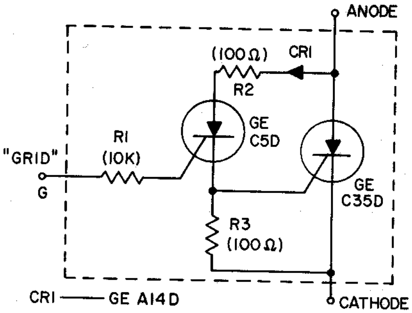
The loads can be either electric motors or solenoid operated valves, operating from AC power. Liquid level detection is accomplished by two metal probes, one measuring the high level and the other the low level.

The relay K_1 is energized by Q_1 which is controlled by Q_2, a PUT, whose gate form the detector. The PUT is normally off but when liquid rises to the high probe level, the impedance of the liquid creates a voltage divider and the PUT triggers. When the PUT conducts it turns on Q_1 which will pick up K_1. K_1 will turn on Q_3 activating the load and will also arm the low level probe which holds the circuit on until the liquid level drops below this probe. At this time the circuit is de-energized, turning off the load.

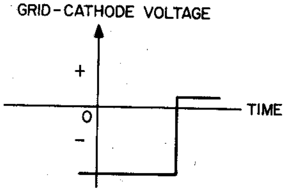
An inversion of the logic (keeping the container filled) can be accomplished by replacing the normally open contact on the gate of Q_3 with a normally closed contact.

8.13 THYRATRON REPLACEMENT

A thyratron tube is characterized by a very high signal input impedance, low pick-up and drop-out currents, and good power handling capabilities. On the other hand, it is fragile, requires filament power, is frequency limited by a long deionization time, and has a fairly high forward drop. While the solid-state equivalents to this device, using the C5 as a trigger element for a larger size SCR, can match the thyratron in input impedance, current handling ability and low pick-up current, they possess none of the gas tube's limitations. At the present time, however, the maximum forward blocking voltage attainable using a single C5 is 400 volts. This can be increased by series connecting additional SCR's (see Chapter 6).



(a) Equivalent Circuit



(b) Grid Voltage Waveforms

FIGURE 8.38 SIMPLE THYRATRON REPLACEMENT

Referring to Figure 8.38; with a negative potential on grid terminal "G", stabilizing gate bias is provided through R1 and R3 for the C5. When the "Grid" is driven positive, however, a maximum current of 200 microamps will trigger the smaller SCR into conduction. The C35D is triggered in turn by the C5, and can conduct up to 25 amps

rms load current. With the voltage grades shown, the "device" is capable of blocking voltages up to 400 volts. Over-all pick-up current is determined by the C5 rather than by the C35, a useful feature when the "thyratron" is operating into a highly inductive load. Diode CR_1 prevents transistor action in the C5 if positive grid voltage should coincide with negative anode potential.

General Electric is manufacturing the S26 and S27 solid state thyratrons which are 200 volt devices, but higher voltage devices such as the SL-3 and SL-4 and custom designs are available. (For more information on solid state thyratrons see also Reference 7.)

8.14 SWITCHING CIRCUITS USING THE C5 OR C106 SCR AS A REMOTE-BASE TRANSISTOR

8.14.1 "Nixie"® and Neon Tube Driver

The C5 SCR, when biased as a remote-base transistor (for detailed information on remote-base transistors see Chapter 1), makes an excellent high voltage transistor suitable for driving Nixie, neon and other type of high voltage digital readout displays. Collector voltage rating of the equivalent transistor equals or exceeds the $V_{BR(FX)}$ rating of the parent SCR (400 volts) while the common emitter current gain is approximately two (2). The circuit Figure 8.39 is self-explanatory; note however the connections to the C5 terminals. Where a memory feature is desirable (pulse initiation with load remaining energized until reset externally), the same basic circuit may be used, but with the C5 connected conventionally as an SCR.

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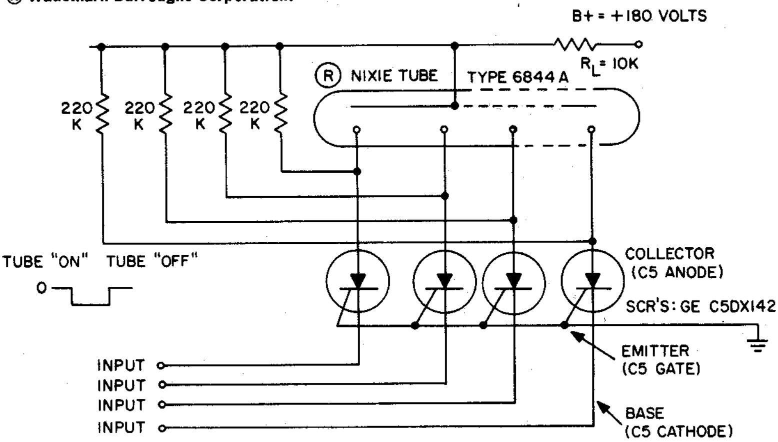
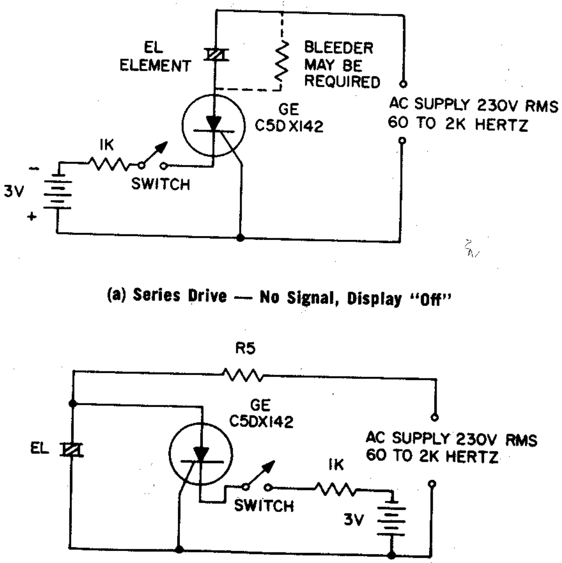


FIGURE 8.39 TRANSISTORIZED NIXIE® DRIVER

8.14.2 Electroluminescent Panel Driver

Either of the circuits of Figure 8.40 may be used to drive the elements of an electroluminescent display panel, depending on the input

logic required. Here, the high voltage capabilities of the C5 SCR are again combined with its usefulness as a transistor, in this case a *symmetrical* transistor, to control full-wave AC drive at high voltage and frequency, low current.



(a) Series Drive — No Signal, Display "Off"

(b) Shunt Drive — No Signal, Display "On"

FIGURE 8.40 ELECTROLUMINESCENT PANEL DRIVER

REFERENCES

1. "Using the Triac for Control of AC Power," J. H. Galloway, General Electric Company, Auburn, N. Y., Application Note 200.35.*
2. "Solid State Electric Heating Controls," R. W. Fox and R. E. Locher, General Electric Company, Auburn, N. Y., Application Note 200.58.*
3. "Regulated Battery Chargers Using the Silicon Controlled Rctifier," D. R. Grafham, General Electric Company, Auburn, N. Y., Application Note 200.33*
4. "Flashers, Ring Counters and Chasers," R. W. Fox, General Electric Company, Auburn, N. Y., Application Note 200.48.*
5. "Using Low Current SCR's," D. R. Grafham, General Electric Company, Auburn, N. Y., Application Note 200.19.*
6. "The D13T – A Programmable Unijunction Transistor Types 2N6027 and 2N6028," W. R. Spofford, Jr., General Electric Company, Syracuse, N. Y., Application Note 90.70.*
7. "The Solid State Thyratron," R. R. Rottier, General Electric Company, Auburn, N. Y., Application Note 200.36.*

*Refer to Chapter 23 for availability and ordering information.