BROWNING MODEL OL-15B

FREQUENCY RESPONSE
Vertical Amplifier 5 cps to 6 Mc, flat within 3 db
Horizontal Amplifier 5 cps to 1 Mc, flat within 1 db
Sweep Circuit 5 cps to 500 kc

DEFLECTION FACTORS
Vertical Amplifier 0.05 rms volts/inch
Vertical-Deflection Plates 100 rms volts/inch
Horizontal Amplifier 0.05 rms volts/inch
Horizontal-Deflection Plates 100 rms volts/inch

LINE RATING 115 volts, 60 cps

The schematic diagram of Model OL-15B Oscillosynchroscope is shown in Fig. 22-3. The two general classes of signals that may be studied are:

1. Signals whose duration is long compared with the time between successive signals under observation and, 2. signals whose duration is short compared to the time between successive signals.

A study of the schematic diagram, Fig. 22-3, shows several important features. The sync, sawtooth generator, and triggered sweep circuits are particularly interesting. The sync amplifier output can be fed through a switching system to the sawtooth generator, when desired, and to the triggered sweep generator; it can also be fed to the delay circuit if switched into it. The input of the triggered generator can be derived either from the delay circuit output or sync amplifier output. The triggered generator feeds into the cathode-ray-tube horizontal plate circuit, when switched in, and also into the intensifier. The intensifier goes to the first grid of the cathode-ray tube.

Input Circuit and Sawtooth Sweep

The vertical-amplifier input stage is a cathode-follower type, using *V1;* the vertical gain control is *R8,* with a series capacitor *C8* to block d.c., thereby preventing bias change of *V2* as the setting of *R8* is varied. *V2, V3,* and *V4* are successive amplifier stages. *V2* and *V3* use plate-circuit inductances for high-frequency compensation. *V4* is a combined voltage amplifier and phase inverter. A balanced vertical output stage of conventional design is used. Resistors *R28* and *R29* are parasitic suppressors.

The input system of the horizontal amplifier is almost identical to that of the vertical amplifier with the exception of the calibrator circuit. A 6C4 with gain control in the cathode circuit feeds a 6AG7, which, in turn, drives the push-pull 6AG7 tubes *V11* and *V12. V11* is a grounded-grid amplifier, in which respect it differs from its counterpart in the vertical-deflection amplifier.

The sawtooth generator is of the hard-tube variety and produces sawtooth waveforms from 5 to 500,000 per second. It is composed of *V6, V7,* and *V8,* with feedback action produced by *V6* and *V7. V8* serves as a constant current device for supplying a linear change of voltage across the sweep capacitance.

Triggered Sweep

The triggered sweep circuits in the OL-15B are built around a one-shot multivibrator consisting of a 6C4 triode and a 6SH7 triode. The gate pulse produced by this combination is amplified and inverted by *V17* first triode, and then fed to a clamper *V17* second triode, constant current pentode *V18,* and inverter *V19,* to produce a push-pull linear sweep voltage for direct application to the horizontal plates of the cathode-ray tube.

For purposes of circuit explanation, we may assume that *S8* is in position *1,* corresponding to the 0.25 microsecond per inch sweep speed condition. *C52* and *R99* are then associated with *V15* and *V16.* Since the grid return for *V16* is to the cathode, this tube will conduct readily and sufficient voltage drop will appear across *R96* to reduce the plate current in *V15* to nearly zero.

If a negative impulse should be sent through *C51,* it would be impressed equally upon the plate of *V15* and on the grid of *V16* through *C52,* resulting in a decrease of plate current in *V16.*

The decreasing space current will cause a decreasing voltage to appear across cathode resistor *R96.* Since the *V15* cathode is connected to the cathode of *V16,* the voltage change results in an effective decrease in bias on *V15* with increasing plate current. Hence, the plate voltage will drop, and this change, in turn, will be communicated to the grid of *V16.* We have a feedback condition which will result in the grid of *V16* being driven beyond the condition of plate current cutoff. *V16* remains in this condition as *C52* charges through *R99.* When the voltage on the grid of *V16* reaches a certain point, plate current begins to flow again and the voltage across *R96* increases.

Feedback action rapidly returns the circuit to its stable condition where it remains until another trigger signal arrives. Thus, a negative voltage will be produced at the plate of *V15* and a positive voltage pulse at the plate of *V16.*

C52 and *R99* are chosen to produce a gate whose duration is as long as the sweep time desired. In this case it is 1.25 microsecond (5 inches of deflection at 0.25 microsecond per inch). A portion of the positive output of *V16* is applied to the grid of *V17,* triode No. 1, which has been biased to a condition of very small plate current. As the pulse is applied, the tube conducts and a large negative pulse appears at the plate.

V17, section 2, is normally conductive so that the sweep capacitance selected by *S8C* will be charged to a voltage determined by the relative impedances of *V17,* section 2, and *V18.* When the negative voltage at the clamp tube *V17,* section 2, cuts off current in this tube, the sweep capacitance discharges through *V18* at a linear rate. This voltage is applied to the grid of *V19* through a compensated attenuator and appears as a positive sweep voltage at the plate of *V19.* Negative and positive sweep voltages are applied to the horizontal-deflection plates of the cathode-ray tube. At the same time as the sweep is applied, a positive pulse from the sweep gate is impressed on the intensity grid of the cathode-ray tube.

With SYNC SELECTOR in EXT NEG position, a negative trigger at the SYNC INPUT terminals is passed through *R88,* the SYNC GAIN control, to sync amplifier *V13.* This pulse appears as positive at the plate of *V13* and triggers the sweep gate through the sync inverter *V14A.* With SYNC SELECTOR in EXT POS position, a positive trigger at the SYNC INPUT terminals is passed through the SYNC GAIN control to the sync inverter which, in turn, triggers the sweep gate. The triggered sweep circuit may also be triggered from the video amplifier, as in the case for internal sync using the sawtooth sweep. SYNC SELECTOR will be in either the POS SIG or NEG SIG position, as the case may be.

Trigger Generator and Delay Circuit

An 884 thyratron relaxation oscillator serves as the trigger timing source in the OL-15B. A resistor *R119* of 200 ohms is in the cathode circuit of this tube *V20.* When *V20* fires, a sharp voltage pulse is formed across *R200.* This pulse is inverted by *V14B* and triggers *V21* which operates in a similar manner to that of the sweep gate multivibrator. The width of the delay multivibrator gate is adjustable by means of *R127,* the DELAY CONTROL. *R127* and *R127A* are a concentric shaft dual control with *R127* (1 meg) for coarse phasing control and *R127A* (10,000 ohms) for fine phasing control.

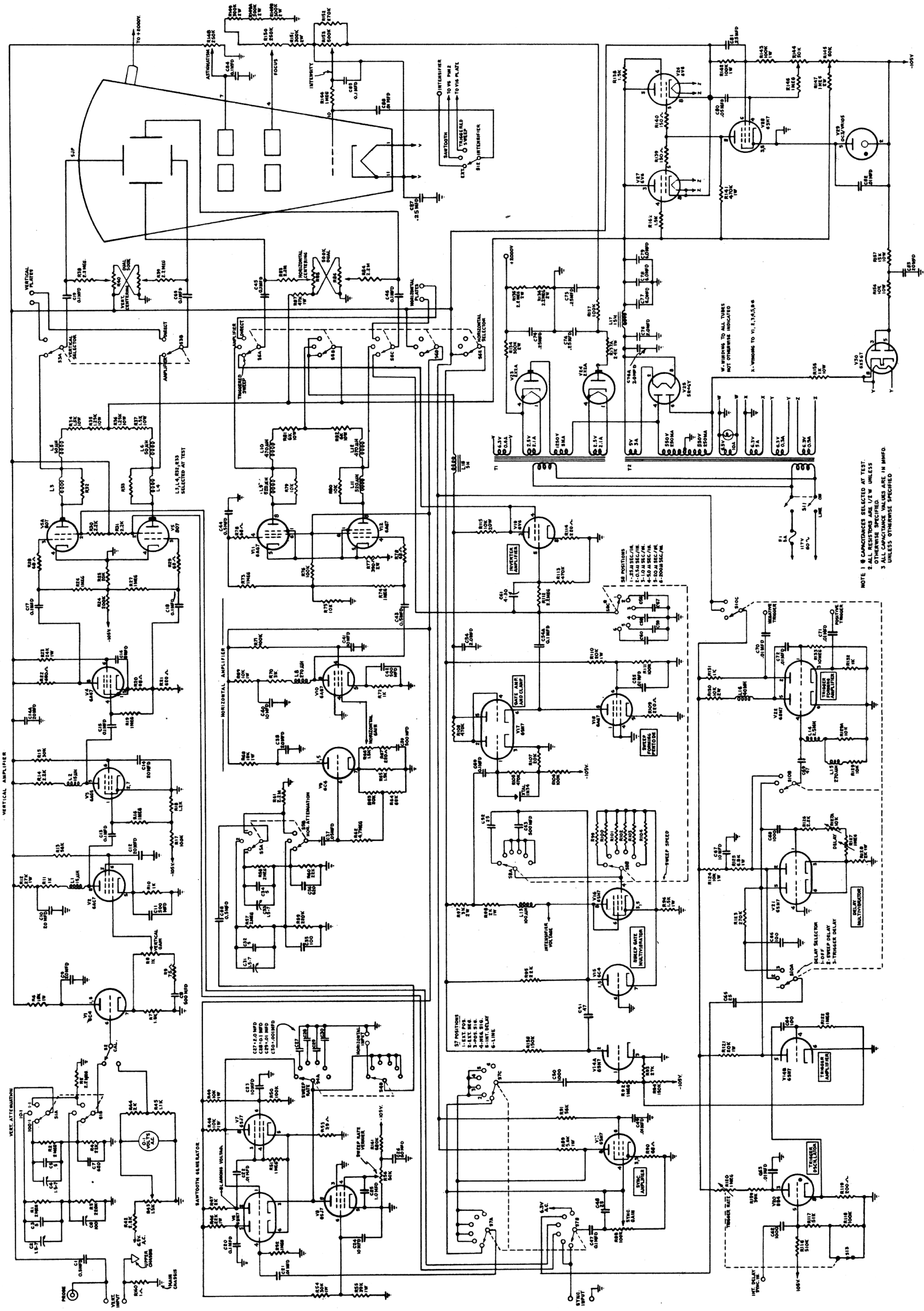
With *S10* in SWEEP DELAY position, the negative output of the gate is differentiated by the network in the grid circuit of *V22.* Since *V22,* triode No. 1, is at zero bias condition, this stage responds only to negative grid excursions so that a positive trigger voltage appears at the plate of *V22,* section 1, coincident with the leading edge of the delay gate.

At the same time, the negative trailing edge of the gate output at the plate of the second triode is applied through *C65* to trigger the sweep multivibrator through the sync amplifier *V13.*

With this arrangement, the sweep is delayed with respect to the output triggers. In TRIGGER DELAY position, the trigger is delayed with respect to the sweep. Since the width of the delay multivibrator circuit cannot be reduced to zero, it would normally be impossible to reduce the delay between the trigger and sweep to less than about 2 microseconds, so that the trigger could not be phased to occur during the two fastest sweep speeds.

To overcome this difficulty, *R123* and *C66* are used in the circuit to delay the start of the sweep by about 2 microseconds, so that the trigger can be phased in to zero time with respect to the sweep start.

When TRIGGER RATE is turned to the extreme counterclockwise position, *S13* is opened and *V20* is heavily biased so that its running rate is very low, around 30 cps. A positive trigger of at least 30 volts applied to INT DELAY SYNC IN will trigger the thyratron, which, in turn, will operate the trigger and delay circuits in the same manner as for the free-running condition of the trigger generator.



Courtesy Browning Labs.

Fig. 22-3.—Schematic of Browning Model OL-15B.