TEKTRONIX MODEL 511-A AND 511-AD

FREQUENCY RESPONSE
Vertical Amplifier 5 cps to 8 Mc, —3 db
Triggered Sweep Circuit 0.01 sec/cm to 0.1 μsec/cm
DEFLECTION FACTORS
Vertical Amplifier 0.27 rms volts/cm (minimum)
LINE RATING 105-125/210-250 volts, 50-60 cps

TUBE COMPLEMENT

Type	*Function*
6AC7 (V1)	Trigger-Phase Splitter
6AG7 (V2)	Trigger-Amplitude Control
6AL5 (V3)	Trigger-Coupling Diode
6AC7 (V4)	Multivibrator
6AG7 (V5)	Multivibrator
6AL5 (V6)	Unblanking Limiter
6C4 (V7)	Unblanking Cathode Follower
6C4 (V8)	Gate-Output Phase Splitter
6AG7 (V9)	Sweep Generator
6C4 (V10)	Sweep-Output Cathode Follower
6J6 (V11)	Sweep Magnifier
6AL5 (V12)	Sweep, D-C Restorer
6AU6 (V13)	Sweep Amplifier
6AU6 (V14)	Sweep Amplifier
6C4 (V15)	Sweep-Voltage Regulator
6AG7 (V16)	Video Amplifier, 1st Stage
6AG7 (V17-V18)	Video Amplifier, 2nd Stage
6AG7 (V19)	Video Amplifier, Gain-Control, Cathode Follower
5CP1/A (V20)	Cathode-Ray Tube
6X4 (V21)	Sweep-Supply Rectifier
5V4G (V22)	Low-Voltage Rectifier
5V4G (V23)	Low-Voltage Rectifier
6X4 (V24)	Bias Rectifier
6AQ5 (V25)	Sweep-Supply Regulator
6AU6 (V26)	Low-Voltage Regulator Amplifier
6AS7G (V27)	Low-Voltage Regulator
6AU6 (V28)	Sweep-Supply Regulator Amplifier
5651 (V29)	Voltage Reference
VR150 (V30)	Bias Regulator
6AQ5 (V31)	High-Voltage Supply Oscillator
1B3GT/8016 (V32)	High-Voltage Supply Rectifiers
1B3GT/8016 (V33)	High-Voltage Supply Rectifiers

The schematic circuit diagram for Model 511-A is shown in Figs. 22-67A and B. Model 511-AD is identical to the 511-A, except that it contains a video-delay network, operating in the cathode circuit of the *V17* video amplifier. The network provides a delay of 0.25 μsec, permitting the cathode-ray tube to be unblanked and the sweep to operate linearly. before the initiating figure reaches the vertical-deflection plates. This allows observation of random pulses.

Power Supply

The high-voltage power supply uses a unique method of developing the 3,000-volt potential required for operation of the cathode-ray tube. A 6AQ5 is used in a plate-tuned Hartley oscillator circuit, the primary of *T2* and *C75* forming the tuned circuit. At resonance, there is a large circulating current in *C75* and its associated transformer primary winding. The secondary has a low current characteristic and the 1B3GT rectifiers do not develop excessive voltage drops.

Trigger Circuit and Multivibrator

The trigger-input circuit feeds into *V1* through the switching system. *V1* has a cathode resistor and a plate-loading resistor. Across these, signal voltages are developed that may be selected by the switching system. The voltage across the series circuit of *R4* and *R5* is in phase with the input voltage on the grid, while the voltage at the plate of the phase splitter is out of phase by 180° with the grid-input voltage. *V2*, a trigger amplifier, requires a positive impulse on its grid to provide the correct trigger action for the multivibrator. When the TRIGGER SEL. switch is in the positive INT. or positive EXT. positions, signal voltages are taken off the cathode of *V1* and do not change in polarity. Therefore, a positive impulse must be supplied by the external source, or video amplifier, as the case may be.

With the TRIGGER SEL. in the negative INT. or negative EXT. positions, signals are taken off the plate, are reversed in polarity due to the phase-shifting property of the tube, and thus provide the required positive-output phase from negative-trigger sources.

To convert the various shapes of trigger impulses into square waves of controllable duration, suitable for operating the sweep generator and unblanking the cathode-ray tube, a multivibrator is provided. This circuit uses *V4* and *V5* as multivibrator tubes.

Sweep Magnifier

The function of this circuit is to delay the start of the sweep for a variable time, and then to cause it to go at five times its normal speed. This is accomplished by the biased cathode-coupled amplifier *V11*. In this type of amplifier, a positive change in the grid potential of *V11A* raises the potentials of both cathodes, and therefore corresponds to a negative change on the grid of *V11B*. Thus the plate of *V11* gives an amplified version of the signal on the grid of *V11A*, without change of polarity. The SWEEP MAGNIFIER POSITION potentiometer raises the potential on the grid of *V11B* above ground potential, and at the same time the cathode potential of *V11A*. No sweep appears on the plate of *V11B* until the plate of the sweep generator overcomes this bias. Then, the amplified sweep appears. Sufficient bias is available on the SWEEP MAGNIFIER POSITION to make it possible to start the magnified sweep at any point on the normal sweep.

Sweep Amplifier

The sweep voltage at the plate of *V9* has an amplitude of only 20 volts, approximately. To sweep the spot across the screen, about 350 volts are needed. The sweep amplifier provides the necessary amplification, and, in addition, converts the single side voltage from the sweep generator into a balanced voltage suitable for beam deflection in the cathode-ray-tube circuit. This balanced voltage is necessary to maintain the average potential of the deflection plates constant over the entire sweep range, and thus prevent defocusing. The amplifier which does this uses a cathode-coupled circuit consisting of the triode connected 6AU6 tube *V13* and *V14*.

The HOR. POSITION control varies the bias on *V14* and thus determines the position from which the sweep starts. When the SWEEP RANGE switch is on the EXT. position, the input to the sweep amplifier is shifted from the sweep generator to the arm of the EXT. SWEEP ATTEN. potentiometer.

The biasing current is obtained from the —1,500-volt cathode-ray-tube power supply through the voltage-dropping resistors *R153* and *R154*. Since the impedance of the neon-glow lamps is rather high at frequencies involved in the fastest sweeps, *C24* and *C25* are shunted across them to transmit currents at such frequencies efficiently.

Video Amplifier

A wide-range two-stage video amplifier is incorporated in the circuit, using a switching arrangement, so that only one stage need be used if desired. The first stage, which is used only in the 2 STAGES position of the INPUT CHAN. SEL. switch, uses a 6AG7 tube *V16*. The output stage is a cathode-coupled, push-pull 6AG7 stage, providing approximately 110 volts of undistorted output. Low-frequency compensation is provided to correct for the effect of the coupling capacitors. The resistors *R110* and *R125* along with the capacitors *C51A* and *C51B* provide a rising low-frequency characteristic together with a phase correction effect. To compensate for variations in the component values, *R116* is made adjustable. The inductances *L7*, *L8*, *L9* and *L10* provide high-frequency compensation. A four-terminal coupling network is used to provide the greatest possible bandwidth. The 6AG7 cathode follower *V17* serves primarily as an impedance transformer, so that a low-resistance potentiometer may be used as a gain control. The cathode follower permits the insertion of a delay line in the video amplifier, which is provided for Model 511-AD.

S1 TRIGGER SELECTOR
S2 SWEEP RANGE
S3 SIGNAL CALIBRATE
S4 INPUT ATTENUATOR
S5 INPUT CHANNEL SELECTOR
S6 SWEEP MAGNIFIER

Fig. 22-67A.—Schematic of Tektronix Model 511-A.

Courtesy Tektronix Inc.

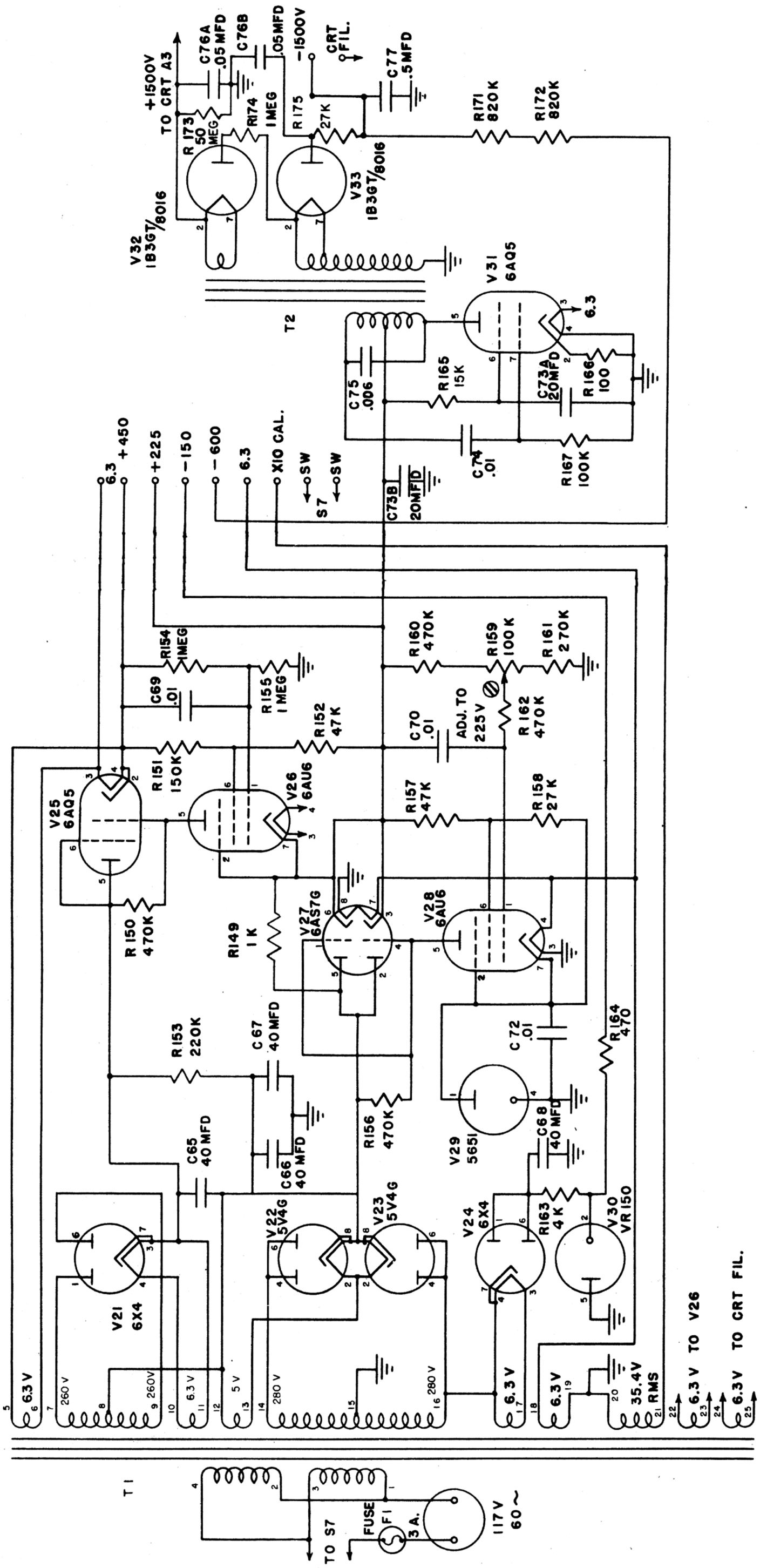

Fig. 22-67B.—Power supply of Tektronix Model 511-A.

Courtesy Tektronix Inc.