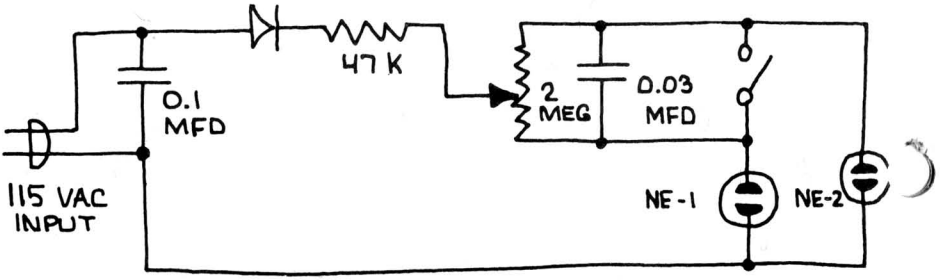
Ed. Note: We would recommend using Signalite's high brightness LT2-24 neon lamp for this application.

DEMONSTRATING OPERATION OF A FLIP-FLOP

Dear Sirs:

I should like to submit the following circuit application for neon glow lamps.

This circuit was used in Northridge Junior High School to demonstrate the operation of a flip-flop.



Yours truly,
Anthony Paolantonio, P.E.

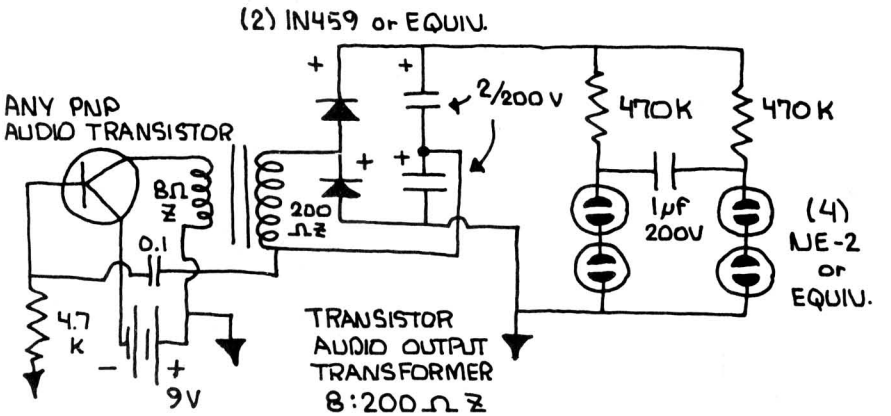
GIVING US THE EYE?

Sirs:

The Miniature Regulated Power Supply mentioned in Vol. 2, No. 4 was built by me, using a type 5783 subminiature V/R tube for lack of a Signalite Z82R10, using a type 6021 subminiature twin-triode tube as the voltage amplifier/series passing tube, for regulation of the voltage in a Vacuum tube voltmeter. A NE-2 was used in the original circuit but would not maintain the needed voltage unless the VTVM were left on continually.

I am presently looking for a circuit that will blink neon bulbs in sequence, for a direction indicator/attention getting display I want eight lights, blinking sequentially with a reset in one second, and a half-second delay before beginning the sequence.

Using a transistor audio output transformer as the power transformer in an oscillator circuit, with a voltage doubler power supply, I have been able to construct a miniature power supply for powering a flip-flop neon oscillator inserted in a child's doll, with the bulbs arranged as Vol. 1, No. 3's Halloween "Pumpkin Eyes" Blinker This is a light-weight unit, and does away with the need for large, short-life high voltage batteries, substituting type 216 or larger 9-volt batteries, which are easier to obtain and less expensive. (circuit below)



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If you have an interesting application of neon glow lamps in your circuitry. or a problem concerning the use of neon lamps, drop us a note telling about it. Interesting letters will be published in a future issue of the **Application News**—and we will send you an Owl Eye Nite Lite for your home.

Applications which in the opinion of Signalite have significant interest will also be brought to the attention of the editors of leading technical publications for consideration as articles and featurettes. If you would like help in preparing your material for publication, just send us the facts and data. We will put it in the correct form for publication. Your by-line and company credit will be given with your permission.

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* * * * *

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