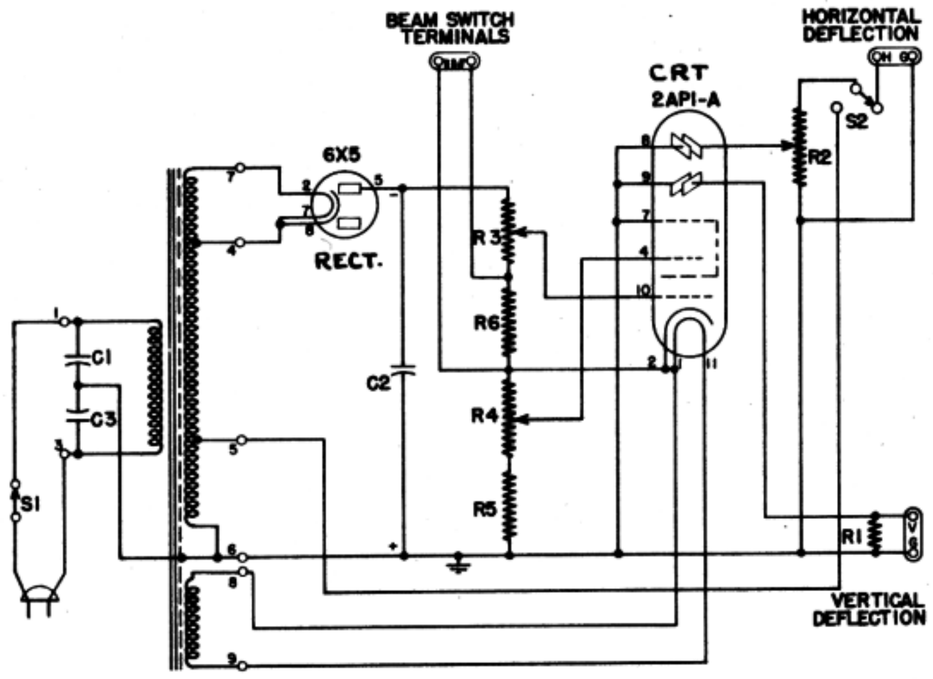
NATIONAL MODEL CRU
Foundation Unit

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.



C1—.01 mfd. r.f. filter condenser
C2—2. mfd. 600 volt (working) condenser
C3—.01 mfd. r.f. filter condenser
R1—4.7 megohm, ½ watt fixed resistor
R2—500,000 ohm potentiometer (sweep voltage control)
R3—50,000 ohm potentiometer (brilliancy control)
R4—100,000 ohm potentiometer (focusing control)
R5—220,000 ohm ½ watt fixed resistor
R6—47,000 ohm ½ watt fixed resistor
S1—Line switch
S2—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.