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APPLICATION NEWS
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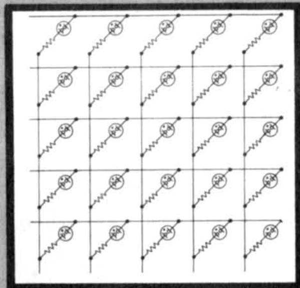


Vol. 10, No. 2 Signalite, 1933 Heck Avenue, Neptune, N J 0775[illegible]

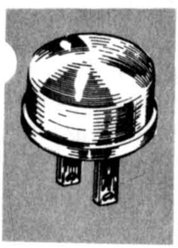
NEON LAMP BOOSTS EFFICIENCY IN TV RECEIVER CIRCUITRY

By: Thomas L. Taylor
Engineering Department
GTE Sylvania

Recent improvements in the design and manufacture of neon glow lamps have resulted in their increasing use as primary circuit components in electronic circuitry Unique characteristics such as low current requirements, stable voltage operation, light output, not to mention small size, facilitate their utilization in a variety of applications in electrical and electronic circuitry.

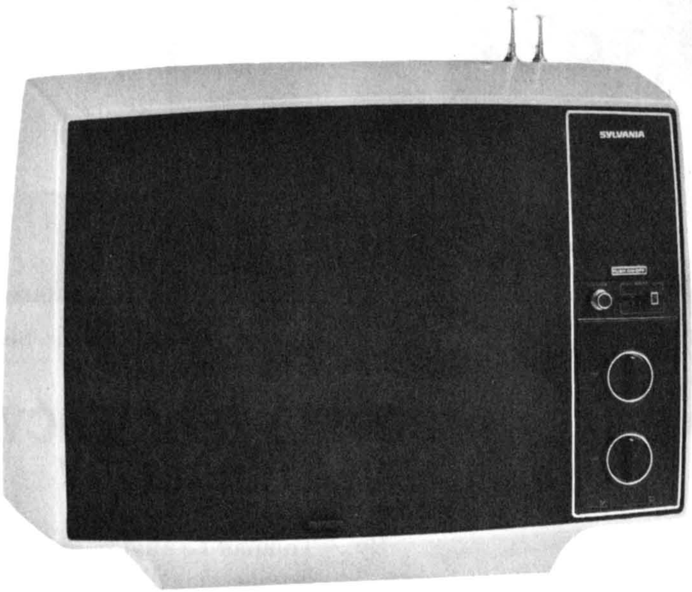
As is generally known, one of the three basic operations the neon lamp will perform is switching. This would include simple switching, energy transfer, memory switching, frequency dividers, oscillators, timers, and proportional control, among others.

In this context, the following discussion focuses on a switching operation performed by Signalite neon glow lamp (NE83) as utilized in a monochrome GTE Sylvania TV receiver horizontal oscillator drive circuit.



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

You can get a free Signalite Owl Eye Nite Lite simply by sending us an application for neon glow lamps or spark gaps, 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.



Using the neon lamp to perform this function has significantly improved the efficiency of the receiver horizontal output stage by providing faster switching of the horizontal drive while maintaining easy adjustment of the horizontal frequency, and simpler, and consequently, less expensive circuitry

Before detailing the modifications effected in the aforementioned improved circuitry, let us first examine earlier basic circuit design. An understanding of this arrangement will help point up the magnitude of improvement in the re-design.

It should be noted that on the plus side the basic circuit design, compared to a multivibrator (cathode coupled with sine wave stabilization), offered these advantages simplicity of circuitry, simplicity of adjustment, and lower cost. On the minus side, however, the basic circuit design had the disadvantage that the switching speed of the negative 50% pulse was 3 μ-sec., compared to 1 μ-sec. of the multivibrator circuit.

Figure 1 shows the basic circuit arrangement comprising a Colpitts sine wave oscillator, using elements K, G1 and G2 of the pentode V1 This oscillator is electron coupled to the plate circuit, consisting of the charge circuit RcCc. For a horizontal oscillator in a TV chassis, the oscillator frequency (f) is approximately 15,750 hertz. The time constant RcCc is some value greater than $\frac{1}{f}$.

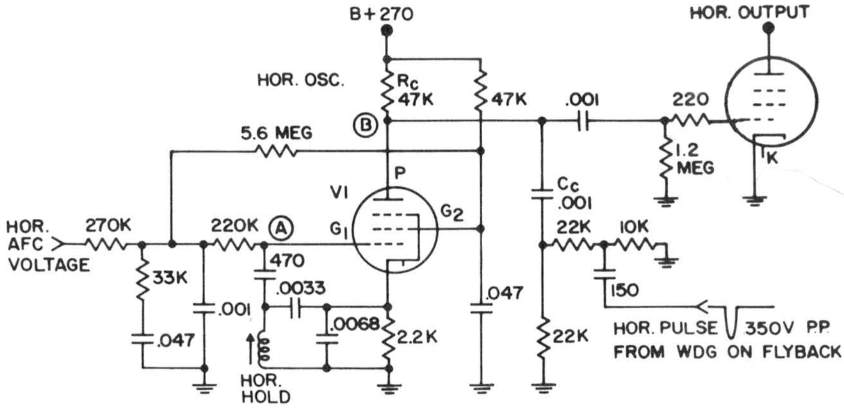


Figure 1: Basic circuit

During that part of the oscillation cycle that G1 allows G2 and hence Plate P to conduct, capacitor Cc is discharged. During the remaining part of the cycle, plate current is cut off and capacitor Cc charges through Rc from the supply voltage. When G1 again allows G2 and plate conduction, capacitor Cc is again discharged by the tube plate current. Thus a sawtooth of output voltage is generated. This is the drive waveform used to control the grid of the horizontal output tube in a TV chassis.

The problem with this basic circuit was that the start of the discharge of Cc was slow compared to a cathode-coupled multivibrator circuit. Figure 2 shows the waveform of the basic circuit, and Figure 3 shows the cathode-coupled multivibrator waveform.

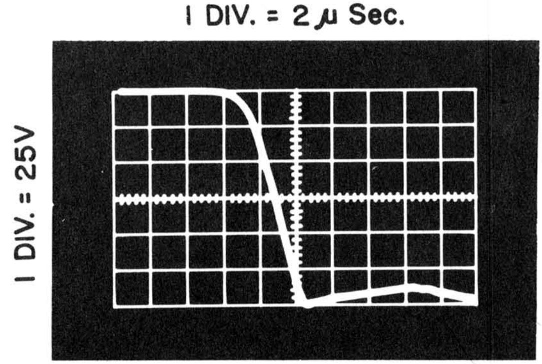


Figure 2: Waveform of the basic circuit

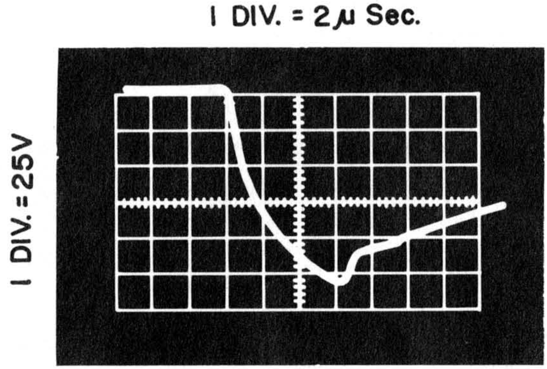


Figure 3: Waveform of the Cathode-Coupled Multivibrator

The discharge or switching speed is determined by the AC voltage on the grid of V1. This voltage is sinusoidal and, even though the point of plate discharge is arranged to occur at the greatest slope of grid voltage, the start of discharge is slow One method used to improve the switching speed, as for example in the GTE Sylvania DO6 color TV chassis, was to have a larger amplitude sinusoidal voltage on the grid G1. This reduced the discharge time by operating the grid G1 on a steeper slope of the sine wave, as shown in Figure 4. However, the disadvantage of this circuit using increased grid voltage was that the

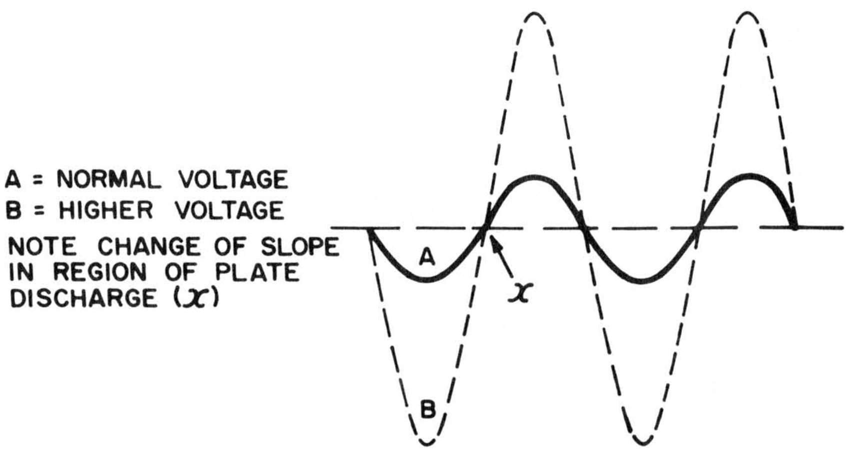


Figure 4: Fast switching time can be obtained by operating the grid G1 on a steeper slope of the sine wave. Normal voltage is shown as A, and the higher voltage as B. Note the change of slope in the region of plate discharge (x).

sensitivity of the grid to AFC voltage control was reduced, and a separate triode tube had to be used as reactance control.

Referring again to Figure 1, the slow discharge of the basic circuit when used to drive the output tube in a TV receiver horizontal deflec-system results in reduced efficiency in the output tube.

This is due to the plate voltage of the output tube increasing rapidly during the retrace cycle of the flyback system. Simultaneously, the grid voltage has to go negative at a fast enough rate to prevent plate current from flowing. This basic circuit does not give a fast enough negative pulse to accomplish this. (Any plate current flow during this part of the cycle results in an extra load on the flyback system, thus lowering the system efficiency and increasing the plate dissipation of the output tube).

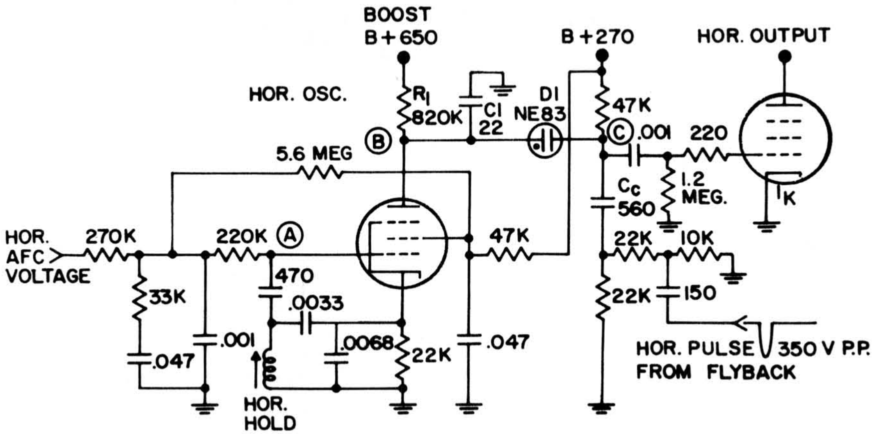


Figure 5: Modified circuit to improve switching speed.

The modified circuit shown in Figure 5 allows the use of the basic circuit with its advantages of simplicity and cost, but also provides significantly faster switching speed.

In the modified circuit operation, the plate circuit with its slow rate of discharge is coupled to the charge circuit (RcCc) through the neon glow lamp (D1)* The neon is not conducting during the charge period,

**Specifications for the Signalite NE-83 neon lamp are:*
Breakdown Voltage is 60-100 VDC; Maintaining Voltage is 60 VDC max. at 5.0 ma, 65 VDC max. at 10.0 ma; Average life (operating) is 5,000 hours at 5.0 ma, 500 hours at 10.0 ma.

so the plate circuit is isolated from the charge circuit. However, as the plate goes less positive, and the charge capacitor more positive, the potential across the neon lamp reaches its ignition voltage and capacitor Cc is discharged rapidly through the neon lamp to the plate circuit. The neon maintains conduction so that the drive waveform follows the plate waveform during the remainder of the discharge period.

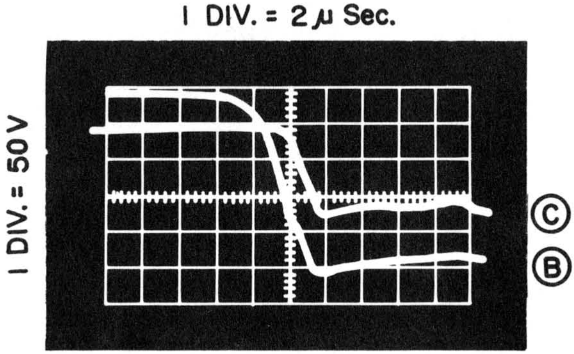


Figure 6: Waveforms of the modified circuit. B is the plate of the horizontal oscillator, and C is the drive to the horizontal output.

Thus, in effect, the neon circuit isolates the slow plate circuit discharge time from the drive circuit at the start of retrace; the oscillator maintains control of the phase of the drive waveform, and the grid sensitivity to AFC voltage is not affected by the improved circuit. As Figure 6 shows, the modified circuit gives further substantial performance improvement by reducing the switching speed from 4 µ-sec. to 2 µ-sec.

In the modified circuit (Fig. 5) the horizontal pulse (—350 V PP) was applied to point "C" through a shaping network (22K, 22K, 150 pf). The amount of pulse that could be fed back to "C" was limited by the effect of the trace parts of its waveform on the drive wave shape (positive feedback). Feeding the pulse back to "C" was, therefore, inefficient.

Note, however, that in the final circuit (Fig. 7) capacitor C1 is returned directly to the horizontal pulse. The negative retrace pulse is now applied to point "B", instead of "C". Because the neon lamp (D1) is not conducting during the trace period, the trace waveform of the feedback pulse does not affect the drive waveform at "C". The amount of pulse can therefore be increased to point "B" to provide still faster switching of the order of 1 µ-sec.

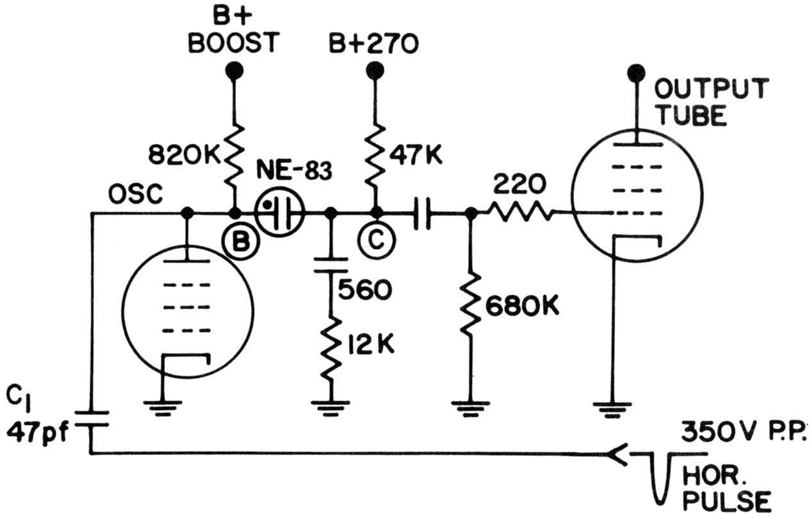


Figure 7 Final modification to circuit.

The significant improvements offered by the new circuit utilizing Signalite neon glow lamp (NE-83) are improved efficiency as a result of substantially faster switching speed, and a reduced number of components with consequent reduction in parts expenditure.

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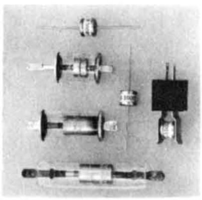
NEW TECHNICAL DATA PACKAGE ON SURGE ARRESTERS



A technical discourse on "Gas Discharge Devices for use in Transient Voltage Protection and Electrical Energy Transfer" is the feature piece in a technical data package just published by Signalite. This is a basic reference file for those who are concerned with surge protection or high energy switching.

The technical manual is divided into two parts, transient protection and energy transfer, each of which is discussed in detail. Under transient protection, for example, is found information on sources of voltage transients, construction and operation of gas discharge protectors, a comparison of various devices, and illustrated applications. High energy switching covers two electrode and triggered devices and, again, a series of illustrated applications.

Supplementing the technical manual is a series of specification and data sheets on devices designed and produced by Signalite which satisfy the requirements discussed in the manual. For a free copy of this technical data package contact Signalite's Sales Department.

CAN YOU SOLVE THIS? ?????

Gentlemen

In reply to your request for application ideas . how would your neon glow lamps work across the ringing voltage of a shipboard telephone system?

We could use a visual indication, especially in areas of high ambient acoustic noise. Light emitting diodes are being considered, but they're rather expensive. And although some MTBF data looks good, they may not survive the rugged shipboard environment. Any comments?

Sincerely

R. B. Bishop, Jr
Annandale, Va.

Ed. Note: Let's have comments. Also refer to ring detector circuit contributed by Mr Robert M. Brown in SANS, Vol. 9, No. 1, pp. 394,395.

YOUR GLOW LAMP APPLICATION FORUM

TAKES ISSUE WITH THE BRIDGE

Dear Sirs.

I must take issue with a statement made in Vol 9, No. 5 of *Application News.*

On page 436, para. 1, it states, "The resistors appearing on (sic) the anode and cathode leads in Figure 3 are used to effect a perfect balance in the resistance bridge circuit."

Gentlemen, there *is* no bridge! With the lamp off there is simply a voltage divider formed by the heating elements. With an element open there is another divider formed by the ionized lamp partially paralleled by the undamaged element.

Yours truly,

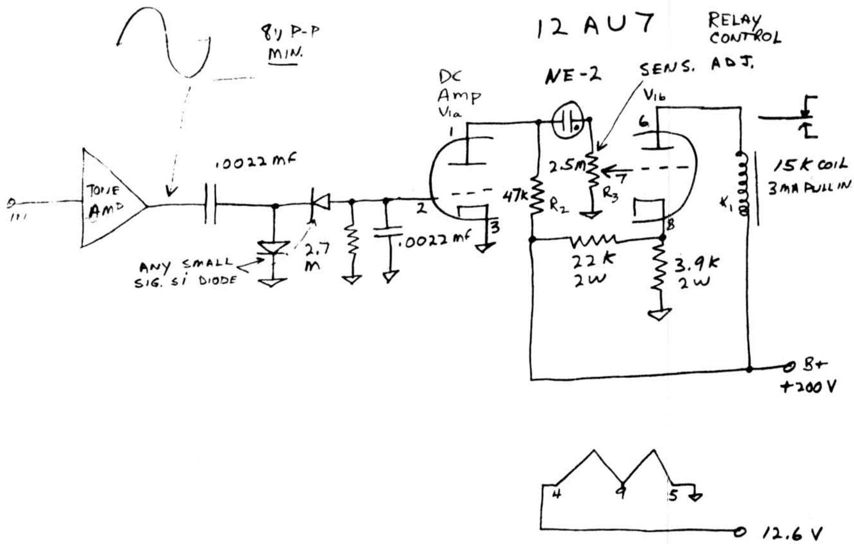
William Beckett
St. Petersburg, Fla.

TONE RECEIVER — NEON SWITCH

Gentlemen

Please find enclosed an application for neon glow lamps in a tone receiver used on a radio link.

When proper tone (2000 Hz) is received, it is amplified, rectified,



and applied to grid of V_{1a} V_{1a} is then cut off raising voltage across R_2 to point where glow lamp fires. This causes current flow through R_3 developing sufficient voltage to turn V_{1b} on—thus operating K_1.

Yours truly,

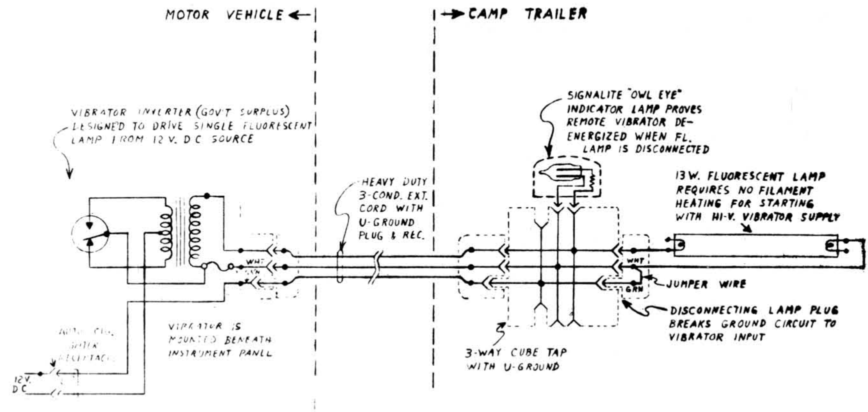
Mike Strand
U.S. Polymeric, Inc.

LOW POWER INDICATOR CONSERVES BATTERY

Dear Sirs,

I am submitting a circuit schematic for a fluorescent lighting system I devised and find very handy for camping or emergency home use.

The "Owl Eye" night light functions as an ideal compact plug-in indicator light for my application.



There are many compact, solid-state inverters for fluorescent lighting on the market, but they cost approximately four times what my total system cost. Measured D.C. current drain is slightly over 3 amps a conservative drain on the car battery for the clear, brilliant illumination it provides.

Yours truly,

Alfred Fortier
Rockville, Connecticut

Ed. Note. Neon lamp used is ideal low power drain indicator. Also serves as an indication of proper voltage level, lamp will not fire when supply voltage is below 90 VDC.

FUSE FAILURE ALARM

Gentlemen

When the fuse blows, voltage across the fuse charges .05 capacitor C. When voltage on C rises to lamp breakdown voltage the lamp current triggers the Triac, which sounds the Alarm Bell On A.C. the process is repeated each 1/2 cycle, on D.C. the bell will ring continuously til power is removed.

The time delay is used to develop sufficient voltage to trigger the Triac through the Neon Lamp. The time constant of the R/C circuit is 1.3 milliseconds, which is approximately 15% of a 60 Hz. waveform.

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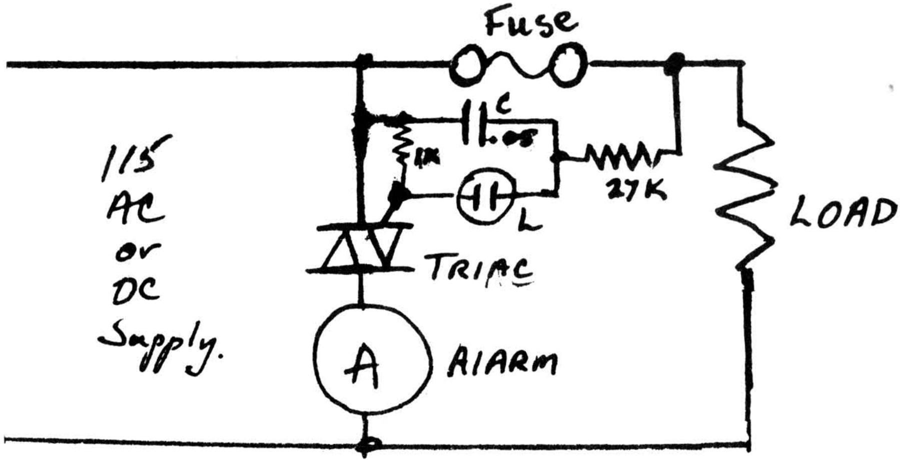


Thus, using a 60 Hz. supply the Triac will be pulsed into conduction for 85% of each half cycle—supplying over 95% voltage to the Alarm Bell

On a D.C. supply the Triac will conduct continuously after the initial trigger pulse.

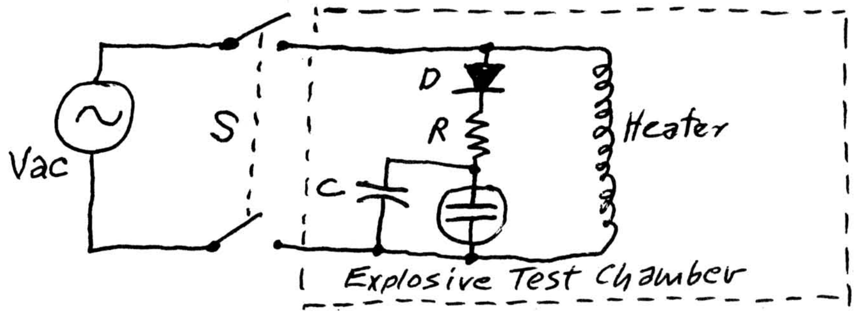
Very truly yours,

Graham R. Phillips
Century Electric Company

WARNS THAT HEATER IS ENERGIZED

Dear Sirs.

Below is a circuit that was developed to provide a warning that voltage was being applied to a heater coil in an explosive test chamber



The neon lamp flashes whenever the switch is closed. The flashing rate gives an indication of the relative amplitude of the applied voltage.

Sincerely,

James O. Lillywhite
Bloomington, Indiana

Ed. Note

Capacitor value should be kept low in order to preserve lamp life. A limiting capacitor in the capacitor leg might also be considered.

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Drop Us A Line

If you have an interesting application of neon glow lamps or spark gaps in your circuitry or a problem concerning the use of these components, 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 interest.

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.

For immediate technical application or circuit design assistance, you may contact Signalite directly at:

TWX: 201-775-2255 *TEL. 201-775-2490*

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For information about Signalite neon glow lamps, spark gaps, and other gas discharge products for circuit component and/or indicator applications, for specifications on Signalite components, or for general information about Signalite and its products, call us at any of the following telephone numbers:

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