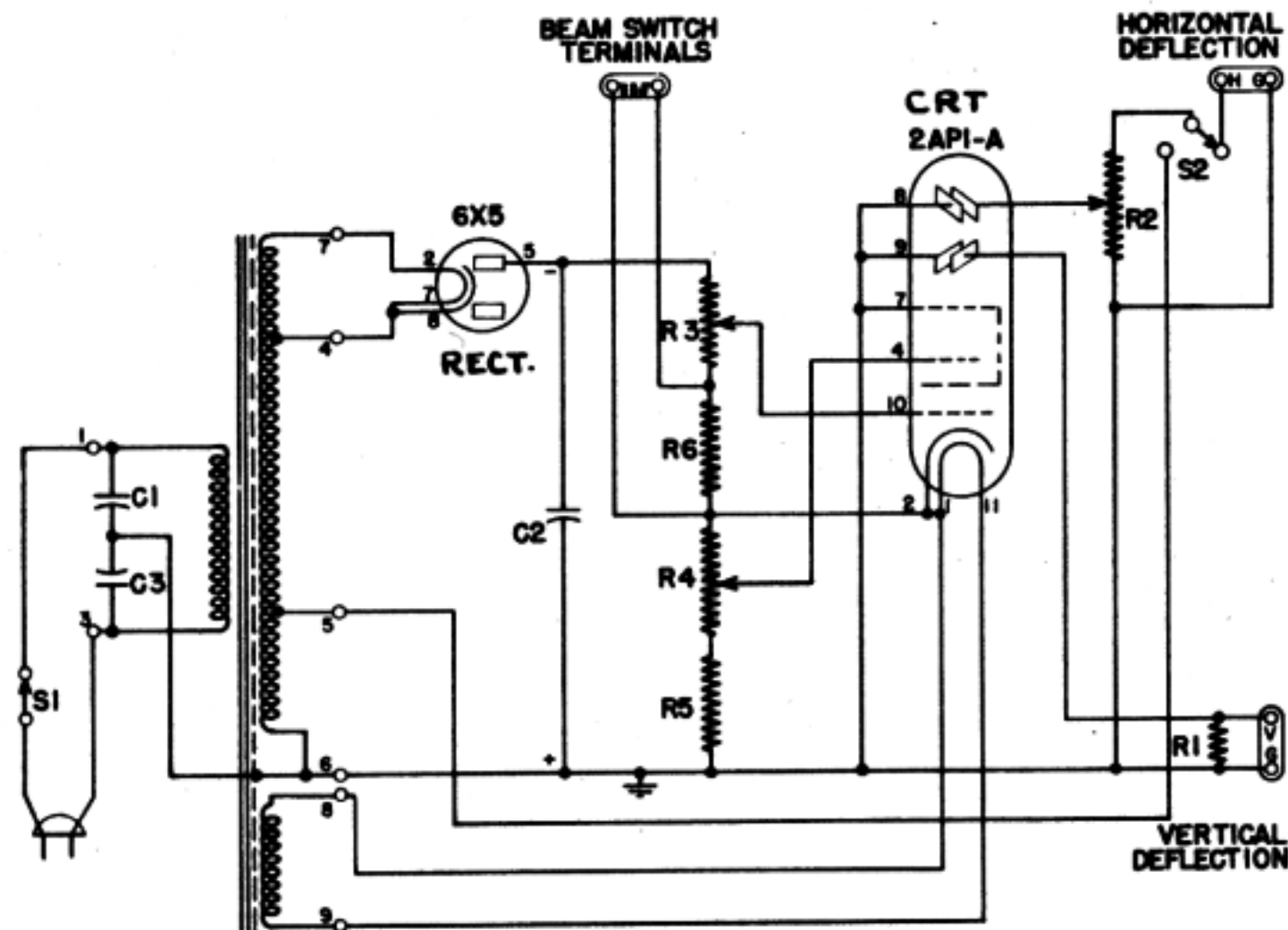


# ENCYCLOPEDIA ON CATHODE-RAY OSCILLOSCOPES AND THEIR USES

## NATIONAL MODEL CRU Foundation Unit

LINE RATING 115 volts, 60 cps

The schematic circuit diagram of Model CRU appears in Fig. 22-42. This instrument is a basic unit that may be used with additional apparatus. It contains only the cathode-ray tube and power supply.



- C<sub>1</sub>—.01 mfd. r.f. filter condenser  
C<sub>2</sub>—2. mfd. 600 volt (working) condenser  
C<sub>3</sub>—.01 mfd. r.f. filter condenser  
R<sub>1</sub>—4.7 megohm, ½ watt fixed resistor  
R<sub>2</sub>—500,000 ohm potentiometer (sweep voltage control)  
R<sub>3</sub>—50,000 ohm potentiometer (brilliance control)  
R<sub>4</sub>—100,000 ohm potentiometer (focusing control)  
R<sub>5</sub>—220,000 ohm ½ watt fixed resistor  
R<sub>6</sub>—47,000 ohm ½ watt fixed resistor  
S<sub>1</sub>—Line switch  
S<sub>2</sub>—Horizontal sweep switch, s.p.d.t.

Courtesy National Co.

Fig. 22-42.—Schematic of National Model CRU.

## PANORAMIC MODEL PCA-2 TYPE T-200

### FREQUENCY RESPONSE

Vertical Amplifier R-F bandpass, 355 kc to 555 kc

R-F Sweep Circuit 581 kc to 781 kc

LINE RATING 115 volts, 50-60 cps

### TUBE COMPLEMENT

Type	Function
6SG7 (V1)	R-F Amplifier
6SA7 (V2)	Converter
6SG7 (V3)	I-F Amplifier
6SQ7 (V4)	Detector, Video Amplifier
6AC7 (V5)	Reactor
VR105 (V6)	Voltage Regulator
6SN7 (V7)	Sawtooth Generator and Amplifier
902A or 2AP1-A (V8)	Cathode-Ray Tube
6X5 (V9)	Low-Voltage Rectifier
6X5 (V10)	High-Voltage Rectifier

The schematic circuit diagram of the Panadaptor Model PCA-2 is shown in Fig. 22-43. This instrument is a special electronic development used for the visual observation of r-f signals over a band of frequencies that is relatively broad compared with the r-f band-pass characteristic of an ordinary radio set. V1 is essentially a stage of r-f amplification of controllable gain. This gain is a function of the setting of R3 in the cathode circuit which determines the bias voltage applied to the grid of V1. The signal output of V1 is fed to the grid of V2, a 6SA7. V2 is a mixer which combines the incoming signals

and the locally generated oscillator signal provided by the oscillator section of V2.

V5 is a reactance-modulator tube used to frequency modulate the local oscillator of the Panadaptor. This frequency modulation action is dependent upon the amplitude of the signal voltage at grid pin 4 of V5 and is derived from the cathode circuit of V7, pin 3, through R14, R22, R23 and C22. The screen voltage of V5 and that of V2 are stabilized by the gaseous voltage regulator tube V6.

V3 is used in a typical i-f stage comparable to that found in a radio receiver, except that its selectivity is made as high as consistent with the sweep width and sweep rate. The detector is the diode section of a 6SQ7, V4. Its output is directly coupled to the grid of the triode section of the same tube so that the lowest possible signal frequency voltage, in this case d.c., appearing across the diode load resistor R9, will be amplified by the triode video amplifier.

During panoramic reception, the voltage pulses of i.f. fed to the detector appear (rectified and filtered) across the diode load resistor R9. These negative voltage pulses are fed back through the filter R7-C7 to the control grid of the i-f amplifier. Strong signals produce high negative voltage pulses which reduce the gain of the i-f stage. In this way, the amplitude of strong signals is automatically decreased and it becomes possible to present simultaneously signals which differ considerably in strength. The time constant of the filter is sufficiently short so that a pulse of a strong signal does not reduce the gain for an adjacent weak signal.

### Sawtooth Generator and Amplifier

The sawtooth voltage applied to the modulator V5 is obtained from a blocking oscillator, which is an unusual application for this type of circuit. The operation of a blocking oscillator is discussed fully in Chapter 9.

By introducing the power line frequency into the grid input circuit, through divider resistors R19 and R21 (not present in units using a type 902A cathode-ray tube), the sawtooth is locked or synchronized to one-half the power line frequency. The sawtooth voltage developed across C20 is applied and amplified by the other half of the 6SN7.

Another sawtooth output is taken at the cathode of the section and this is applied through potentiometer R23, the SWEEP PAD, and the SWEEP WIDTH control R22 to the modulator tube. The function of the sweep pad is to proportion the proper amount of sawtooth signal across the sweep-width control so that a 200-kc oscillator excursion is obtained with the sweep-width control set to maximum. The fact that the same sawtooth voltage is used to swing both the electron beam and the oscillator frequency simultaneously is necessary for understanding the development of the Panoramic display.

Since a given instantaneous value of sawtooth voltage will correspond to one particular horizontal location on the tube face, and to one particular frequency of the oscillator, signals across the band being examined will be spread across the face of the cathode-ray tube in exactly the same manner that the signals would be spread across the range of a tuning dial.

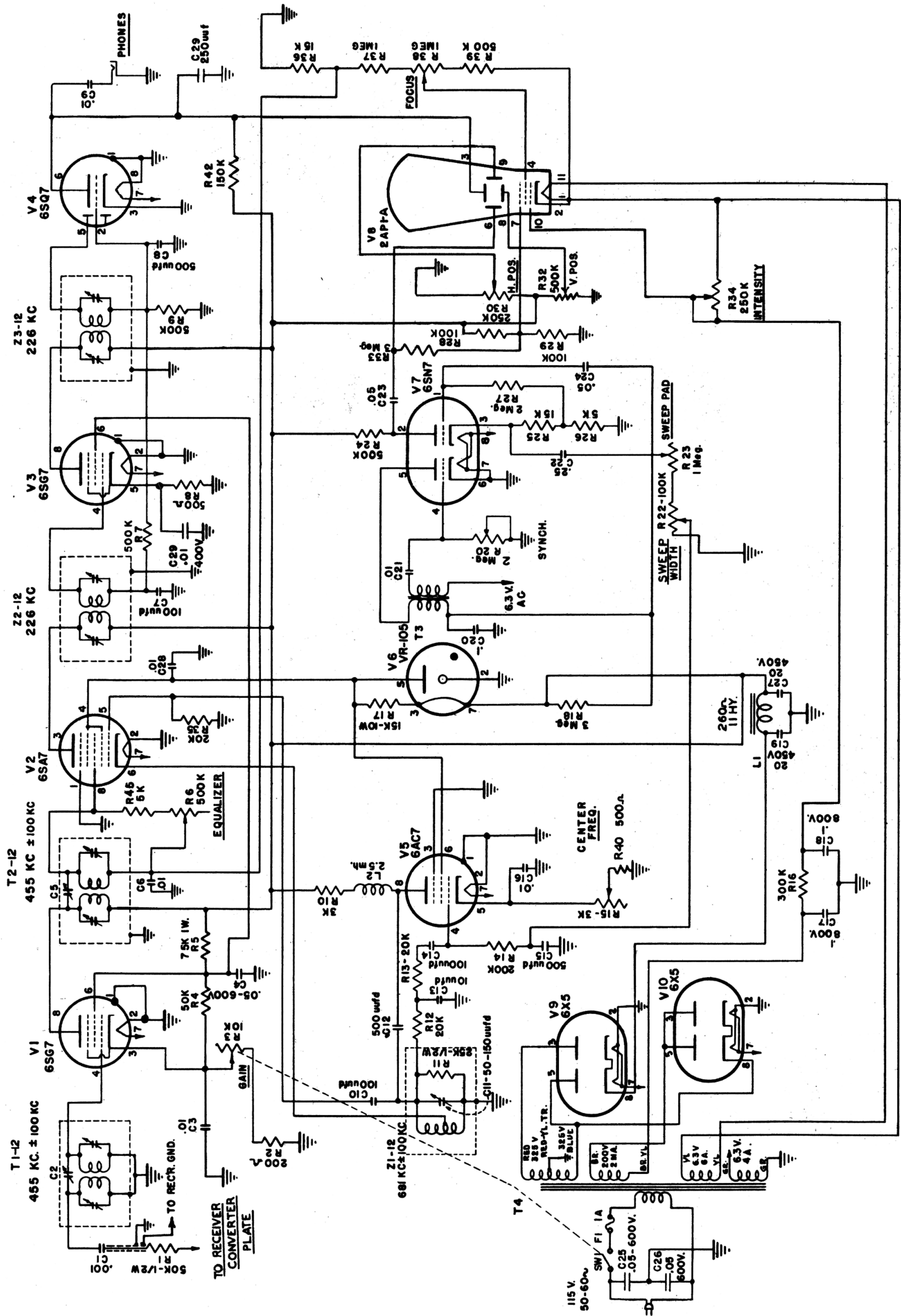
### Panoramic Operation

During operation, the oscillator is "rocked" through a band of frequencies by a linear-sawtooth voltage taken off the SWEEP-WIDTH control R22, and applied to the control grid of the modulator tube V5. The oscillator, thus, is frequency-modulated, and the extent of the deviation is proportional to the amplitude of the applied sawtooth voltage. The position of the SWEEP-WIDTH control contact arm determines the amount of sawtooth voltage applied to the modulator grid.

Linear-frequency calibrations on the Panoramic screen are obtained by having the oscillator frequency-excursion follow the sawtooth voltage linearly. A special phase net made up of R12, R13, and C13 accomplishes this task. The design of the net is critical, but once it has been adjusted properly, it is highly stable. As the oscillator makes its excursion, it beats progressively and periodically with one incoming signal after another to produce pulses of i.f. at the 225-kc frequency, and these are passed and amplified by the i-f section.



COMMERCIAL OSCILLOSCOPES AND RELATED EQUIPMENT



- NOTES.
1. ALL CONDENSER VALUES ARE IN  $\mu\text{F}$ s EXCEPT AS NOTED.
  2. RESISTOR VALUES DESIGNATED "K" ARE IN THOUSANDS (OHMS).
  3. C19 AND C27 CAN BE 2  $\times$  15 MFD - 450 V.

Fig. 22-43.—Schematic of Panoramic Model PCA-2, type T-200.

Courtesy Panoramic Radio Corp.