MAY—JUNE, 1957
JULY—AUG., 1957
Vol. 9, No. 3 and 4

Electronic TUBES
Techni-talk
on AM, FM, TV Servicing

Color Receivers II

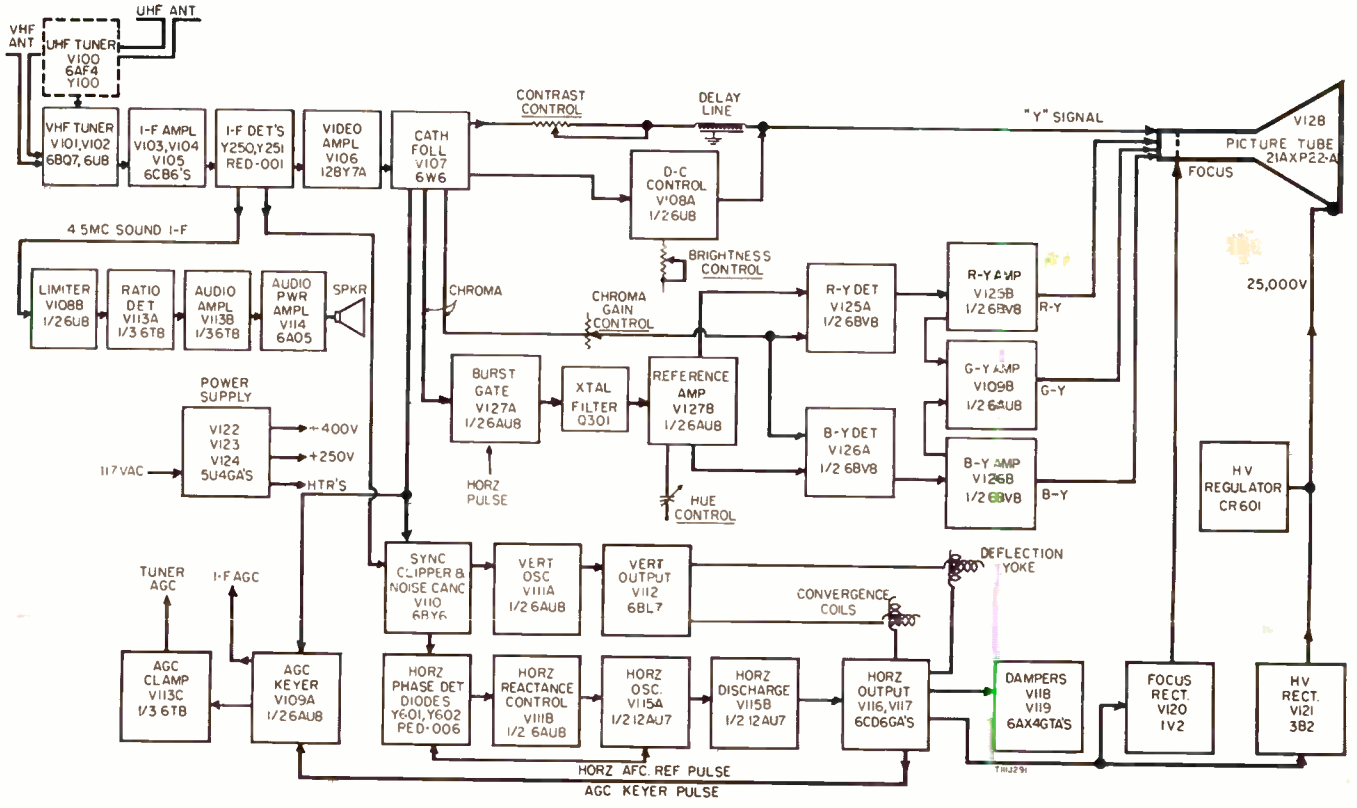


Fig. 1. Block diagram of General Electric Type "CL" color receiver.

In the last issue, the NTSC system was reviewed and color receiver tuner and i-f sections were discussed in general. In this issue, the general discussion will continue, but in addition, one of the latest type color chassis will be discussed in considerable detail. This color chassis Type "CL" is used in General Electric models 21T500, 21C700 and 21C701. A block diagram of this color chassis is shown in Fig. 1 and a complete schematic in Fig. 6.

The tuner and video i-f amplifiers are similar to those previously described with the exception of the video i-f response curve. This curve, shown in Fig. 2, varies considerably from the typical i-f response curve shown in Fig. 3. The reason for this difference will be given presently. It will be noticed that the curve shown in Fig. 2 is quite similar to General Electric monochrome curves, except for the hole created by the 41.25 mc sound trap.

VIDEO DETECTORS AND AMPLIFIERS

The next sections of the receiver to be considered are the video detectors and video amplifiers. It is at this point that color receivers vary between manufacturers and it is also the first point where color circuitry may be noticeably different from monochrome circuitry.

The color receiver requires the same two signals necessary for monochrome reception, e.g., the "Y" or brightness signal plus the audio or sound signal. In addition, the color receiver requires the chroma signal including the color sync or burst signal. The primary difference between various color receivers is found in the points where the sound and chroma information is taken off. In some receivers this information is taken from the next to last i-f amplifier where the signal is then amplified, detected and fed to the respective circuitry. Other receivers use one detector for sound and another for the combined video and chroma information. The General Electric receiver uses this method as can be seen in Fig. 1.

The 4.5 mc sound i-f signal is fed to sound circuits which are conventional and similar to those used in monochrome receivers. The combined video and chroma information must be amplified so that adequate "Y" signal is available to drive the picture tube and also to provide sufficient chrominance sideband information for synchronous detection. This function is performed by V106, the 12BY7A video amplifier tube in the video amplifier circuit shown in Fig. 4.

CATHODE FOLLOWER

The output of V106 is fed to the grid of V107 which is a type 6W6-GT cathode follower. The video or "Y" signal, the horizontal and vertical synchronizing pulses, the 3.58 mc chrominance signal, and the 3.58 mc burst signal are all taken from the V107 cathode circuit as can be seen in Fig. 4. The cathode follower circuit is used for the following reasons:

1. It provides a low-impedance source of output signal. As a result, the capacitive loading effects of the picture tube guns and intermediate circuits become negligible and easy to compensate.
2. With the 6W6-GT tube and the plate voltage used, truly linear output may be obtained over the range of required signal amplitude.

MAIN CHASSIS SCHEMATIC WITH T

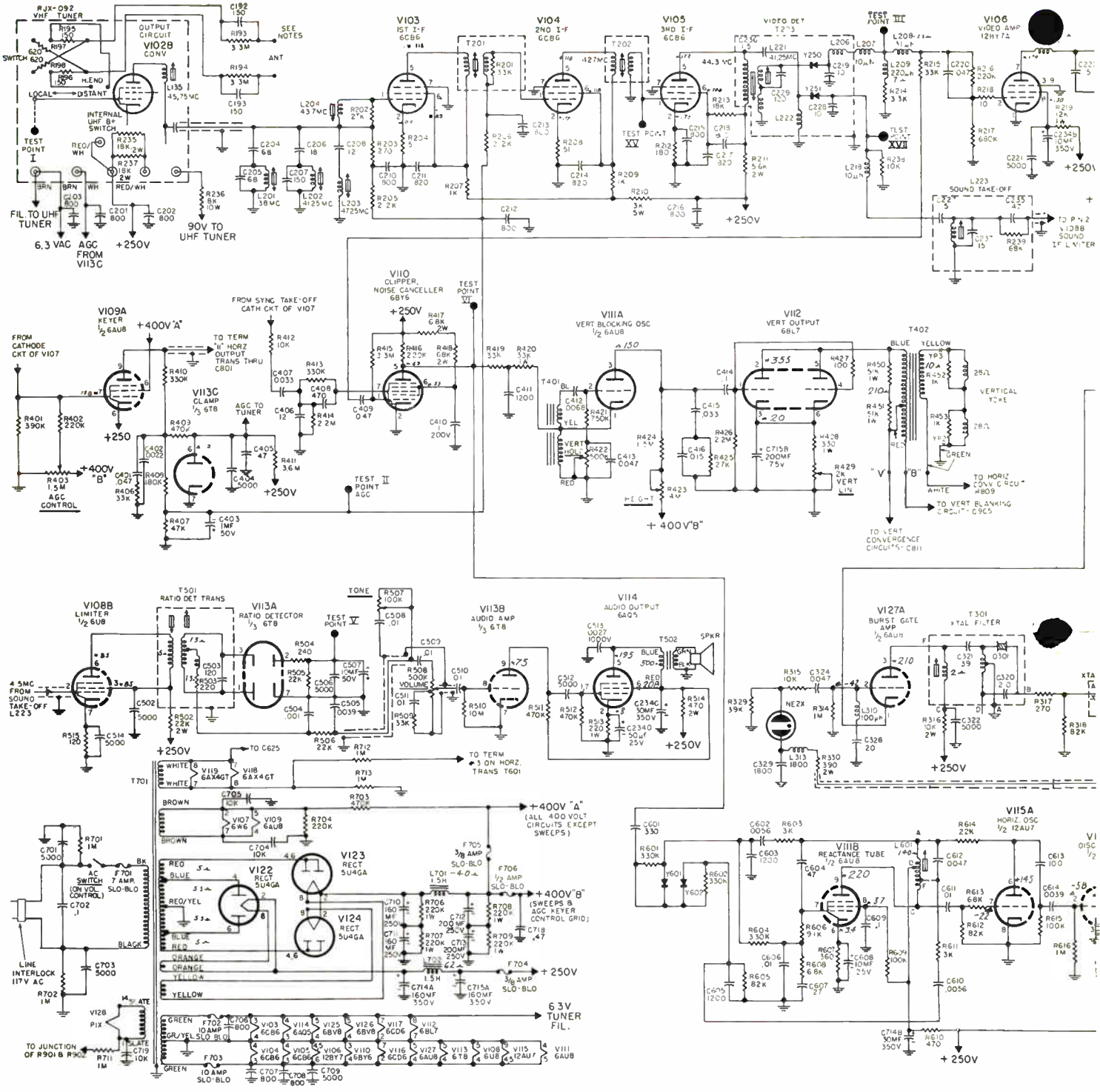


Fig. 6. Schematic diagram for General Electric Type "CL" receiver.

SYMBOL	PURPOSE	TYPE
V101	R-F Amplifier	6BQ7A or 6BS8
V102	Converter-Oscillator	6U8
V103	1st I-F Amplifier	6CB6
V104	2nd I-F Amplifier	6CB6
V105	3rd I-F Amplifier	6CB6
V106	Video Amplifier	12BY7A
V107	Video Output	6W6GT
V108	Audio I-F Limiter, D-C Cont.	6U8
V109	AGC Keyer, G-Y Amplifier	6AU8
V110	Clipper, Noise Canceller	6BY6
V111	Vert. Osc., Horiz. Reactance	6AU8

SYMBOL	PURPOSE	TYPE
V112	Vertical Output	6BL7GT
V113	Ratio Detector, Audio Amplifier AGC Clamp	6T8
V114	Audio Output	6AQ5
V115	Horiz. Osc. Discharge Tube	12AU7
V116	Horizontal Output	6CD6GA
V117	Horizontal Output	6CD6GA
V118	Damper	6AX4GT
V119	Damper	6AX4GT
V120	Focus Rectifier	1V2
V121	High Voltage Rectifier	3B2 or 3C2
V122	Power Rectifier	5U4GA

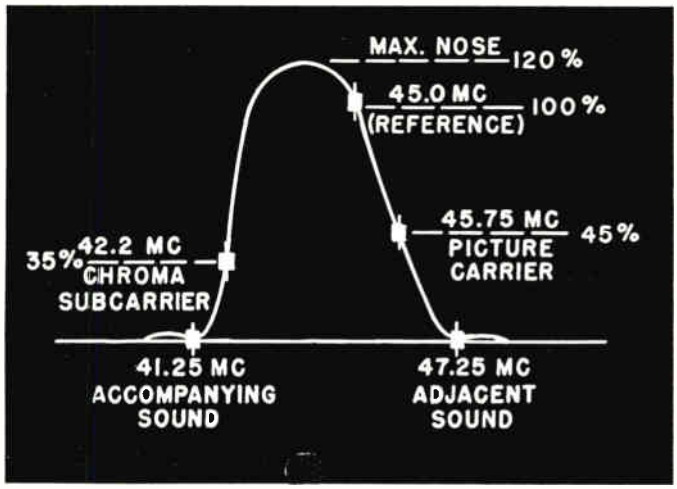


Fig. 2. Video i-f response curve used in General Electric color receiver.

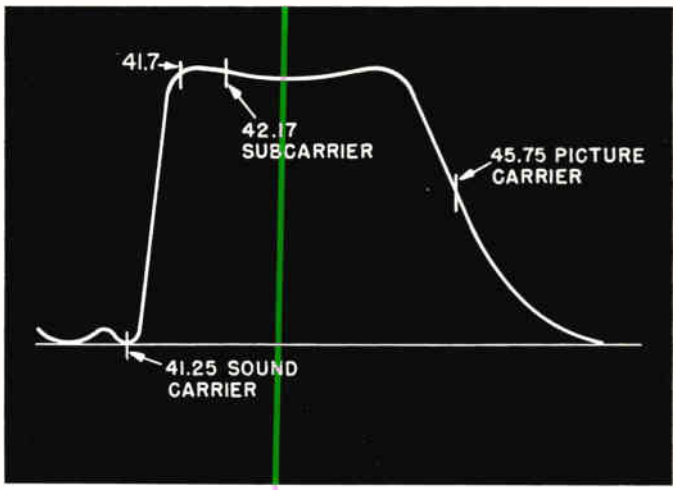


Fig. 3. Typical video response curve.

3. The degenerative nature of the cathode follower reduces the capacitive loading effect on the video amplifier V106 and eases the task of high-frequency peaking near 4.2 mc.
4. Matching into low impedance delay line is efficiently accomplished.

VIDEO COMPENSATION

It was mentioned previously that the curve shown in Fig. 2 differs considerably from the typical response curve shown in Fig. 3. The reason why this type of i-f curve was decided upon was to make the tuning somewhat less critical and therefore easier for the set owner to tune. Since the slope at the right of the 11.25 mc sound carrier is steeper in the Fig. 3 curve than in the Fig. 2 curve, a slight adjustment of the fine tuning control will cause sound bars to appear in the picture if the sound carrier is shifted to the right. If the fine tuning is adjusted so that the shift is to the left, sound as well as chroma will be noticeably affected if not lost. Although these same changes will occur with the Fig. 2 i-f curve, the shift will not be as abrupt and therefore tuning will be less critical.

Due to the location of the subcarrier on the slope of the curve in Fig. 2, a compensation network in the V106 plate circuit is necessary. This network consists of choke L211 and capacitor C222 in a parallel combination in series with choke L210. As a result of this compensation, the ratio of the chroma subcarrier to the "Y" amplitude is essentially the same as transmitted. Undesirable chroma phase shifts which would occur due to the position of the chroma subcarrier on the i-f response curve are also eliminated. Fig. 5 shows frequency response curves resulting from video compensation. Note that the chroma response is essentially flat 0.6 mc above and below the subcarrier which is the desired bandpass characteristic for R-Y, B-Y type receivers.

A delay line will be found in all color receivers. Its purpose is to slow down the "Y" signal to match the delay in the chrominance signal caused by the narrow bandwidth in the chroma circuits. The delay line is shown in Fig. 4 between the contrast control and test point IV. A description of delay lines and how they work appeared in the Vol. 7, No. 3 issue.

D-C RESTORATION

Most color receivers use some sort of d-c restoration. Earlier model receivers used a diode in each of the three gun input circuits. The 6BJ7 tube was developed for this purpose and contained three diodes. Each diode was similar to one-half of a 6AL5 tube. Some later model receivers use straight-through d-c coupling which does not require d-c restoration.

Straight-through d-c coupling was maintained in the General Electric receiver from the video detector to the cathode follower, but could not be used

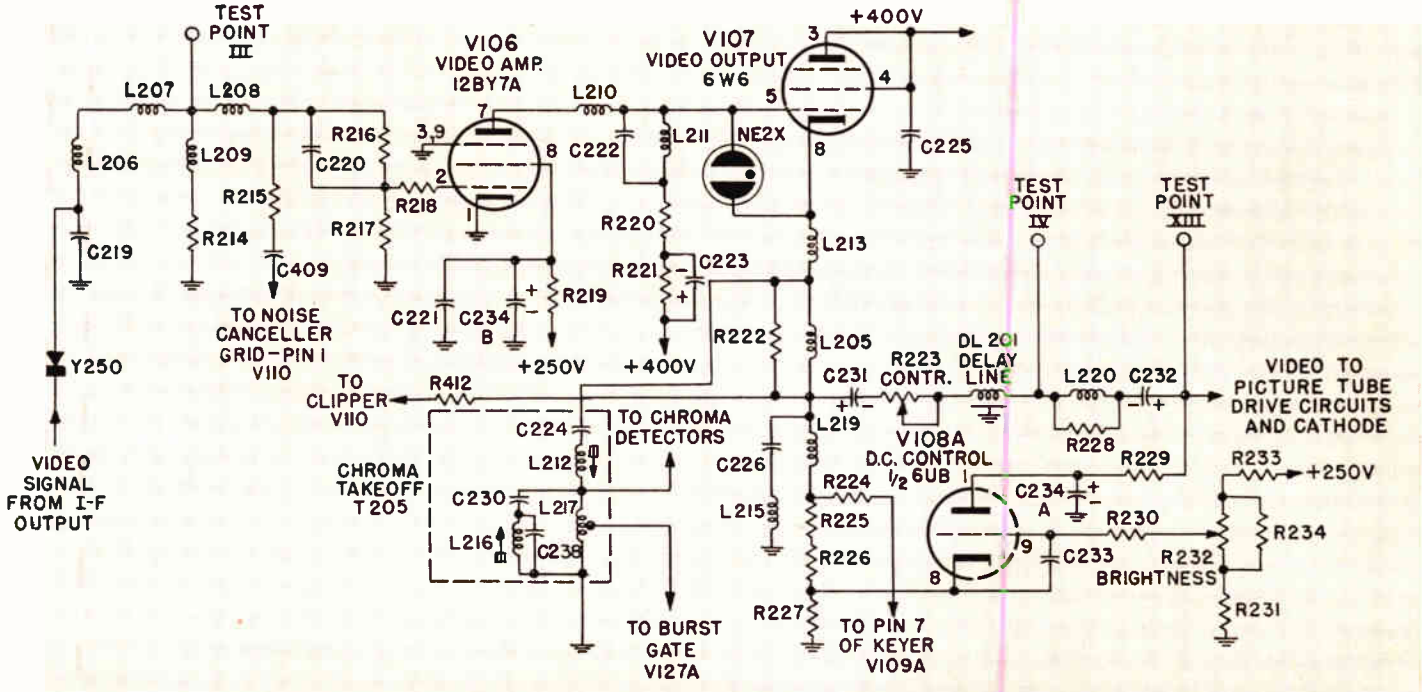


Fig. 4. Video amplifier circuit used in Type "CL" color receiver.

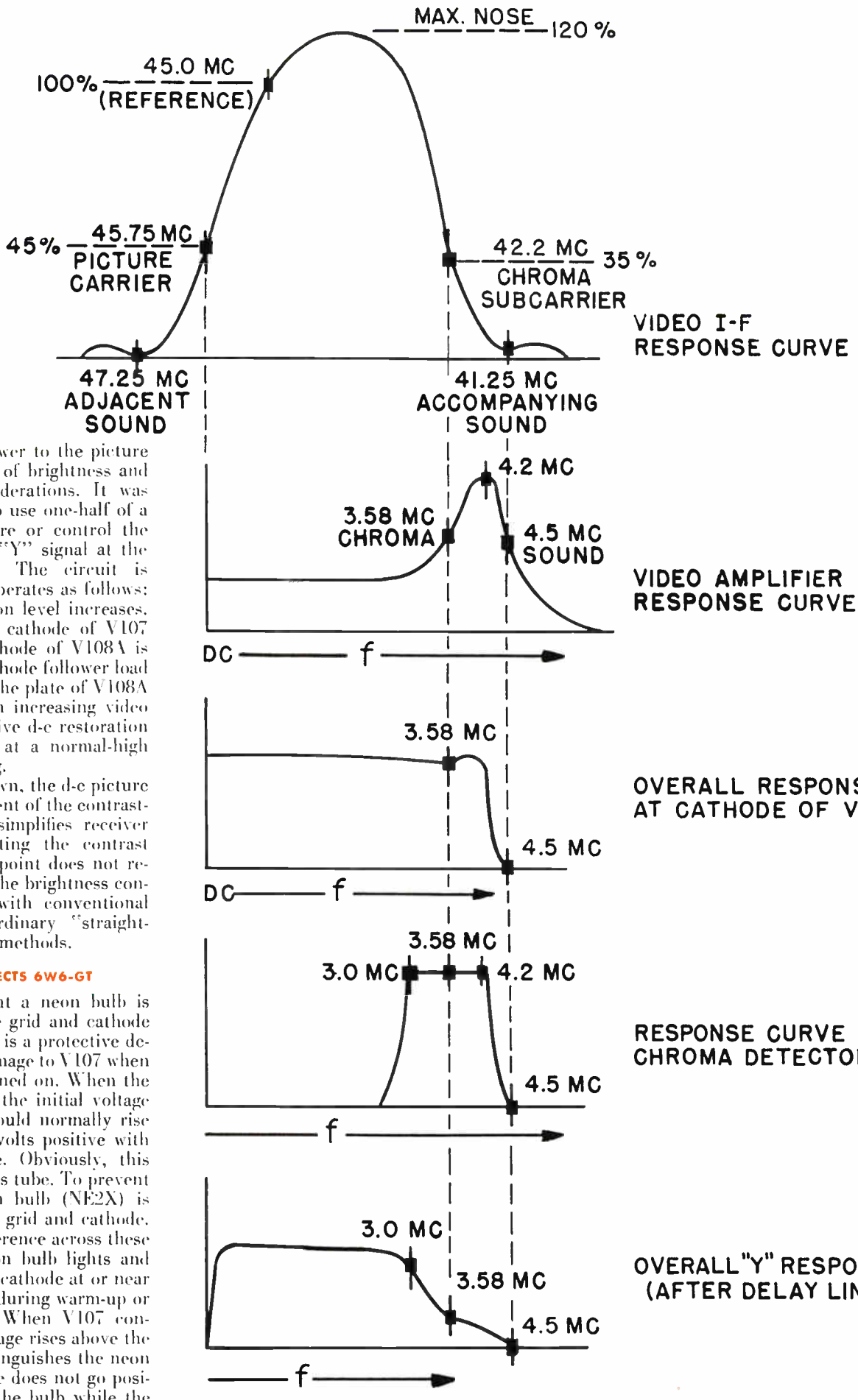


Fig. 5. Video detector and amplifier response curves.

from the cathode follower to the picture tube cathodes because of brightness and contrast control considerations. It was necessary, therefore, to use one-half of a 6U8 (V108A) to restore or control the d-c component of the "Y" signal at the picture-tube cathodes. The circuit is shown in Fig. 4 and operates as follows: As the video modulation level increases, the d-c voltage at the cathode of V107 goes negative. The cathode of V108A is tapped down on the cathode follower load resistance. Therefore, the plate of V108A also goes negative with increasing video modulation. The effective d-c restoration is approximately 50% at a normal-high contrast control setting.

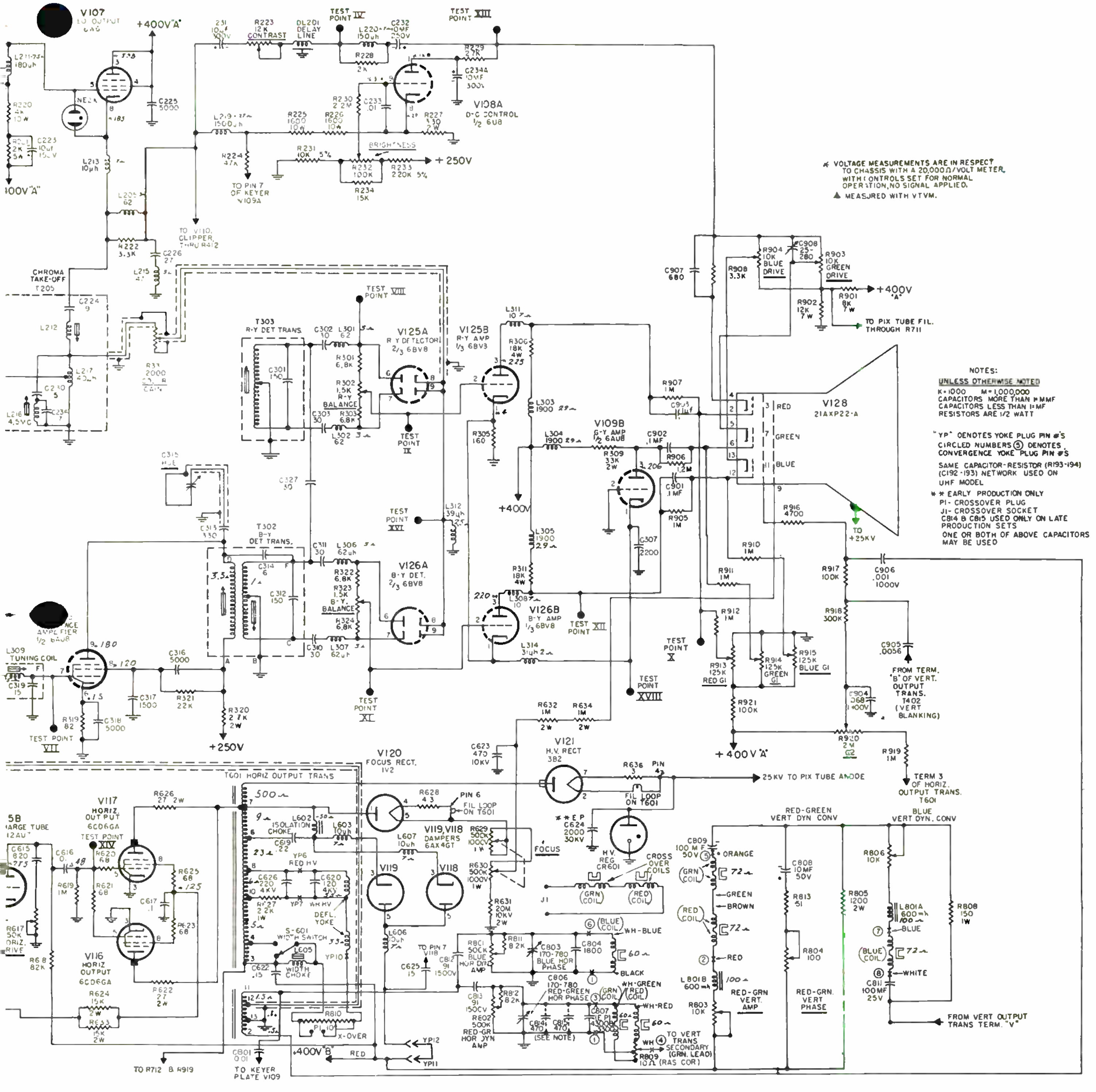
With the circuit shown, the d-c picture component is independent of the contrast-control setting. This simplifies receiver operation in that setting the contrast control to the desired point does not require readjustment of the brightness control, as is necessary with conventional diode restorers or ordinary "straight-through" d-c coupling methods.

NEON BULB PROTECTS 6W6-GT

It will be noted that a neon bulb is connected between the grid and cathode of V107 in Fig. 4. This is a protective device which prevents damage to V107 when the receiver is first turned on. When the receiver is turned on, the initial voltage at the grid of V107 would normally rise to approximately 500 volts positive with respect to its cathode. Obviously, this could be harmful to this tube. To prevent this condition, a neon bulb (NE2X) is connected between the grid and cathode. Due to the voltage difference across these two elements, the neon bulb lights and maintains the grid and cathode at or near the same d-c potential during warm-up or until V107 conducts. When V107 conducts, the cathode voltage rises above the grid voltage which extinguishes the neon bulb. Since the cathode does not go positive enough to ignite the bulb while the receiver is in operation, the NE2X serves as a protective device during warm-up but performs no other function.

(To be continued)

TUBE AND CRYSTAL COMPONENTS



SYMBOL	PURPOSE	TYPE
V123	Power Rectifier	5U4GA
V124	Power Rectifier	5U4GA
V125	R-Y Detector, R-Y Amplifier	6BV8
V126	B-Y Detector, B-Y Amplifier	6BV8
V127	Burst Gate, Reference Ampl.	6AU8
V128	Picture Tube	21AXP22-A
Y1	UHF Mixer	RED-005
Y250	Video Detector	RED-001
Y251	Sound Detector	RED-001
Y601	Germanium Phase	RED-007
Y602	Detectors	

PICTURE TUBE

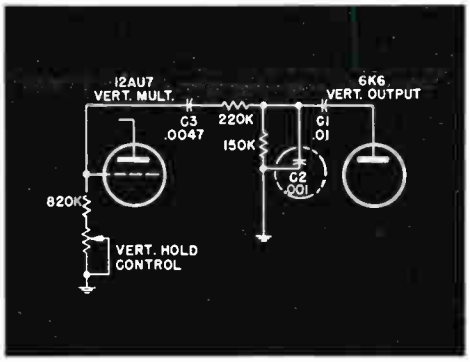
V128	Type	21AXP22-A
	Size	21 inches, round
	Deflection	electro-magnetic
	Convergence	magnetic
	Focus	electro-static

BENCH NOTES

Contributions to this column are solicited. For each question, short-cut or chronic-trouble note selected for publication, you will receive $10.00 worth of electronic tubes. In the event of duplicate or similar items, selection will be made by the editor and his decision will be final. The Company shall have the right without obligation beyond the above to publish and use any suggestion submitted to this column. Send contributions to The Editor, Techni-talk, Tube Department, General Electric Company, Schenectady 5, New York.

Emerson Vertical Sync

Symptom: Intermittent vertical sweep and unstable vertical sync in Emerson Models 741-757-781-784-785 and others using similar circuitry.

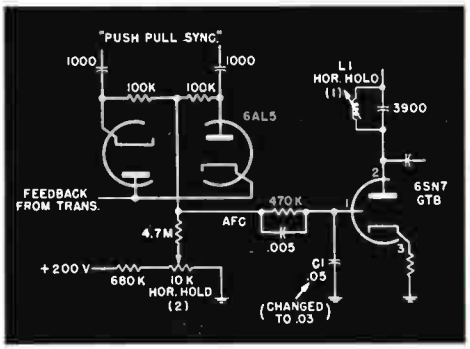


This is a very common complaint on these and similar models. Solution usually lies in replacement of C2, .001 mfd capacitor. This capacitor may be either leaky or completely shorted. High incidence of failure is caused by high pulse voltages present. Replacement should be a high quality unit rated at 600V or higher.

Leon Henner
Lakeside T.V.
Riverdale, North Dakota

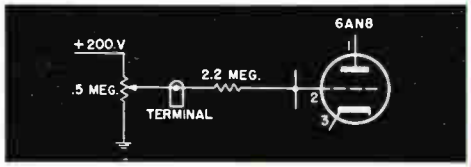
Raytheon Color TV Chassis 21CT1C

Set was "touchy" as to horizontal hold even though both adjustments (1) and (2) were tried. All pertinent tubes and other components seemed ok.



Changed C_1 from .05 to .03 (changing time constant) and readjusted L_1. This corrected sync problem and set has operated satisfactorily ever since.

Color killer (triode of 6AN8) did not work, resulting in "colored confetti" on black and white programs.



Adding .5 meg. adjustable resistor ("pot") and 22 meg. resistor cured the trouble.

There is a blank place for "pot" in horizontal part of chassis (at top of vertical chassis), and an extra terminal for "T" as shown.

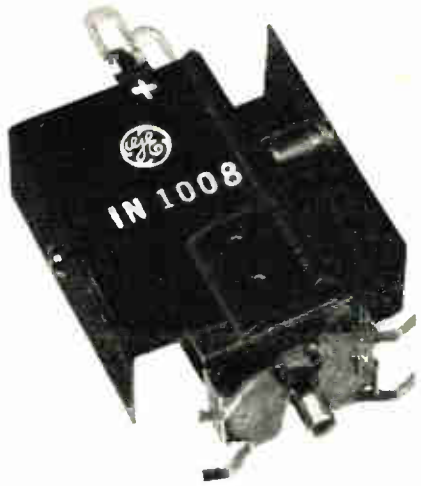
Walter Johnson
495 No. Sierra Madre Blvd.
Pasadena, California

What's new!

Type IN1008

400 MA GERMANIUM TV RECTIFIER

Here is a new General Electric germanium TV rectifier with a rating of 400 ma. This type can be used as a half wave rectifier or with a second IN1008 as a voltage doubler.



RATINGS AND SPECIFICATIONS

	RECOMMENDED DESIGN CENTER	ABSOLUTE MAXIMUM
RMS Input Voltage	*117*	*130 volts*
Peak Inverse Voltage	*340*	*380 volts*
D-C Output Current (IN1008)	*200–400*	*400 ma*
*Rectifier Full Load Voltage Drop**	*0.28*	*0.30 volts*
Series Surge Resistor	*4*	*4 (min) ohms*
Ambient Operating Temperature	*40*	*55°C*
Operating Fin Temperature	*50*	*65°C*

**Full Cycle Average*

ELECTRONIC COMPONENTS DIVISION
GENERAL ELECTRIC
Schenectady 5, N. Y.

Vol. 9 Nos. 3 and 4

TECHNI-TALK
on AM, FM, TV Servicing
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