



Techni-talk

on AM, FM, TV Servicing

COLOR TV-VIII Electronic TUBES

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The previous issue included a discussion and illustrations of signal voltages developed as a result of scanning 50% saturated colors. Recent mail indicates that before continuing with new material on Color TV it might be appropriate to include some further information regarding other than fully saturated colors.

A 100% saturated color does not contain any white. As an example, a saturated red of the specific wavelength chosen for the red camera filter would produce an output of one unit from the red camera. The green and blue camera outputs would be zero because there is no green or blue in saturated red. If this saturated red is diluted with white light it will become less saturated depending on the percentage of white light added. Keep in mind that the color under discussion is a red hue with a specified wavelength and that the hue does not change, only the saturation. It may be somewhat puzzling that a deep red and a pink may have the same

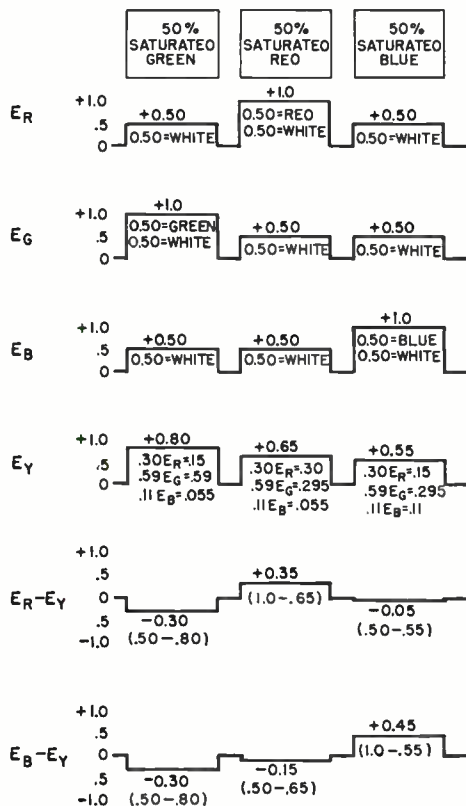


Fig. 1. Signal voltages developed as a result of scanning 50% saturated colors.

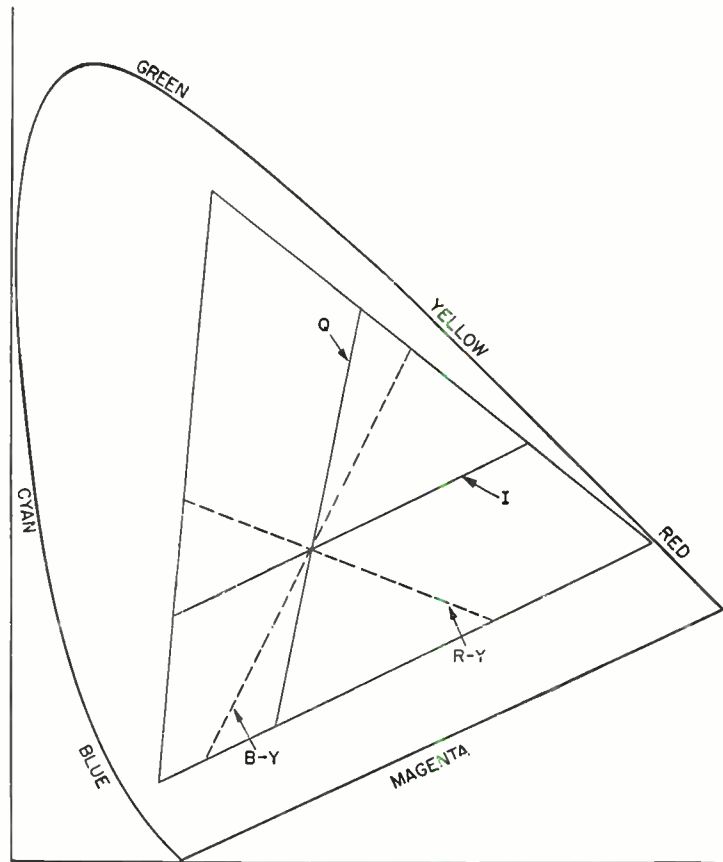


Fig. 2. Chromaticity diagram showing the location of the I and Q axes as well as the R-Y and B-Y axes.

wavelength and therefore the same hue, but this is the case.

Figure 1, on page one of the last issue, shows that white produces one unit each of E_R , E_G and E_B . A saturated red produces one unit of E_R only. A 50% saturated red would be diluted by 50% white. If each 50% were treated separately the red would produce an E_R signal of 0.5 units whereas the white would produce 0.5 units each of E_R , E_G and E_B signals. Added together the E_R signal would be one unit and the E_G and E_B would be 0.5 units each as shown in Fig. 1 in this issue. The 1.0 unit of E_R is made up of 50% derived from the red hue and 50% representing the red component of white. The E_Y signal in Fig. 1 represents 30% of E_R plus 59% of E_G plus 11% of E_B and rounded off to the closest hundredth.

The only color signals discussed so far

have been the R-Y and B-Y signals. Actually the chrominance signals transmitted in accordance with NTSC specifications are the I and Q signals. In this issue the I and Q signals as well as the 3.58 mc burst signal will be described.

It was previously stated that the fine detail in a color TV picture is supplied by the Y or brightness signal, and the low detail color information is supplied by the chrominance signals. The NTSC system provides the receiver manufacturer with a choice of color signal detectors. The color receiver may be designed to detect either R-Y and B-Y signals, I and Q signals, or a combination such as R-Y and Q signals.

I AND Q SIGNALS

The I and Q signals are chrominance signals similar to R-Y and B-Y in that they are composed of specific proportions of

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identified at the greatest distance are found along a line between orange and cyan on the chromaticity diagram. It was therefore determined that the wide-band I signal should be located near the orange-cyan axis. The location of the I signal is shown in Fig. 2. Also shown in Fig. 2 are the Q, R-Y and B-Y color axis.

It was shown in the last issue how R-Y and B-Y signal voltages were de-

veloped and plotted on R-Y and B-Y axes. Various colors produced specific R-Y and B-Y voltages which when added vectorially produced vectors with specific amplitude and phase characteristics. If the same color camera voltages are combined using different proportions of these voltages, I and Q signals will be produced instead of R-Y and B-Y signals. The I and Q signals are composed of the following proportions of color camera voltages.

$$I = .60 E_R - .28 E_G - .32 E_B$$

$$Q = .21 E_R - .52 E_G + .31 E_B$$

Fig. 3 shows the various I (E_I) and Q (E_Q) signal voltages produced by a color bar pattern.

It will be recalled that in the last issue R-Y and B-Y voltages were plotted on two axes, one horizontal (B-Y) and one vertical (R-Y). Since the I and Q axes have been established as thirty-three degrees away counterclockwise from the B-Y and R-Y axes, they would be located as shown in Fig. 4. If the I and Q voltages shown in Fig. 3 are plotted on the I and Q axes in Fig. 4 instead of the R-Y and B-Y axes, the voltage vectors would have the same amplitude and phase characteristics as those produced by the corrected E_R-E_Y and E_B-E_Y voltages shown in Fig. 5. This is shown in Fig. 6 which has the various I (E_I) and Q (E_Q) voltages in Fig. 3 plotted and added vectorially. It will be noticed that the amplitude and phase of each color vector in Fig. 5 derived from R-Y and B-Y voltages, are the same as those

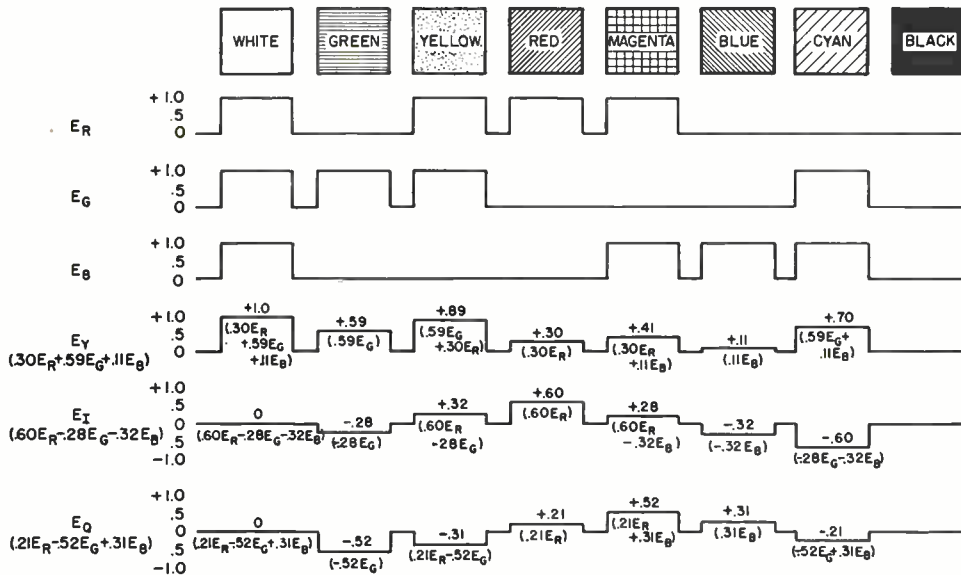


Fig. 3. I and Q signal voltages developed as a color bar pattern is scanned.

the red, green and blue camera signals. The I signal, however, has a wider bandwidth (1.3 mc) than the Q signal (600 kc). The wider bandwidth of the I signal may or may not be utilized depending on the design of the receiver.

It was decided that if a wider bandwidth was to be assigned to one of the color signals, it should be used for those colors which would produce the most noticeable improvement. Numerous color tests have been made which indicate that the human eye can only distinguish fine color detail at close range. As the distance is increased some colors lose their identity before others. The colors which can be

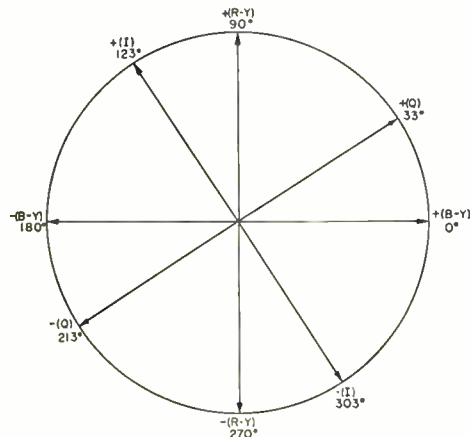


Fig. 4. Phase relationship of I and Q and R-Y and B-Y axes.

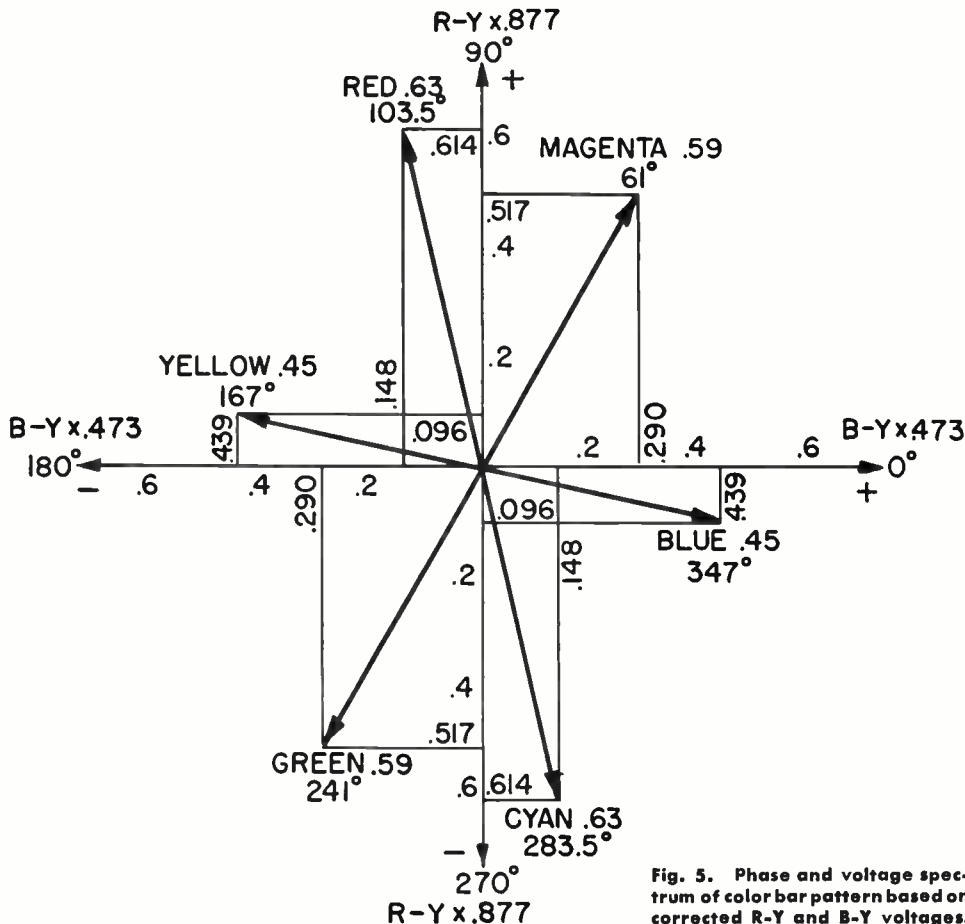


Fig. 5. Phase and voltage spectrum of color bar pattern based on corrected R-Y and B-Y voltages.

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.

NO RASTER

The set—RCA 17T200. The whole series through 17T220 are similar. The complaint—no raster, and sound present only for a short time after the set was turned on. Absence of raster would indicate loss of high voltage, but when this was measured with a VTVM high voltage probe, 15,000 volts was the reading.

The "boost" voltage was in the neighborhood of 500 volts as was the voltage on G2 of the picture tube. It was found that removing the plate voltage from the horizontal output tube resulted in normal sound, but no raster.

After considerable testing, the trouble was found to be in the 6AC7 video amplifier tube. Some sets in this series use a 6AG7 or a 6CL6. The replacement of this tube resulted in a normal raster with picture and sound. Since the loss of raster is not normally associated with a defect in the video amplifier, it is possible that this tip may be of considerable help to others who may run into a similar problem.

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SHORT DUE TO PIN LENGTH

Several STRATOPOWER sets, particularly Models 21T3 and 21C206, exhibited the following symptoms. After approximately 20 to 30 minutes of playing time the set would overload and exhibit signs of SYNC instability.

Replacing V-111B(6T8)AGC clamper tube had no noticeable effect upon the trouble. After substituting all the tubes in the I.F. section without results, attention was then focused upon the tuner.

Close examination of the tuner revealed the following: While replacing V-102 (6AK5) the set trouble was corrected as long as the tube was only partially inserted into the socket. When the tube was pushed all the way into the socket the set acted as previously described. Examination of the underside of the tuner revealed that insufficient clearance was allowed between the aluminum shield and the tube pins of the 6AK5 when it was completely inserted. Consequently pin No. 7 and/or pin No. 1 touched this shield, which caused a short to ground. Since shorting pin No. 1 effectively placed the AGC line only 10,000 ohms from ground (thru R-104) this allowed the I.F. tubes to operate "WIDE OPEN."

For a cure I simply nipped $\frac{1}{16}$ in. off pins 1 and 7.

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TURRET CONTACT CLEANER

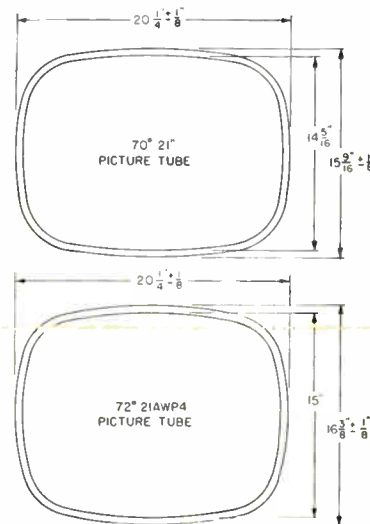
In my TV laboratory, I come across numerous television receivers with intermittent sound, picture, sync, etc. Usually when this situation arises, the trouble can be traced to dirty channel selector switch contacts. On switch-type tuners, contact cleaner applied with a "pipe cleaner" is a good remedy. In addition, the contact spring tension may, when necessary, be increased by bending with needle-nose pliers.

On turret-type tuners, I remove one of the r-f and oscillator strips on a channel not being used (preferably between channels used), and cut a strip of silk or cotton cloth to cover the silver-plated contacts. The cloth is wrapped over the contact area and the ends fastened with a staple. It will be found that the channel strips will snap snugly in place and that the cloth cleaner can be left on permanently. Whenever the receiver is again in the shop the strip may be removed and the cloth cleaner moved to a new clean position.

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The 21AWP4 is a magnetic-focus and magnetic-deflection, all-glass picture tube with a high quality gray faceplate and a reflective aluminized screen. Its $19\frac{1}{8}$ by 15-inch picture area is *unsurpassed* by that of any other 21-inch tube.

Heater Voltage	6.3 Volts
Heater Current	0.6 ± 10% Amperes
Focusing Method—Magnetic	
Deflecting Method—Magnetic	
Deflection Angle, Approximate	
Diagonal	72 Degrees
Horizontal	67 Degrees
Vertical	53 Degrees
Over-all Length	$23\frac{3}{2} = 3\frac{3}{8}$ Inches
TYPICAL OPERATING CONDITIONS	
Anode Voltage	16000 Volts DC
Grid-No. 2 Voltage	300 Volts DC
Grid-No. 1 Voltage	28 to -72 Volts DC
Focusing-coil Current, Approximate###	116 Milliampers DC
Ion-trap Field Intensity, Approximate	40 Gauss
### For JETEC focusing coil No. 109 with distance from the yoke reference line to center of air gap equal to $3\frac{3}{4}$ inches.	



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