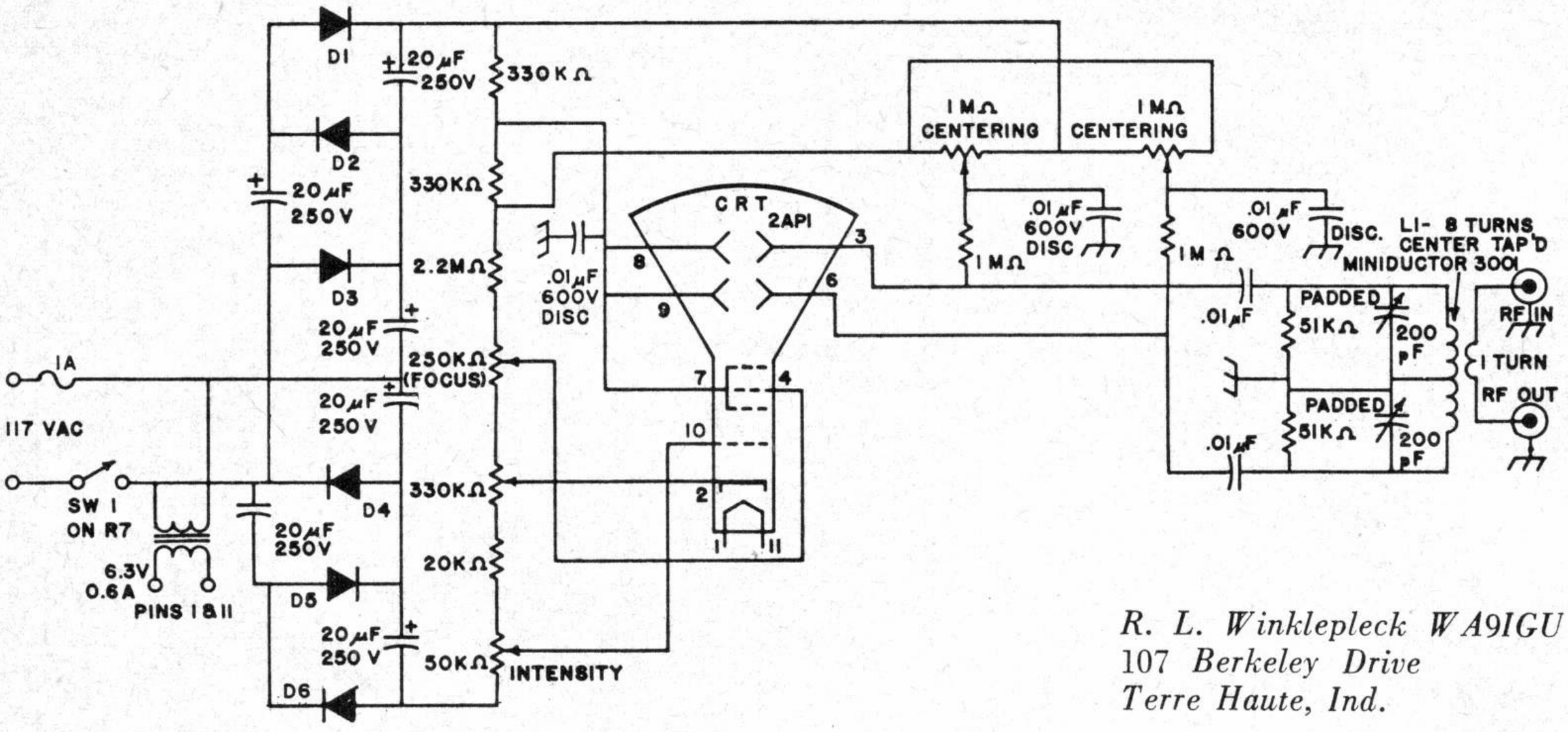

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Circular Modulation Monitor

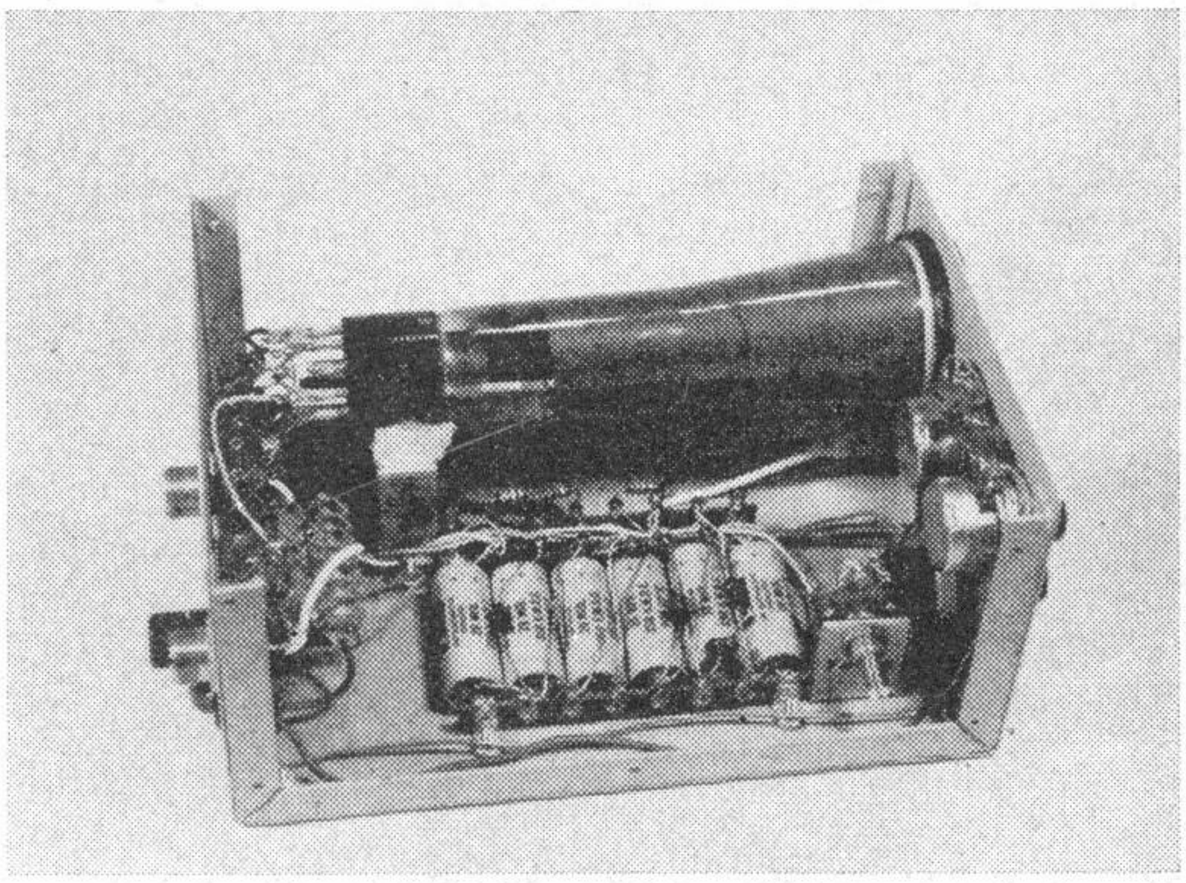
It's as important to keep an eye on your modulation as it is to regularly check your power output. Both characteristics combine to give you a good, intelligible signal.

There are many ways to check your modulation percentage and freedom from distortion. Each method has it's advantages. Nothing, however, is quite as good as CRT observation and here's a unique scope presentation. It'll have you going around in circles.

For a circular modulation indication it's only necessary to shift a sample of your *rf* output 45° each way and feed these two signals, phased 90° apart to the vertical and horizontal plates of a cathode ray tube. This shift is accomplished with a center-tapped inductance with trimmer capacitors across each half. The trimmers tune to the exact phase shift necessary to produce a circle and resistors across the tuned circuits lower the circuit "Q" sufficiently to prevent them from locking in phase. L2, the *rf* pickup link, is adjusted to provide the pattern size desired.

You may use this tuned circuit with any scope you have available or you may build one especially for this purpose. The one illustrated uses a surplus two inch scope tube usually available for a couple of bucks. The circuit is standard except possibly the high voltage supply. High voltage scope transformers are somewhat expensive. The voltage multiplier/rectifier circuit used here is simple and inexpensive. It provides 800-volts and can be duplicated with almost any silicon rectifiers and electrolytic capacitors with a 200-volt or higher rating. Current consumption is only two or three mils so even 5 mfd capacitors will do the job. While it's connected directly across the power line there is no hazard since the chassis is grounded only for *rf*. No horizontal sweep is required.

The chassis is formed from two bent up rectangles of sheet aluminum. Tie strips are used for those components which don't mount directly to the base. The CRT bezel



The row of electrolytics with associated diodes make up the high voltage supply. The mini-ductor on the back panel is L1 and L2 is the single turn of wire with white insulation.

is a plastic wide-mouth bottle cap with the center cut out. It is epoxied in a press-fit hole cut in the front panel. The base of the CRT is supported by the filament transformer. If no socket is available a few pin clips from octal sockets will provide convenient pin connections. Be sure that all 60-cycle and dc voltages are isolated from the chassis. The only chassis grounds, other than in the phase shift circuit, are *rf* bypass capacitors, C7, C8 and C9.

Before *rf* is applied, a single spot will appear on the face of the CRT. This can be centered with R8 and R9 and focused with R4. It's intensity is adjusted with R7. Try one or two turns around L1 for L2, connect the transmitter output to one coax fitting and the antenna or a dummy load to the other. If a diagonal line appears before *rf* is applied, reverse the power line plug. Turn on the transmitter and the CRT pattern will become a circle as C12 and C13 are adjusted to produce the 90° phase shift. This circle should be no more than one-half the diameter of the CRT. If it's too large reduce the turns or the coupling of L2. If too small change L2 to increase power transfer.

Modulate your transmitter and an annulus will result bounded by two circles; one larger and one smaller than the circle produced by the unmodulated carrier. As you talk, this annulus will become thin at low modulation levels and quite thick on modulation peaks. The percentage of modulation is equal to the difference of the two radii divided by their sum multiplied by 100. At 100% modulation a completely shaded circle will be produced with a dark dot in the center. A bright dot in the center warns of over 100% modulation.

The CRT pattern also tells several other things about your signal. If the shading of the annulus is not uniform when a steady tone is transmitted some distortion is present. If you adjust to a perfect circle using a purely resistive dummy load an antenna with capacitance or inductance will produce an oval. The amount of distortion accurately indicates the extent of maladjustment. Since the size of the unmodulated circle is directly related to the amount of *rf* in your feed-line this monitor can serve as a very sensitive tune-up indicator.

The value given for L1 permits use on the six meter band. By using less inductance you can tune up on two, or move down to the dc bands with more inductance. Increasing L1 to ten turns will permit use on the Citizens' Band. The few CB'ers who still are running five watts will need to increase L2 several turns to pick up enough *rf* for a good pattern. The correct inductance for the frequency of interest can be determined from the charts in the Handbook. Possibly a more scientific approach is by cut and try with a grid dip meter.

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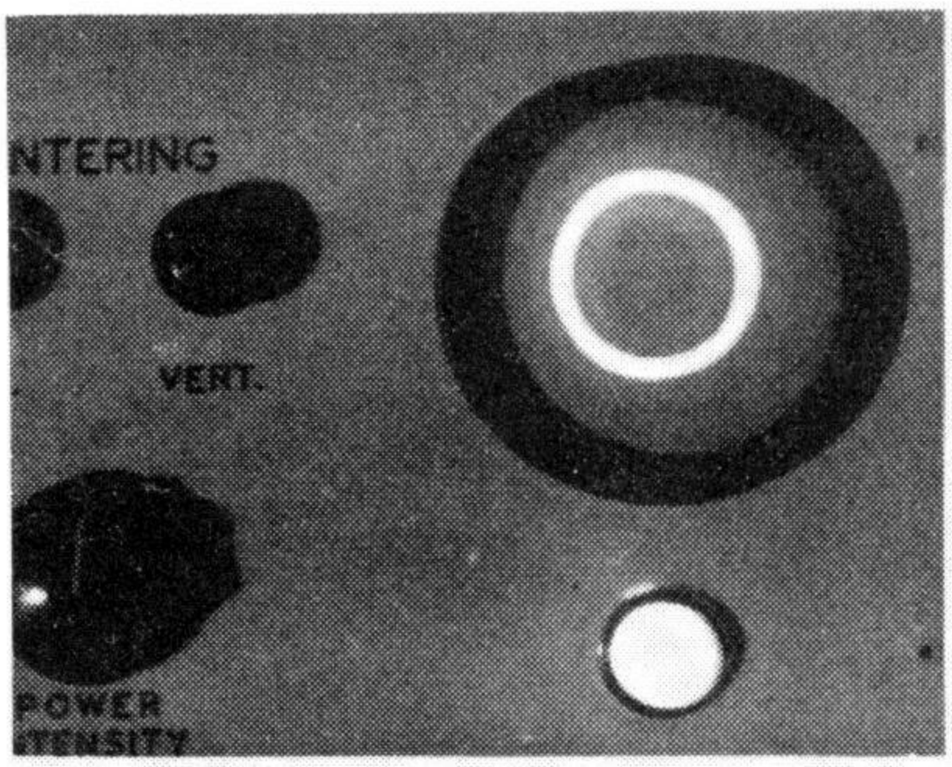

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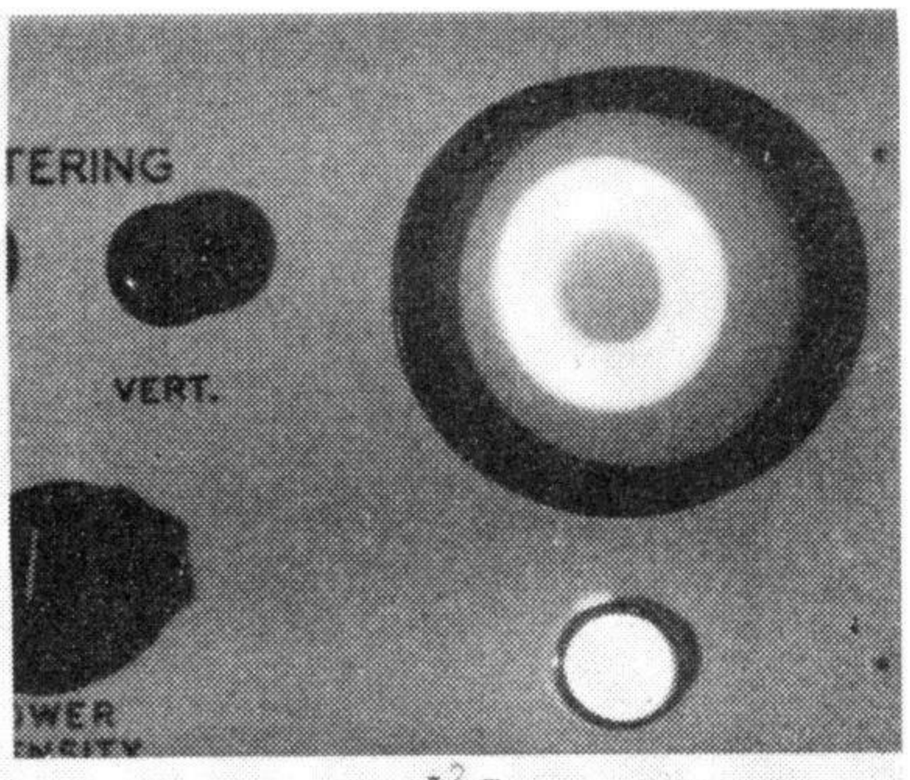

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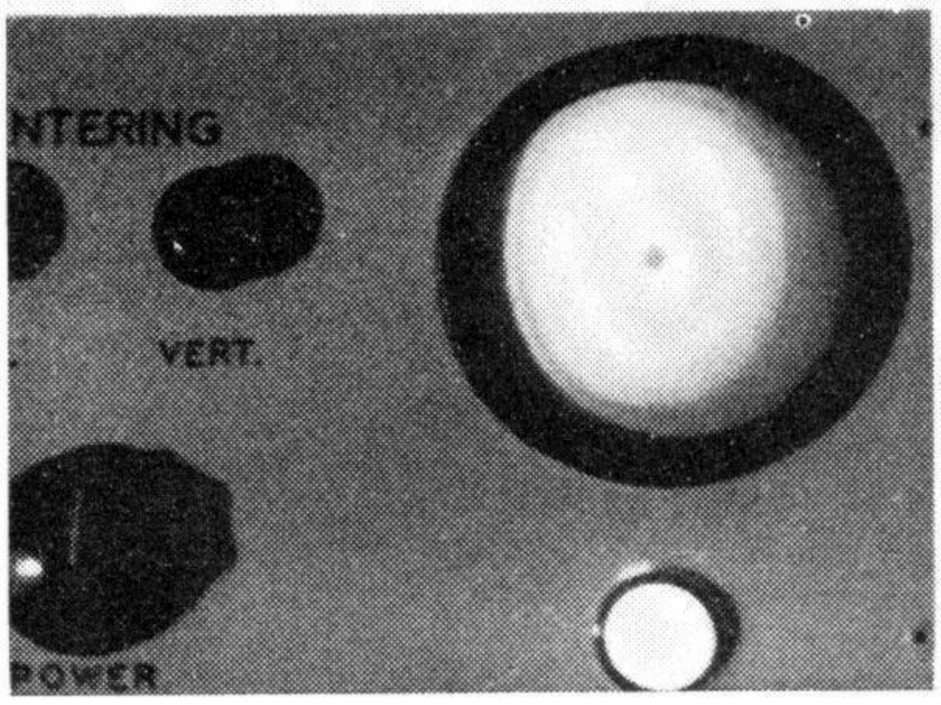

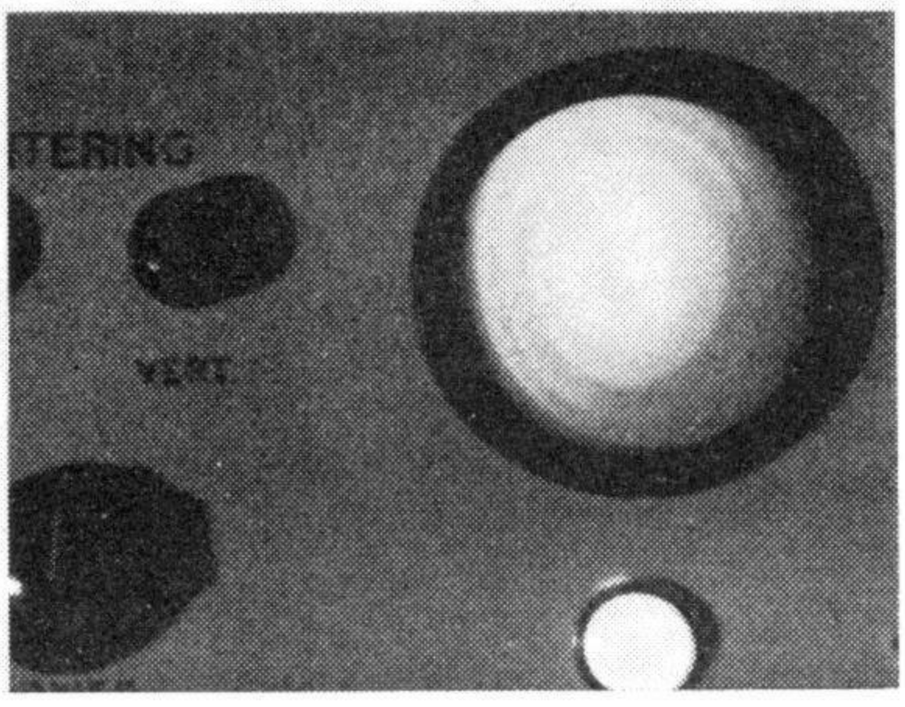

Without a carrier a white spot shows in the center of the CRT. An unmodulated carrier produces a circle.

1. *Very low modulation.*
2. *Approximately* 33% *modulation.*
3. *Nearly* 100% *modulation.*
4. *Bright spot in center warns of over* 100%.