PLAIN TALK AND Technical Tips

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A BRIEF REVIEW OF CHROMINANCE CIRCUITRY

In a color television receiver both color and black-and-white video information, as well as color sync "burst" and sweep sync signals, are present at the output of the video detector and are fed to the first video amplifier.

The first video amplifier in a color television receiver is an important signal distribution center. The black-and-white video signals are fed through the luminance channel, the second video amplifier, and applied to the cathodes of the color picture tube. The bandpass amplifier extracts the color information (chrominance signals) and feeds this information to the color demodulators. (See figure 3.) Black-and-white information (luminance signals), the "burst," and sweep sync signals must not enter the demodulators because, if they do, they can produce spurious interference during color broadcasts. To insure that these signals do not get into the color demodulators, the bandpass amplifier is keyed off by pulses from the horizontal output tube during the horizontal line retrace interval.

The bandpass amplifier in a color television receiver operates only when a color signal is being received; it is turned off and on automatically when the program changes from black-and-white to color. This is done by a special bias voltage developed in the color killer stage. The bias applied to the bandpass amplifier due to the color killer circuit increases whenever the "burst" disappears, as it does when only black-and-white signals are transmitted. The "burst" signal is taken off in the grid circuitry of the bandpass amplifier.

If a technician places a vacuum tube voltmeter on the grid of the bandpass amplifier and notes the changes in grid voltage on the bandpass amplifier as he simultaneously observes the waveform at the video amplifier grid, he will see that the bias on the grid of the bandpass amplifier reduces appreciably as "burst" appears and the program shifts from black-and-white to color. Sometimes during commercials the local stations merely drop the "burst" signal out of the horizontal blanking pulse and continue to transmit the network color information. The commercials then appear as black-and-white in the local area.

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COLOR TEST JIG

Following numerous requests and suggestions from distributors and servicemen, RCA has developed a new color test jig to assist the service technicians in taking full advantage of the dynamic growth in color TV. The test jig, shown in figure 1, will enable the television servicing industry to service color TV receivers more quickly, more efficiently and more professionally.

The RCA color test jig consists of a metal cabinet finished in cobalt blue hammertone. A components kit furnished with the test jig includes all necessary components, hardware and instructions for installation of an RCA color picture tube. The jig has a professional appearance that matches the RCA test equipment line. It includes a safety glass and kine mask assembled at the factory.

The new color test jig provides the means for complete testing, servicing and adjusting of the color TV chassis on the bench and therefore makes a one-man service call out of a costly two-man cabinet pulling job. At the same time, it eliminates the possibility of any damage to the customer's set while in transit between the home to the shop. The test jig also eliminates the need to reconverge the set when the chassis is returned. The color test jig is now available through Parts and Accessories, Box 654, Camden, New Jersey.

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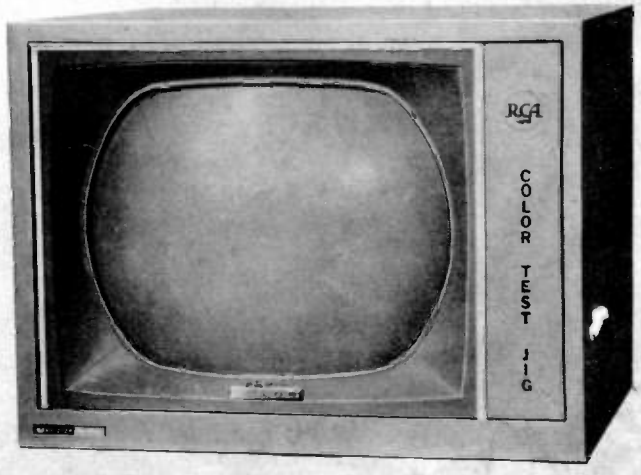

Fig. 1—RCA Color Test Jig.

COLOR TEST JIG (continued from page 1)

In conjunction with the color test jig, RCA Parts and Accessories has developed a basic inventory of replacement parts that will cover all service requirements for the CTC-10 and CTC-11 Chassis. This basic inventory is provided along with a convenient, specially designed rack that has been designed for quick access to parts. See figure 2. The rack is compact in design and saves appreciable space. The parts rack covers in excess of some 120 parts and may be mounted on a service bench, or in a convenient location in any service department.

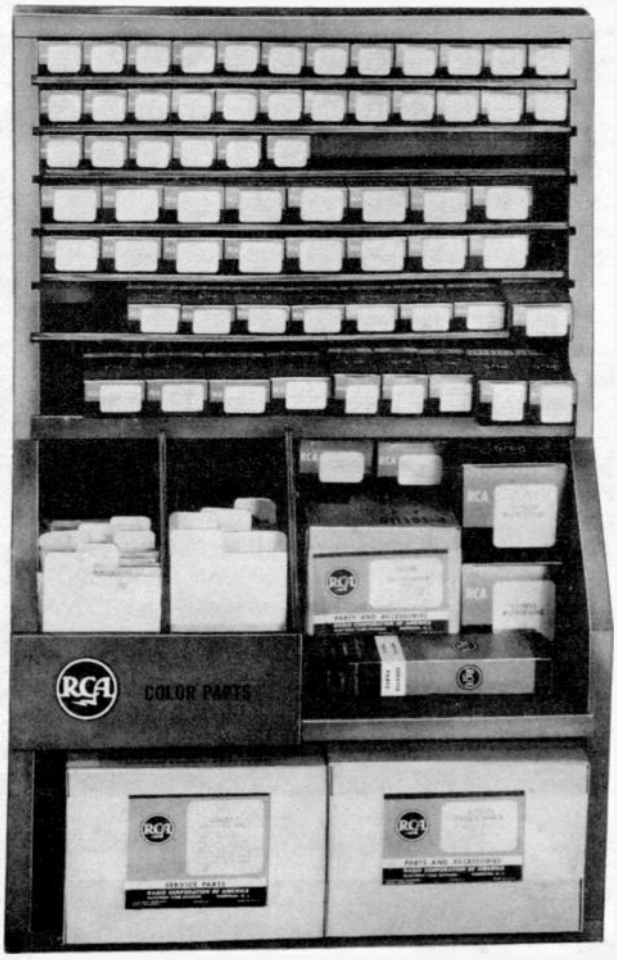

Fig. 2—Color Replacement Parts Rack.

Five special extension cables that are required for servicing the various color receiver chassis are also available.

With the new RCA color test jig, the parts rack and replacement parts, the cables, and a set of RCA test equipment, servicemen will have a complete service station to perform a top quality job on color television receivers in a minimum amount of time.

DARK HEATERS

The recently introduced RCA "dark-heater" tubes have proven to provide outstanding dependability. These tubes have a specially processed dark grey heater insulation coating that provides several significant advantages over tubes employing a conventional heater.

One advantage is that the dark heater has extremely stable current characteristics throughout its life thus assuring constant cathode temperature. Conventional heaters, especially those operating in the higher temperature range, tend to exhibit a rising heater current.

The effects of AC heater leakage and hum are also significantly reduced through the use of the dark heater. This improvement eliminates "spike" or pulse leakage currents which are sometimes present in conventional heaters.

Another important advantage is that the greater heat-radiating ability of the dark heater in an electron tube makes it possible to reduce heater operating temperature on an average of 250 degrees Kelvin as compared with that of conventional heaters. (Conventional heaters generally operate in the range of 1500-1700 degrees Kelvin.) This lower operating temperature results in greatly increased tube life and reliability.

Tube life is increased considerably since the lower heater operating temperature minimizes changes in heater shape, thereby reducing the possibility of heater damage and shorts. Lower internal stresses in the heater wire are also encountered during warm-up due to the smaller thermal change and a decreased expansion differential between the heater wire and the insulating coating.

Thousands of RCA dark-heater tubes of many different types have been life tested and well over a million hours of life data have been accumulated under a wide variety of operating conditions. These life tests on receiving tubes using the dark heater show a much higher per cent of survival than tubes with conventional heaters.

These tests were all conducted at 143 per cent of rated heater voltage (9 volts for a 6.3 volt type) and at a high value of heater-cathode voltage. The operating cycle consisted of one minute on and two minutes off. The tests revealed an improvement factor for heater-associated defects of approximately 20 to 1, under conditions corresponding to approximately 14,500 hours operation at rated heater voltage.

At the present time RCA has more than 100 tube types in production using the dark heater. Future plans call for incorporating dark heaters in all new tube types as well as in popular types now in production.

MODEL NUMBER DESIGNATIONS

RCA Victor Radio, "Victrola"®, and Tape Recorder equipment can be readily identified by their model numbers since each model number forms a basic description of the receiver to which it is assigned. The year designation used will be brought up-to-date to conform with that of the television instruments. This will become apparent when the model numbers change from "1" to "3." Model number designations for 1961 are assigned in accordance with the following system.

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A BRIEF REVIEW OF CHROMINANCE CIRCUITRY (continued from page 1)

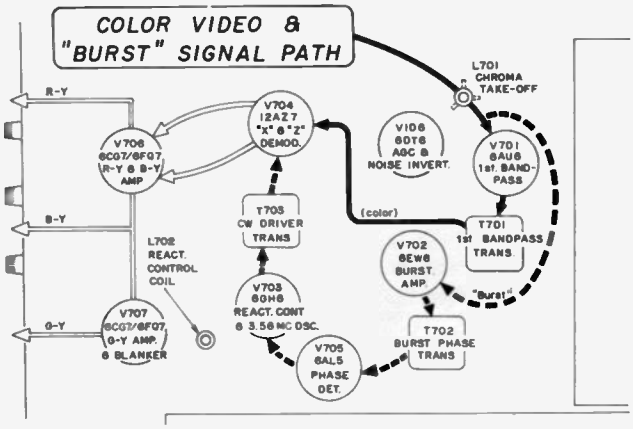

Fig. 3—Chrominance Signal Path.

The operation of the color killer in a color television receiver can be confusing because it is operating when black-and-white signals are being received and is cut off by the "burst" signal when color signals are received. Many technicians do not clearly understand this circuit and think the operation is the other way around assuming that the "burst" signal causes the color killer to conduct. This is not the case.

The purpose of color "burst" signal in a color television receiver is two-fold. In addition to "unlocking the color circuitry" it provides for synchronizing the color signal so that colors are "locked in" properly. To provide for color lock, the "burst" signal is sent to a special circuit called the burst keyer or burst amplifier. This stage is cut off during horizontal line trace time, and most of the horizontal blanking time, and is keyed on only during the interval when the 8 cycles of color "burst" are present. The output from the burst amplifier contains only the 8 cycles of the 3.58mc cw "burst" signal. This information is sent to a color phase detector to form a phase correction voltage for the 3.58mc cw oscillator that provides the very important phase referencing signal.

Whenever the color killer tube conducts, a negative voltage is developed across its grounded plate resistor. This voltage cuts off the bandpass amplifier. The color killer tube can only conduct when there is no DC voltage formed in the output of the phase detector; that is, when there is no "burst" signal present. The "burst" signal, when applied to the phase detector, produces a negative voltage which cuts off the color killer tube. The grid circuit of the color killer is returned through a voltage divider system called the color threshold control. The voltage divider provides a means of determining the level of "bursts" required to cut off the color killer tube and prevents noise from causing undesired color killer action. If the color threshold control is set too low the color circuits may open momentarily and allow the passage of unwanted signals to produce splashes of color on the screen. If the threshold control is advanced too high, weak "burst" signals will not produce color killer cut-off and the color circuits would not open. The color killer circuit functions similar to a keyed AGC system; however, the purpose of the threshold control is not to control the amount of negative bias produced, but instead to adjust the level at which the tube becomes effective.

The color sync section of a color receiver incorporates three main stages: the burst amplifier, the phase detector, and the 3.58mc cw oscillator control stage. These are the stages which must be aligned in the AFPC (automatic frequency and phase control) alignment procedure. The "burst" signal is the color synchronizing pulse; however, if the "burst" signal is not present, the receiver will not simply go out of color sync, but actually all color disappears because the color killer operates by means of a DC bias voltage which is developed from the rectified color "burst" signal. When this bias is not present at the grid of the color killer, the color killer tube conducts and cuts off the bandpass amplifier blocking all color. The video information is still presented on the screen but in black-and-white.

In order to reproduce colors on the screen of a color picture tube accurately, the 3.58mc cw oscillator must be held in exact phase with the suppressed color carrier on which the chrominance signals are modulated. When the AFPC circuits are aligned properly, the "burst" signal together with the 3.58mc cw reference signal from the color oscillator, will generate a correction voltage which keeps the 3.58mc cw oscillator in phase with the suppressed color carrier.

Perfect synchronization of the 3.58mc oscillator in itself is not quite enough to produce the full range of colors accurately. The output of the 3.58mc cw oscillator is phase-shifted through the 3.58mc oscillator transformer in order to supply signals at the demodulator grids which are of a particular phase relationship to each other. By means of the oscillator transformer, the CW signal from the 3.58mc cw oscillator is changed into two signals which differ in phase by an amount depending on the axis of demodulation system employed. One of these two signals is fed into the cathode of each demodulator so that the two demodulators will respond to the difference in phase between the CW signal supplied by the oscillator and the incoming chrominance signal. Since the two demodulators have different CW signals supplied to them, they do not respond in the same way to a given chrominance signal. Therefore, they produce different voltages at the color grids of the color picture tube producing a variation in color corresponding to the variations in the chrominance signals.

When the chrominance signals are closely in phase with the CW signal supplied to the (X) demodulator, for example, then this tube will produce the greater output and the (Z) demodulator will produce less output, the final result being that output from either demodulator will depend upon the phase of incoming chrominance signal. When the incoming signal takes a phase somewhere between the phase angles of the two CW signals, both demodulators operate and the result on the screen is a mixture of two colors. Once you have a clear idea of how the phase shift in the chrominance signals causes a change in

hue on the screen, it is a simple matter to understand how the saturation of any hue can be increased by merely increasing the intensity or amplitude of the chrominance signal without changing its phase angle.

Since the phase of the 3.58mc cw signals, applied to the demodulators, determine color reproduction, the adjustment of the CW oscillator transformer is very important because this is the device by which the phase difference between the two CW signals is determined. Unless this phase difference is correct, accurate color rendition cannot be achieved even though the synchronization of the 3.58 mc is perfect.

MODEL NUMBER DESIGNATIONS

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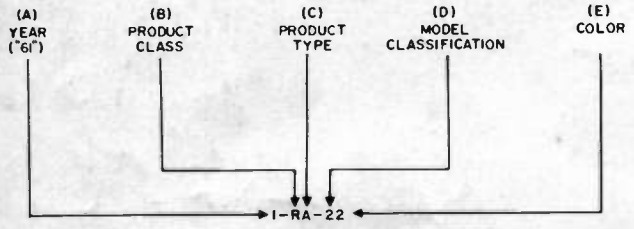
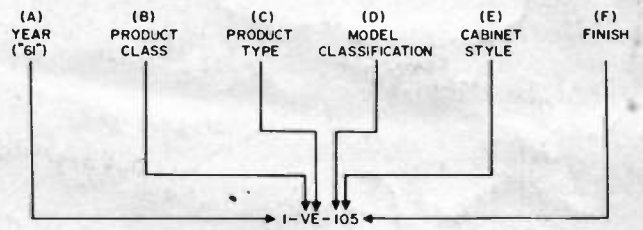
RADIO



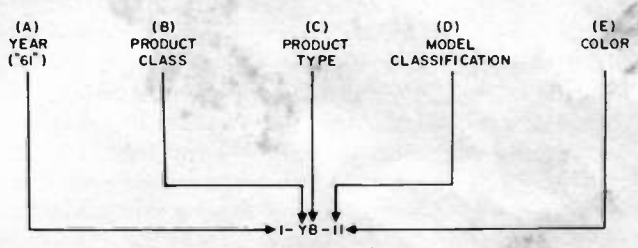
(A) The first character indicates the model line—"1961"
(B) The second character indicates the major product class—
R = radio
(C) The third character indicates the product type—
A = AC/DC Table
B = Portable
C = AM/FM Table
D = Clock
E = Transistor-Table
F = Transistor-Clock
G = Transistor-Portable
H = Transistor-Portable (Miniature)
(D) The fourth character indicates the Model Classification
(E) The fifth character indicates the predominate color
0 = White, Silver
1 = Black, Charcoal, Gray
2 = Blue, Aqua
3 = Red, Pink, Ginger
4 = Brown, Espresso
5 = Green, Turquoise
6 = Beige, Bronze
7 = Yellow, Sugar Maple

"VICTROLA"®



(A) The first character indicates the model year—"1961"
(B) The second character indicates the major product class—
V = "Victrola"®
(C) The third character indicates the product type—
A = Monophonic-Portable
C = Stereophonic-Automatic-Portable
E = Stereophonic-Automatic-Console
F = Stereophonic-Automatic-Combination
(D) The fourth character indicates the model classification
(E) The fifth character indicates the cabinet style
0 = Contemporary
1 = Provincal
2 = Early American-Colonial
3 = Traditional
4 = Danish
(F) The sixth character indicates the cabinet finish
0 = Dark Cherry
4 = Maple
5 = Mahogany
6 = Walnut
7 = Oak
9 = Light Cherry

TAPE RECORDER



(A) The first character indicates the model year—"1961"
(B) The second character indicates the major product class—
Y = Tape Recorder
(C) The third character indicates the product type—
A = Tape Player attachments
B = Monophonic Recorders
C = Stereophonic Recorders
(D) The fourth character indicates the model classification
(E) The fifth character indicates the predominant color
0 = White
1 = Black, Gray
4 = Espresso
5 = Green

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