ELECTRON TUBES

RCA Application Note

AN-154

Horizontal-Deflection-Output and High-Voltage Transformer RCA-230T1 for 18-Kilovolt Kinescope Operation

A deflection system using the new ferrite-core transformer, RCA-230T1, has been developed to provide a high voltage of 18 kilovolts together with adequate deflection voltage for kinescopes such as the RCA-20CP4 and RCA-21AP4 having horizontal-deflection angles of about 66 degrees. The required tube complement includes one RCA-6CD6-G horizontal-output tube, one RCA-6W4-GT damper diode, and one RCA-1B3-GT high-voltage rectifier. The transformer is so designed that the power for the vertical-deflection circuit may be obtained from the boosted B-voltage supply. The RCA-230T1 deflection circuit, shown in Fig. 1, along with a conventional vertical-deflection circuit employing a 6S4 vertical-output tube and RCA-226T1 vertical-output transformer, operates from a B-supply voltage of 290 volts. The B-power consumption for both horizontal-deflection and vertical-deflection circuits is less than 32 watts.

Associated Deflection Components

The RCA-230T1 deflection circuit, shown in Fig. 1, utilizes the RCA-211D1 deflecting yoke, which is especially designed to provide the good corner resolution desirable with large rectangular kinescopes. Two ferrite-core coils are used for linearity control and width control. The width control, RCA-212R1, has an inductance range of approximately 2.9 millihenries to 16 millihenries. The approximate inductance range of the linearity control, RCA-213R1, is 1.5 millihenries to 8.3 millihenries.

Lead Dress

Special attention must be given to wiring techniques utilized with horizontal-deflection and high-voltage circuits to minimize stray capacitance and to prevent corona or arc-overs. It is particularly important to dress the 1B3-GT plate lead away from other leads and the chassis. Other leads having relatively high pulse voltages are: 6CD6-G plate lead, 6W4-GT cathode lead, and leads to transformer terminals 3, 4, and T.

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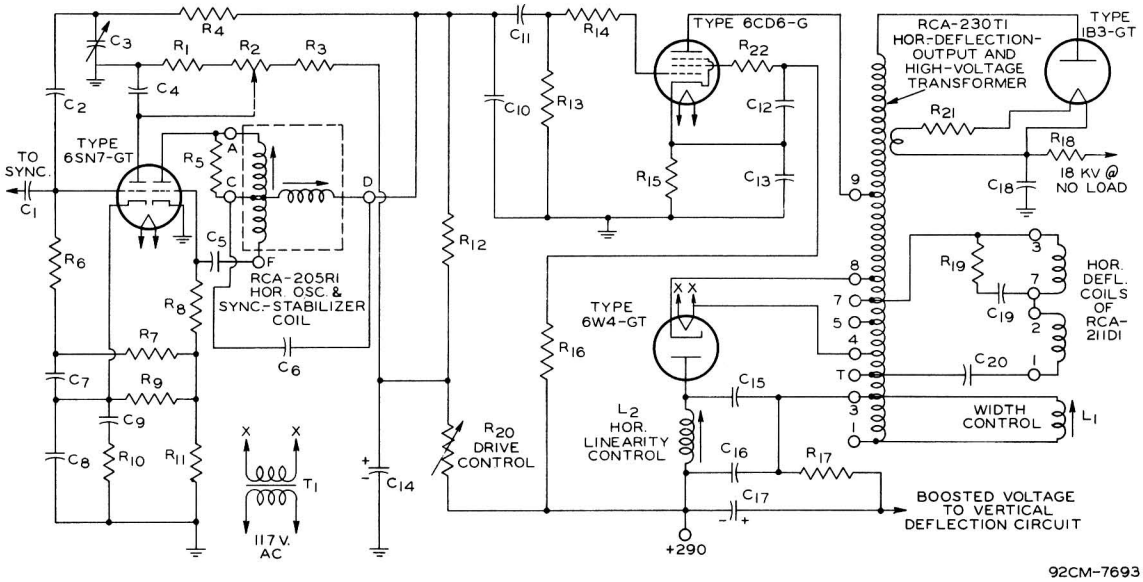
Adjustments

The adjustment of the DRIVE control is important for proper circuit performance. The drive should first be increased until a white vertical bar is seen near the center of the raster, and should then be decreased until this bar just disappears. The linearity control should then be adjusted for best linearity. Because minimum cathode current in the 6CD6-G occurs in this circuit very near the optimum setting of the linearity control, a preliminary adjustment of linearity may be made by setting the linearity control for minimum voltage across the 6CD6-G cathode resistor. The adjustment of drive is somewhat dependent on the linearity adjustment and should be rechecked after other adjustments are completed.



C1 C2: 82 $\mu\mu$f, 500 v., mica
C3: Locking range control, 8 - 70 $\mu\mu$f, mica trimmer
C4: 0.05 μf, 400 v.
C5: 330 $\mu\mu$f, 500 v., mica
C6: 0.01 μf, 600 v., oil-filled
C7: 0.05 μf, 400 v.
C8: 0.02 μf, 400 v.
C9: 0.5 μf, 400 v.
C10: 820 $\mu\mu$f, 500 v., mica
C11: 0.003 μf, 600 v.
C12: 0.1 μf, 400 v.
C13: 0.5 μf, 200 v.
C14: 10 μf, 450 v., electrolytic
C15: 0.05 μf, 400 v.
C16: 0.05 μf, 400 v.
C17: 10 μf, 300 v., electrolytic
C18: 500 $\mu\mu$f. 20 kv.
C19: 62 $\mu\mu$f ± 5%, 1000 v.
C20: 0.1 μf, 400 v.
L1: Width Control, 2.9 - 16 mh with ferrite core, RCA Type 212R1
L2: Horizontal Linearity Control, 1.5 - 8.3 mh, RCA Type 213R1
R1: 0.12 megohm, 1 watt
R2: Hold Control, 50000-ohm potentiometer, 2 watts
R3: 47000 ohms, 1 watt
R4 R8: 0.15 megohm, 1 watt
R5: 8200 ohms, 0.5 watt
R6: 0.33 megohm, 0.5 watt
R7: 0.82 megohm, 0.5 watt
R8: See R4
R9: 82000 ohms, 1 watt
R10: 3900 ohms, 0.5 watt
R11: 0.33 megohm, 1 watt
R12: 82000 ohms, 1 watt
R13: 0.47 megohm, 0.5 watt
R14: 100 ohms, 0.5 watt
R15: 150 ohms, 5 watts
R16: 10000 ohms (approx.), 5 watts
R17: 2200 ohms, 1 watt
R18: 0.1 megohm, 1 watt
R19: 1000 ohms, 0.5 watt
R20: Drive control, 25000-ohm potentiometer, 2 watts
R21: 3.9 ohms, 0.5 watt
R22: 47 ohms, 0.5 watt
T1: Heater transformer insulated for 1.5 kv peak

Fig. 1 - Horizontal-Deflection Circuit and High-Voltage Supply for 18-Kilovolt Kinescope Operation.

B-Supply Voltage

A design-center value of 290 volts is suggested for the B-supply, but some variation in the design-center value is permissible. The minimum design-center voltage is determined by the ability of the circuit to produce an adequate margin of width at low line voltage. A design-center value as low as 280 volts may be sufficient with the circuit shown in Fig. 1.

When B-voltages are specified for particular horizontal-deflection circuits, it is generally advisable not to exceed the recommended voltages. The horizontal-output tube in such a circuit may be operating near its maximum plate-dissipation limit and an increase in supply voltage may cause excessive dissipation. In the 230T1 circuit, however, the 6CD6-G operates considerably below its maximum plate dissipation rating. Therefore, although a design-center B-voltage of 290 volts is suggested for this circuit, a design-center value as high as 330 volts may be used without exceeding the tube plate-dissipation limit provided the value of the screen dropping resistor is suitably chosen to give a plate current of approximately the value indicated in Table I. It is possible to use the 230T1 with a B-supply of 350 to 370 volts if a 6BG6-G horizontal-output tube is used in place of the 6CD6-G and if care is taken not to exceed the 3.2-watt screen input rating of the 6BG6-G.

Performance Data

Table I shows typical performance data for the circuit of Fig. 1 with a line voltage of 117 volts and with the width control set for maximum and for minimum width, respectively. The circuit provides adequate deflection to afford some margin of width at a line voltage of 105 volts.

Table I - Typical Operation of Circuit in Fig. 1*

	Width-Control Setting		
	Maximum Width	Minimum Width	
B-Voltage.	290	290	volts
High Voltage			
at Zero Beam Current . .	18	18	kilovolts
at 140-μa Beam Current .	16.5	16.5	kilovolts
Boosted B-voltage●	550	530	volts
Current from Boosted Voltage Supply	11	11	milliamperes
6CD6-G			
Cathode Current.	96	102	milliamperes
Plate Current.	82	88.5	milliamperes
Grid-No.2 Current.	14	13.5	milliamperes
Grid-No.2 Voltage.	129	132	volts
Grid-No.2 Input.	1.8	1.8	watts
Grid-No.1 Voltage▲	-29	-29.5	volts
Peak Plate Voltage	4500	4500	volts
6W4-GT			
Plate Current.	93	99.5	milliamperes
Peak inverse plate voltage . .	2600	2600	volts
Peak heater-cathode voltage. .	1900	1900	volts

* At a line voltage of 117 volts. All values at zero kinescope beam current unless otherwise noted.

● Measured at terminal 3 of RCA-230T1.

▲ Consists of 15 volts cathode bias and 14 volts grid-resistor bias.