

NOVEMBER, 1961

35 CENTS



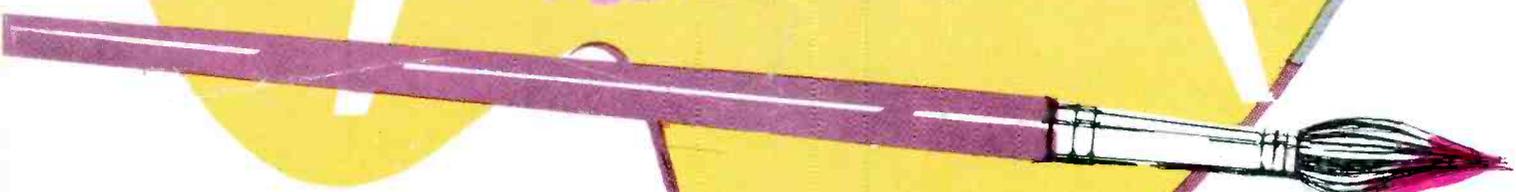
PHOTOFACT REPORTER

Including **Electronic Servicing**

SPECIAL

COLOR TV

ISSUE



What's New in Color TV?

Color Servicing in the Home

Test Equipment for Color TV

Case Histories of Color TV Troubles

Isolating Chroma Troubles by Symptoms

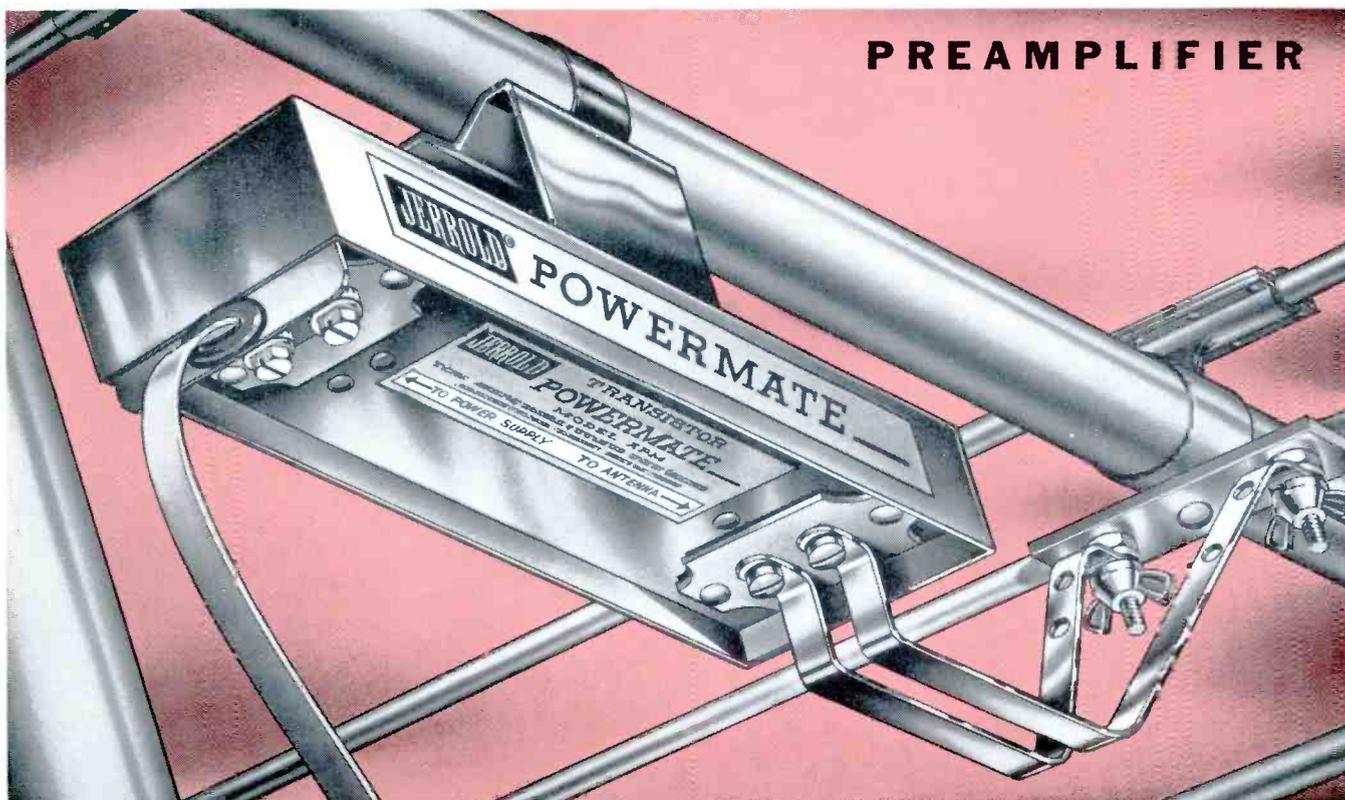
IA OK 7496 1264
WM. M. DAVIS
RAD. & TV SERV.
118 RIVERSIDE AVE.
CANNON CITY, COLO.

**Servicemen everywhere say,
"OUTPERFORMS THEM ALL!"**

NEW

**JERROLD® TRANSISTOR
POWERMATE**

PREAMPLIFIER



offers highest gain, lowest noise figure

Here's the preamplifier for every TV antenna in your area, whether new or up for years! The exclusive universal bracket of the new JERROLD Transistor POWERMATE permits mounting directly on the antenna boom (for greatest boost before downlead losses) or at *any* other point—along the mast, on the wall or windowsill, behind the set—anywhere your best judgment dictates.

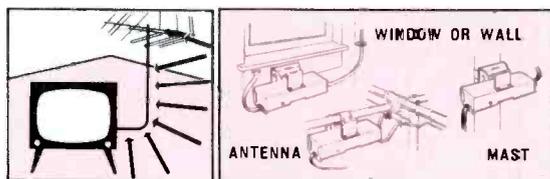
And look at this gain: An average of 13.9db at Channel 13 and 18.25db at Channel 2—by far the highest in the business! This remarkable gain gives any antenna system the lowest System Noise Figure obtainable—the key to better pictures.

See your distributor today, or write for special bulletin describing System Noise Figure. Begin cashing in on your big market for the new JERROLD Transistor POWERMATE!

Model APM-101—\$39.95 list complete with power supply

JERROLD® ELECTRONICS CORPORATION
Distributor Sales Division, Dept. IDS-191.
The Jerrold Building, Philadelphia 32, Pa.

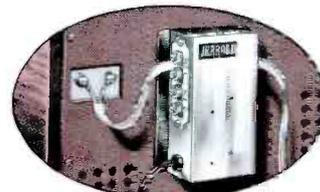
Jerrold Electronics (Canada) Ltd., Toronto, Ontario
Export Representative: CBS International, New York 22, N.Y.



**NO TUBES, NO BATTERIES,
NO OSCILLATION, NO FEEDBACK**
Mount it on the boom or anywhere along the downlead. Thoroughly neutralized against oscillation; output impedance balanced to prevent radiation back to antenna. Same 300-ohm lead that carries signal also carries 15 volts ac to POWERMATE. No tubes or batteries to replace.

**REMOTE AC POWER SUPPLY
OPERATES 1 OR 2 TV OR FM SETS**

installs on or near receiver, draws less current than an electric clock. No polarity nuisance when attaching to lead, no danger of transistor damage.



AMERICA'S LEADING MANUFACTURER OF TV-FM RECEPTION AIDS AND MASTER-ANTENNA-SYSTEM PRODUCTS

Fundamentals of the Color TV System



How chroma information is combined with video to produce a complete color TV signal.

To understand what makes color TV possible, we first need to have some idea of how colors are produced in nature. The basic underlying principle goes back to *electromagnetic radiation*, or energy transmitted by wave motion. This phenomenon takes many different forms (such as radio waves, X-rays, and cosmic rays), and it occurs over a tremendously broad range of wavelengths or frequencies. A small slice of this frequency spectrum can be detected by the human eye, and is thus known as light energy.

The eye not only responds to the strength or amplitude of the light energy, but also is affected by the frequency of the light waves entering the field of vision. White light corresponds to a broadband "signal" covering the entire visible range of frequencies. On the other hand, light energy concentrated within a narrow band of frequencies stimulates the eye to see some particular color. The lowest frequencies produce a sensation of red light; as the frequency is increased, different colors appear one after the other, in the same order as seen in the rainbow (orange, yellow, green, blue, and violet).

When white light shines on various objects, they absorb some of the light energy and reflect the rest. This effect is usually frequency-selective; that is, some wavelengths are reflected more readily than others. The predominant wavelength of the reflected light determines the hue of the object, commonly called its "color." The narrower the band of frequencies reflected, the purer the color. In most natural objects, the

dominant color is diluted (or we can say its *saturation* is reduced) by miscellaneous random-frequency reflections. These might be compared to "cross talk" caused by poor selectivity in a radio receiver; they do not prevent the basic "message" from getting through, but they detract from its clarity.

Another property of an object's appearance to the eye is its *brightness*, which depends on the amplitude of the reflected energy. Brightness is also related to the light sensitivity of the eye, which does not follow a flat response curve, but reaches a peak near the middle of the visible spectrum (Fig. 1).

Black-and-white TV responds to this quality of brightness, but affords no method of varying the frequency of the light output from the CRT;

thus, it can reproduce different colors only as various shades of gray. This is sufficient to develop a recognizable image, but greater realism is made possible by adding a system of frequency-selective light emission that creates a sensation of color.

This system is based on the fact that single-frequency light emission is not the only way to produce a specified color. A combination of several widely-separated frequencies is also interpreted by the eye as a single color, distinctly different from the colors that correspond to the original frequency components. Almost any hue can be formed by mixing or blending certain other hues. In fact, it has been determined that light sources of only three basic colors can produce virtually any

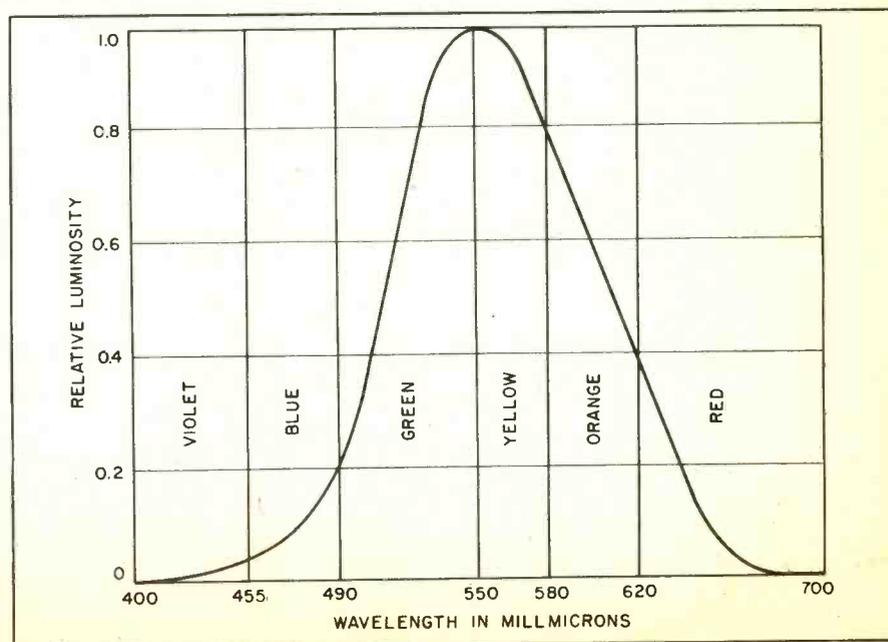


Fig. 1. Eye has varying sensitivity to different colors, as shown by curve.

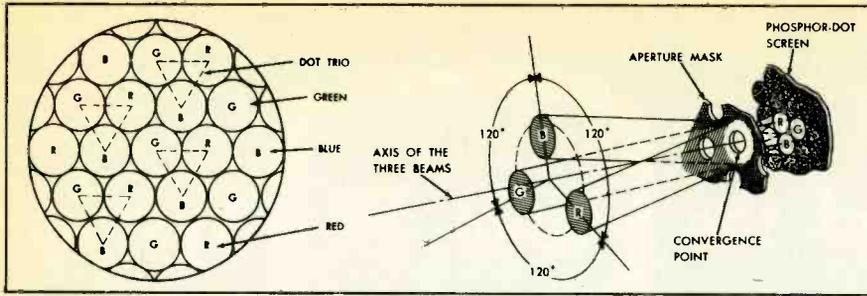


Fig. 2. Electron beams pass through aperture mask and strike phosphor dots.

color in the spectrum when combined in various proportions. The most suitable hues for this purpose, called *primaries*, are green, blue, and red.

Therefore, the color-TV system is a three-way additive process. A trio of camera tubes, equipped with color filters, capture the red, green, and blue components of the light from the televised scene. The transmitted RF carrier is modulated with these triple outputs in a manner that enables the receiver to develop a separate signal for each primary color. These signals are applied to a picture tube having three independent electron guns, mounted parallel to one another in a triangular arrangement. The screen of this tube is coated with a combination of three different phosphors, which respectively glow red, green, and blue when struck by a beam of elec-

trons. The phosphors form a pattern of tiny dots (Fig. 2A). To make sure that each beam energizes the correct set of dots, an *aperture mask* or *shadow mask* is mounted inside the picture tube, just behind the screen. Perforations in this metal plate are aligned with the electron guns and trios of dots so that each beam is allowed to fall only on the correct dot in each trio, as shown in Fig. 2B.

As the three electron beams simultaneously scan the tube face, they constantly produce changes in the relative brightness of the three phosphors. At normal viewing distances, the varying proportions of the three primary colors appear to blend into an almost infinite variety of hues and shades. One specific ratio of red, blue, and green illumination results in either white or some shade of gray, depending upon

the over-all brightness of the screen.

How Color Signals Are Produced

An important requirement of the color-TV system is that it be compatible with the standard monochrome system, so black-and-white sets can develop a usable picture on color programs. To satisfy this requirement, the color signal contains an equivalent of the monochrome video signal (called the *luminance* signal) which reproduces the transmitted scene only according to its brightness.

This output, often called the Y signal, is made up of definite proportions of the signals from the three color camera tubes. Since the average human eye is almost twice as sensitive to green as to red, and five or six times as sensitive to green as to blue (Fig. 1), the Y signal utilizes different amplitudes of the three primary-color signals. As shown in Fig. 3, the Y-channel matrix combines 59% of the green signal, 30% of the red signal, and 11% of the blue signal to produce brightness information.

The following simplified explanation will omit the amplitude-linearity correction introduced by the gamma amplifier in an actual transmitter. Assuming that the camera is scanning a white object of a brightness which produces a 1-volt output from each camera tube, the Y channel will receive a combined signal level of 1 volt—with .59 volt contributed by the green tube, .30 volt by red, and .11 volt by blue! This output will register as white on the CRT of a properly-adjusted black-and-white receiver.

If the camera then scans a red object just bright enough to produce a 1-volt output from the red camera tube only, the Y-signal amplitude drops to .30 volt. This causes a black-and-white CRT to reproduce a moderately dark shade of gray. Scanning a green object of comparable light output results in a Y amplitude of .59 volt, which shows up as a lighter gray. On the other hand, a 1-volt "blue-only" signal develops only .11 volt in the Y channel, and this is interpreted by a black-and-white set as a very dark gray.

Chroma Signals

Since the luminance signal already contains part of the information developed by the color camera,

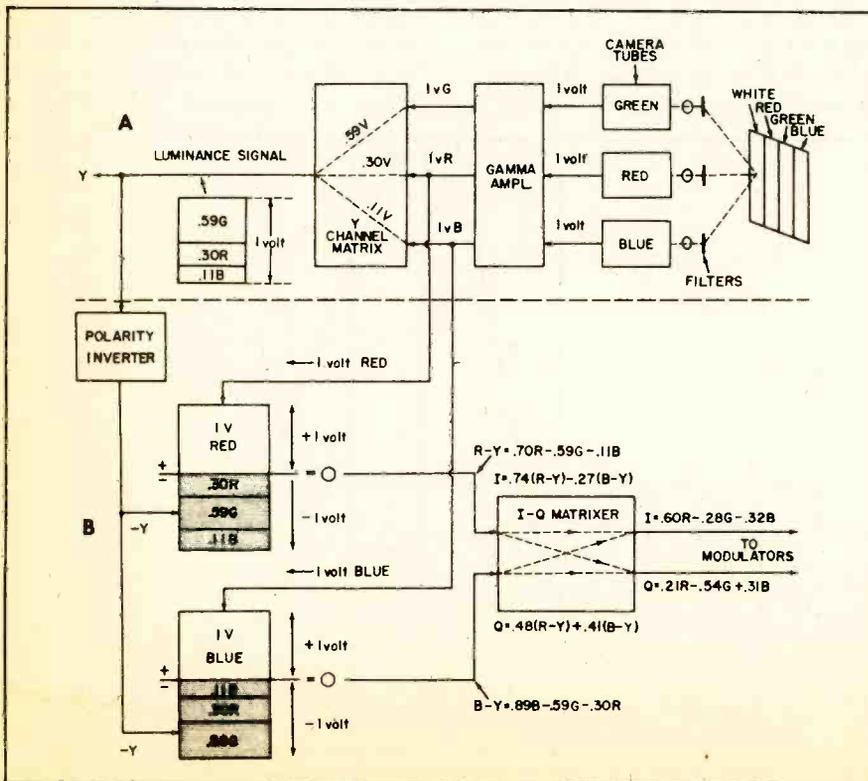


Fig. 3. Block diagram of transmitter circuits that form Y and chroma signals.

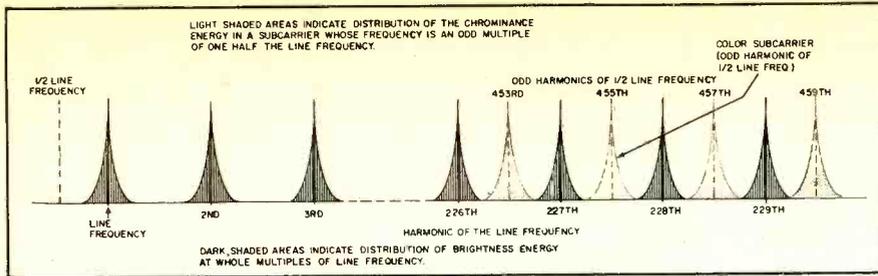


Fig. 4. Chroma and video signals are both transmitted in the same frequency band; interference is minimized by interleaving the peaks of signal energy.

the remainder of the color-TV signal must be designed to complement the luminance output. This is done by simply subtracting the Y signal from each of the camera outputs, resulting in color-difference signals. These are modified into a chroma (sometimes called chrominance) signal, which is used to modulate the RF carrier separately from the Y signal. The chroma information is processed by the color receiver to reconstruct the original differences in the outputs of the three camera tubes.

The development of the color-difference signals can be traced in Fig. 3. The Y signal is fed through a polarity-inverting stage to produce -Y, which is then mixed with the positive-polarity outputs from the individual camera tubes. If a white area is being scanned, the -Y output is equal to the camera-tube output. These two signals then cancel, producing a color-difference voltage of zero. Cancellation can occur just as well at any other output-voltage level, as long as all three camera outputs are equal; therefore, the color TV receiver can produce all the various shades of gray.

When the camera-tube outputs are unequal, the Y signal does not balance out the respective color voltages, so one or more color-difference signals are developed. For example, suppose that the camera in Fig. 3 scans a pure red object and delivers 1 volt from the red camera tube to the R-Y color-difference matrix. At the same time, the matrix receives -.30 volt through the Y channel; so the resultant R-Y output is .70 volt. In scanning a green object of equal light intensity, there is zero output from the red camera tube, but the green tube applies 1 volt to the luminance input. This causes a negative Y signal of -.59

volt to arrive at the R-Y matrix, and since this Y signal is subtracted from zero, the net R-Y output is -.59 volt. A blue object likewise produces no red-camera output, but causes -.11 volt of Y signal to be passed through the R-Y matrix.

Generally speaking, then, the R-Y output is derived by combining 70% of the red output in positive polarity, 59% of the green output in negative polarity, and 11% of the blue output in negative polarity. In short, $R-Y$ equals $.70R - .59G - .11B$. This fixed percentage of each camera-tube output is always used in making up the R-Y signal, even though the camera-output voltages themselves are constantly fluctuating.

It can be similarly demonstrated (or worked out mathematically) that the B-Y signal equals $.89B - .59G - .30R$. The third color-difference signal (G-Y) need not be developed for modulating the transmitter, since this signal can be produced at the receiver by combining

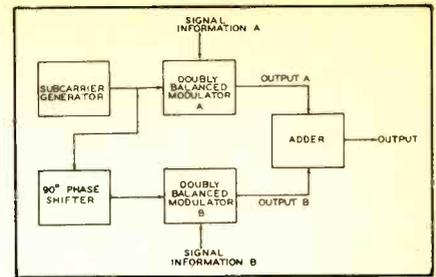


Fig. 5. Chroma signal is developed by this divided-carrier modulation system.

fixed proportions of R-Y and B-Y. Negative polarities of both signals are required, in the ratio of 51 parts of R-Y to 19 parts of B-Y. The G-Y signal can also be expressed in terms of the three camera outputs, as $.41G - .30R - .11B$.

The R-Y and B-Y signals are not directly used to modulate the RF signal at the transmitter, but are recombined into two other signals. This extra step is necessary because only a limited bandwidth is available for transmitting the chroma information. To insure maximum usable color detail in the picture, with the greatest possible economy of bandwidth, the reaction of the eye to small areas of various colors is carefully taken into consideration.

In areas less than approximately $\frac{1}{8}$ " square on a 21" CRT screen, corresponding to video-signal frequencies above 1.5 mc, colors cannot be recognized at normal viewing distances. Since these areas all appear gray, whether or not they con-

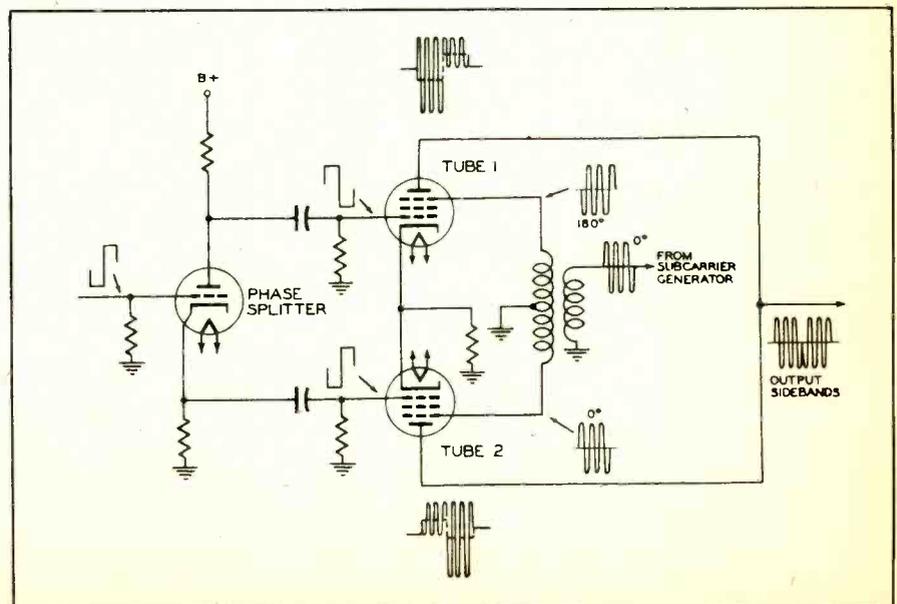


Fig. 6. This doubly-balanced modulator combines the I and subcarrier signals.

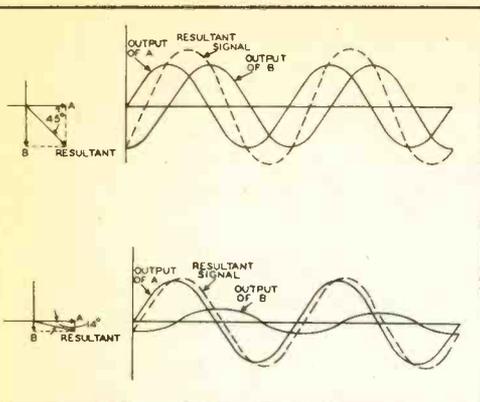


Fig. 7. Transmitted chroma signal is resultant of two modulator outputs. tain color, no chroma-signal components need to be transmitted to reproduce such fine details. In slightly larger areas (between $\frac{1}{8}$ " and $\frac{3}{8}$ " square), the eye can distinguish between "warm" and "cool" colors; however, the former all take on an orange cast, while the latter tend to appear cyan (greenish - blue) in color. This means that only these two hues need to be transmitted at modulating frequencies between 0.5 and 1.5 mc. The signal employed for this purpose, called the I (in-phase) signal, is developed by combining the color-difference signals in the proportion of $+ .74 (R - Y) - .27 (B - Y)$. As noted in Fig. 3, this signal actually contains components of all three camera signals, the ratio being $.60R - .28G - .32B$.

Objects larger than $\frac{3}{8}$ " square on a 21" screen, corresponding to video frequencies below 0.5 mc, can

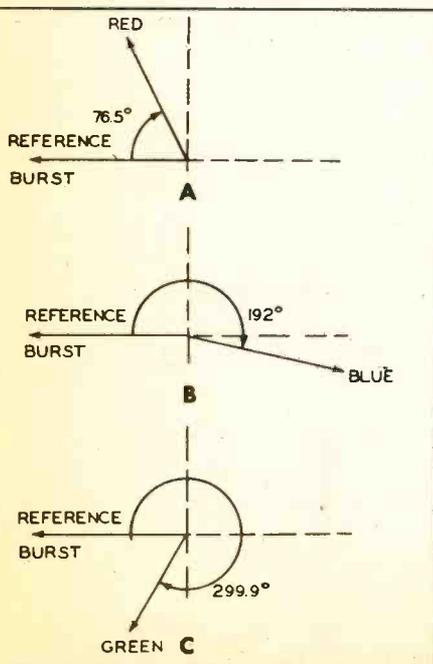


Fig. 8. Chroma - signal phase angles corresponding to three primary colors.

be seen in full color; thus, additional narrow-band chroma modulation is needed. A second chroma-signal component, the Q (quadrature) signal, is therefore transmitted to supply the receiver with further color information besides that contained in the I signal. Its makeup in terms of the color-difference signals is $.48 (R - Y) + .41 (B - Y)$. Expressed as proportions of the three camera-tube signals, it is composed of $.21R - .54G + .31B$. The meaning of the terms "I" and "Q" will be clarified in the next section, which describes how the modulation process is performed at the transmitter.

Modulating the Color Subcarrier

When the compatible color-TV system was still in the planning stage, one of the most difficult problems to be overcome was that of finding a place for the color signal within the standard 6-mc TV channel. Practically all the available frequencies seemed to be occupied by the sidebands of the video and sound carriers.

Fortunately, it was discovered that the video-signal energy produced in scanning an image is concentrated at certain frequencies — specifically at whole multiples (harmonics) of the scanning rate. Very little energy is generated at frequencies in between these points of concentration (see Fig. 4). Thus, it was proved possible to transmit color information within the same frequency band as the video (luminance) signal, by concentrating the color energy in the voids between the peaks of video-signal energy. This process, called *interleaving*, is achieved by placing the chroma information on a subcarrier whose frequency is an odd multiple of one-half the horizontal sweep frequency.

A subcarrier is a signal which is first amplitude-, frequency-, or phase-modulated by a lower-frequency is an odd multiple of one-modulate a higher-frequency RF carrier. After being detected and separated from the main carrier, the subcarrier must go through an additional step of demodulation to recover the low-frequency information it conveys.

In color TV, the frequency of the chroma subcarrier must be low enough so that it and its sidebands

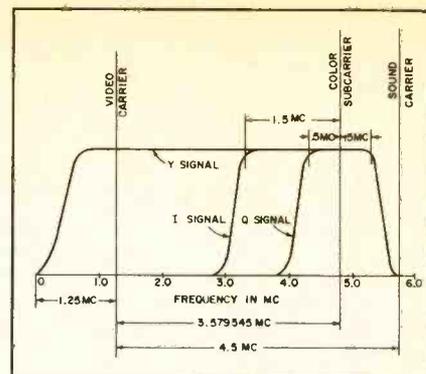


Fig. 9. I portion of chroma signal has greater bandwidth than the Q portion.

can pass through the video detector without objectionable distortion or attenuation. On the other hand, the subcarrier frequency should be as high as possible, in order to minimize chroma interference in the black - and - white picture. If the chroma signal occupies the upper end of the video-frequency range, the worst interference it can produce is a pattern of fine dots. Also, black-and white sets can be designed to exclude the chroma-signal frequencies, with only a slight loss in picture detail.

The desired amount of color detail in the picture establishes the upper limit of the chroma sidebands at 0.6 mc above the subcarrier. Since the maximum practical bandwidth of TV transmitters and receivers is approximately 4.2 mc, the subcarrier frequency should be no higher than 3.6 mc. Of all the odd harmonics of half the horizontal sweep frequency, which one comes closest to meeting the requirements of the chroma subcarrier? The 455th harmonic, at exactly 3.583125 mc, was tentatively chosen as a subcarrier when the color - transmission standards were first being formulated. However, this frequency did not work out well in practice, because the subcarrier heterodyned with the 4.5-mc

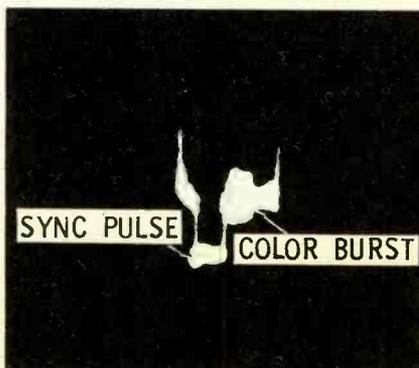


Fig. 10. Color burst is transmitted immediately after horizontal sync pulse.

sound IF signal to produce an objectionable interference pattern on black - and - white receiver screens. Experiments showed that the interference could be minimized by making the unwanted beat frequency also equal to an odd harmonic of one-half the horizontal scanning rate.

To take this extra requirement into account, it was necessary to adjust the horizontal frequency itself. Thus, for color transmissions, the line-scanning rate is slightly reduced to 15734.264 cps—still within the 1% frequency tolerance allowed in existing specifications for black-and-white television. The vertical scanning frequency is also adjusted, to 59.94 cps. As for the chroma subcarrier frequency, its value was established at 3.579545 mc, with a tolerance of only about ± 10 cps. (The frequent reference in technical literature to a "3.58-mc subcarrier" is simply a rounding off of figures for the sake of convenience.) The subcarrier and scanning frequencies are developed from a single source to simplify the problem of maintaining the necessary frequency accuracy.

Divided-Carrier Modulation

During the discussion of the signals used for modulating the color subcarrier, it was pointed out that two separate signals (I and Q) are used to convey the color information. Consequently, the color-TV transmitter must provide for modulating one subcarrier with both these signals.

One way of accomplishing this feat is by using divided-carrier modulation (see block diagram, Fig. 5). The subcarrier generator produces a sine wave of constant frequency and amplitude, which is then applied to a

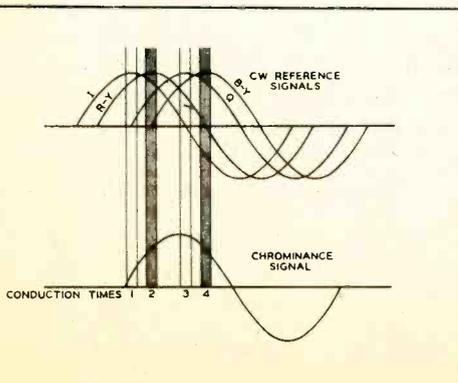


Fig. 12. Comparison of sampling times for the I, Q, R-Y, and B-Y signals.

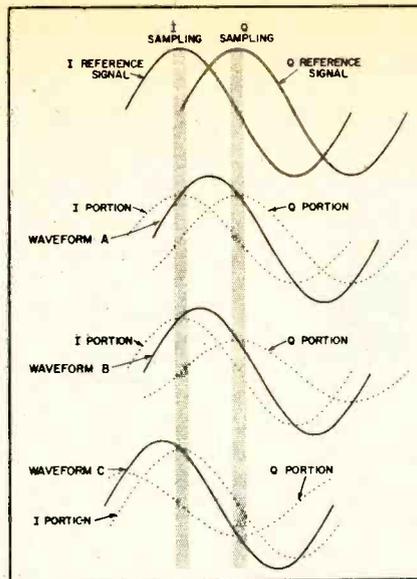


Fig. 11. Sampling time occurs at peaks of I and Q chroma-signal components.

pair of doubly-balanced modulator circuits. The signal is fed directly to modulator A, but is shifted in phase by 90° before being applied to modulator B.

Fig. 6 is a schematic of modulator A, with waveform drawings included to help explain the operation of the circuit. The modulating signal (previously referred to as the I signal) is passed through a phase-splitter circuit to produce two signals of opposite polarity, and these are applied to the control grids of two modulator tubes. The subcarrier signal is coupled into the modulator through a transformer with a tapped secondary. This arrangement also results in two equal-amplitude signals, 180° out of phase, and these are applied to the suppressor grids of the modulators.

Examine the plate waveforms of these tubes, and notice that each output is a subcarrier-frequency signal whose amplitude is high during the positive half-cycle of the grid signal, and low during the negative half-cycle. Furthermore, the subcarrier waveforms at the two plates are 180° out of phase. Since the plates are tied together, the resultant output signal has an amplitude equal to the difference between the two plate signals. For example, on the first half-cycle of the subcarrier waveform in Fig. 6, the output is a combination of a strong positive peak from tube 1 and a weak negative peak from tube 2; thus, the resultant is a fair-sized positive peak. On the second half-cycle, a

strong negative peak from tube 1 combines with a weak positive peak from tube 2, producing a moderate negative peak. Note that the resultant phase of the high-frequency component in the output at any given time agrees with the phase of the plate signal having the greater amplitude.

This system produces a combination of amplitude and phase modulation of the subcarrier. When the signal coming into the grid circuit of the phase splitter increases in amplitude, the splitter produces stronger outputs which create a greater unbalance between the modulators; therefore, the amplitude of the output signal increases. In addition, the phase of the sidebands in the output signals changes by 180° each time a polarity reversal occurs in the modulating signals coming from the phase splitter.

Of course, an absence of modulation at the control grids of tubes 1 and 2 allows the tubes to conduct equally; then the subcarrier signals are completely cancelled, and there is no output.

Modulator B works in exactly the same manner as modulator A, except that the subcarrier input is delayed 90° , and the phase splitter receives the Q signal instead of the I signal. The output of modulator B may either lead or lag that of A, according to the polarity of the modulating signals applied to each circuit.

Both outputs are fed into the adder stage (Fig. 5), which combines them into a single waveform that varies continuously in both amplitude and phase, and is suitable for modulating the RF picture carrier of the TV transmitter. Because of the 90° phase relationship between the I- and Q-modulated subcarrier signals, vector analysis is

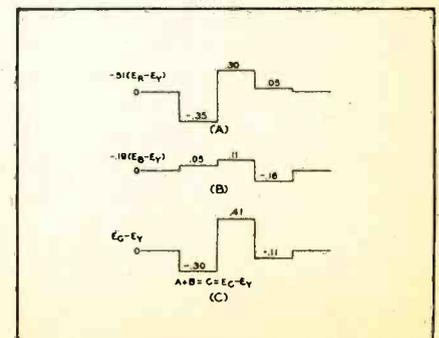


Fig. 13. Formation of G-Y signal voltage by combining R-Y and B-Y.

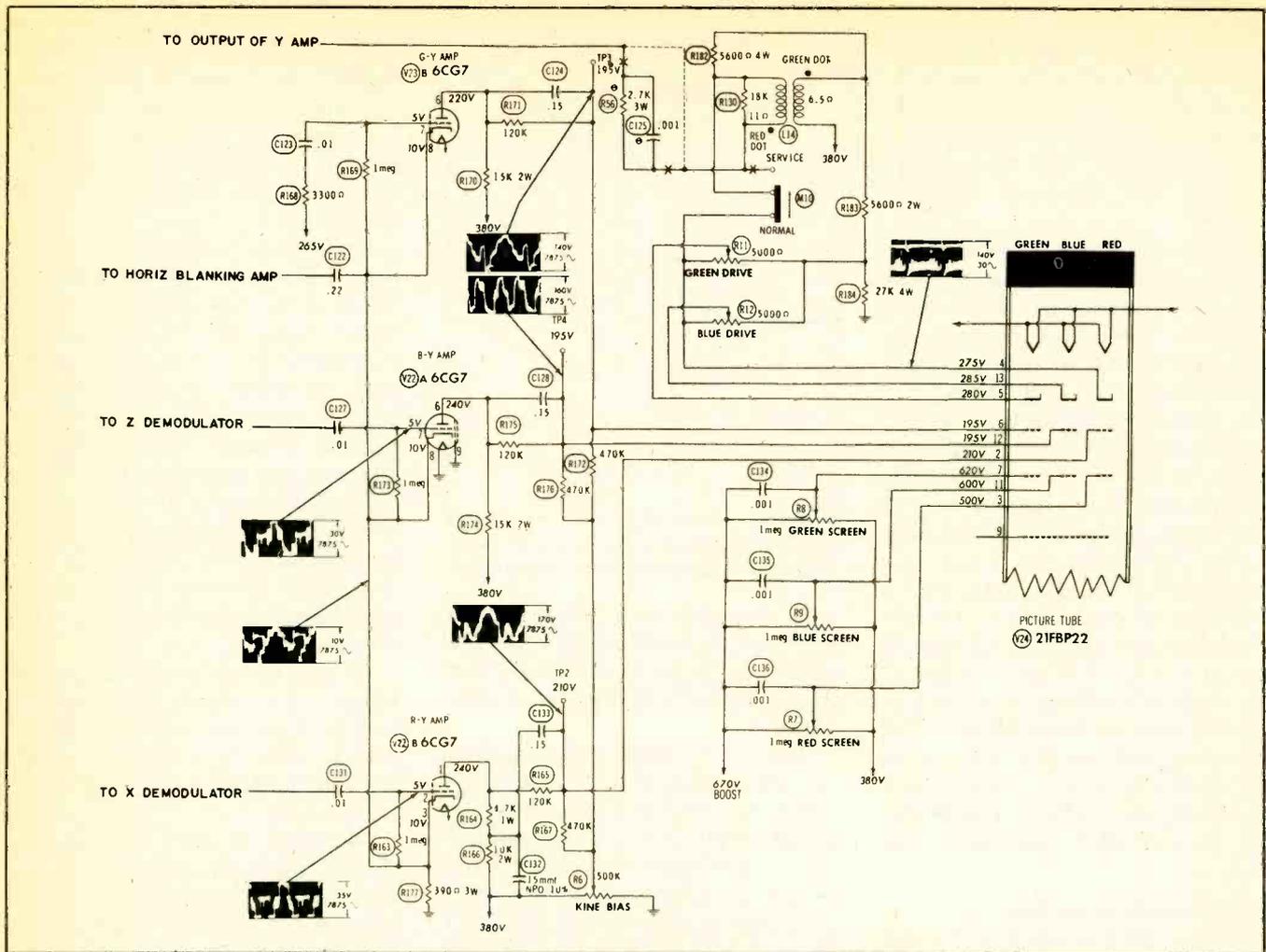


Fig. 14. X and Z matrixing and CRT-drive circuitry of late-model color set.

necessary to demonstrate the phase and amplitude of the resultant output from the adder. A couple of examples are shown in Fig. 7. Part A of this figure shows that equal I and Q signals produce a net output which differs in phase from each original signal by 45°. On the other hand, if a strong I signal from modulator A is combined with a weak Q signal from modulator B, the resultant (Fig. 7B) is very close to I in both phase and amplitude.

The phase difference between the adder output and the original subcarrier constantly varies, and the instantaneous phase angle may have any value between 0° and 360°. Every phase angle corresponds to some specific color; for example, the pure primary hues produce the signal phases shown in Fig. 8.

During the modulation process, the bandwidth of the I and Q signals is limited to the frequency range indicated in Fig. 9. Both upper and lower sidebands of the Q signal are utilized, but modulating frequencies

above 0.5 mc are attenuated. On the other hand, the I channel uses a type of vestigial-sideband operation, similar to that of the picture carrier itself. The upper sideband is attenuated beyond 0.5 mc, but lower-sideband frequencies as high as 1.5 mc are transmitted full strength.

The chroma subcarrier is suppressed, leaving only its sidebands as modulation on the picture carrier. Therefore, the receiver must supply a substitute 3.58-mc signal to take the place of the original subcarrier during demodulation. The phase of this signal must remain very accurately locked in step with the transmitter subcarrier. Accordingly, the local oscillator at the receiver is crystal-controlled to maintain a frequency of 3.579545 mc, and color-sync circuitry is employed to control the phase of the oscillator-output signal. The input to the color-sync section is a sample of the original subcarrier (color burst). This signal, shown in Fig. 10, is transmitted for a short interval during the hori-

zontal blanking pulse in the video signal.

For further information on the operation of the frequency- and phase-control circuitry, refer to "Understanding Color Sync" in this issue.

Several other receiver circuits associated with the chroma signal (the bandpass amplifier, color killer, etc.) are also given extensive coverage elsewhere in this issue. Therefore, this article will skip over these circuits, and will concentrate on explaining how the chroma signals are demodulated and applied to the tri-color picture tube.

Chroma Demodulation

The process of demodulating the chroma signal can be more easily understood if the following facts are kept firmly in mind:

1. The chroma signal arriving at the demodulator is always a sine wave of constant frequency, although both the phase and the

amplitude of this sine wave undergo continual variations.

2. At the transmitter, the chroma signal is formed by combining two other signals (I and Q)—each of which is modulated by a different portion of the color-difference information.

3. The demodulator must break down the chroma signal into its I and Q components (or equivalent) so that the color modulation in both these components can be recovered.

The articles, "Chroma Bandpass and Demodulator Circuits" and "What's New in Color TV" in this issue include schematics of typical demodulator circuits in current use. In both these basic types of circuits, dual stages are required. Each stage receives a chroma input and a locally-generated 3.58-mc reference-oscillator signal. While the chroma signals are identical, the reference signals are deliberately applied out of phase; this is the key to separating the chroma input into its components.

Because of this phase difference between the reference-signal inputs, the two demodulators alternately "sample" the chroma signal (i.e., conduct for a brief interval) at two different times during each cycle. The exact sampling times depend on the phases of the reference signals. As the color TV system was originally planned, these signals were intended to have the same phases as the 3.58-mc inputs to the balanced modulators at the transmitter. They were likewise given the same designations, I and Q. In a demodulator of this type, one stage is driven into conduction on peaks of the I reference signal, and the other on peaks of the Q signal. The demodulator output during each of these sampling intervals is determined by the amplitude of the chroma-signal voltage at the sampling time. The amplitude changes constantly, according to modulation content; in Fig. 11, notice how the sampling times intercept different points on the sinusoidal chroma waveform (solid line) as the latter is shifted in phase by its modulation.

The dotted lines in Fig. 11 trace the waveforms of the original I and Q signals that were combined to form the chroma signal. As the illustration points out, the I and Q

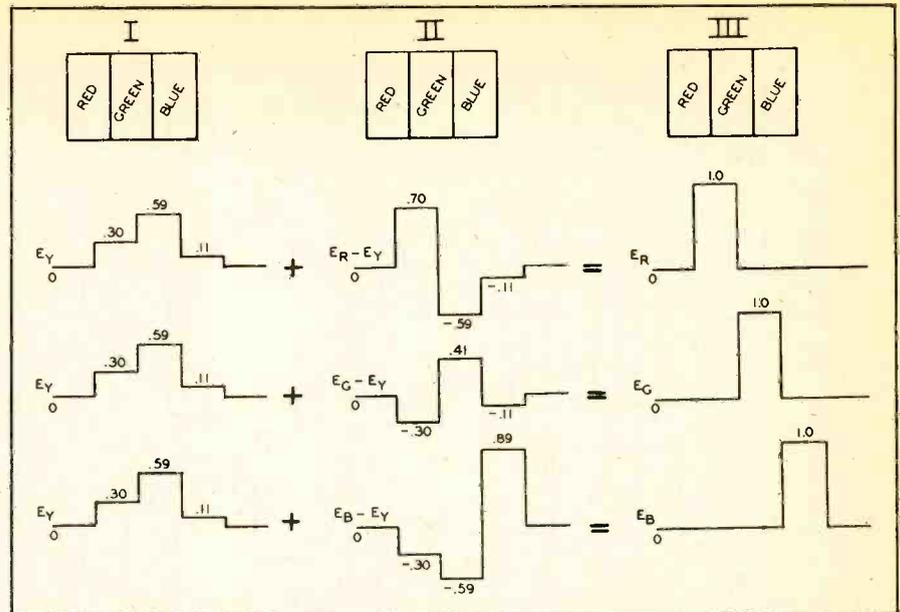


Fig. 15. Y and color-difference signals add to form primary-color signals.

demodulators automatically sample the chroma signal at the right time to detect the peak amplitude of the I and Q signal components. Either the positive or the negative peaks may be sampled; different polarities simply produce different colors.

As cycle after cycle of the 3.58-mc chroma signal is sampled, the output-voltage variations of the demodulators trace out a replica of the I and Q signals that were originally applied to the phase-splitter circuits of the balanced modulators in the transmitter. Any 3.58-mc signals that may remain in the output are removed by filtering.

Recovering Color-Difference Signals

Remember that the I and Q modulation was developed from color-difference signals, which in turn were obtained by subtracting the luminance signal from the color-camera outputs. This process must be reversed in the circuitry following the demodulator, so that the three color signals can be made available to the CRT of the receiver.

The I and Q signals can be recombined into color-difference signals, according to specific formulas related to those given earlier in this article for converting R - Y and B - Y into I and Q. This operation can be carried out in special matrixing circuitry following the demodulators, but there's an easier way. Since the color-difference signals contain definite percentages of I and

Q "ingredients," they can be obtained directly from the demodulators—thus dispensing with the matrix. The only change needed in the demodulators is an alteration of the phase difference between the locally-generated reference signals and the transmitted color subcarrier. For example, in Fig. 12, a slightly greater lag in reference-signal phasing enables the demodulators to sample the peak amplitudes of the R - Y and B - Y components in the I and Q signals. I and Q, as such, do not have to be detected.

The only disadvantage of this system is that, since a pure I signal is not recovered, the added detail transmitted in the I channel between 0.5 and 1.5 mc cannot be faithfully reproduced in sets using direct demodulation of color-difference signals. Therefore, the bandpass of the chroma circuits in these sets is simply reduced to take in only about 0.5 mc on either side of the subcarrier. Since color-difference demodulation considerably simplifies the circuitry with only a slight loss of color detail, all present-day sets use this system. Any arrangement which produces any two of the color-difference signals is theoretically usable, since the third signal can be derived from the first two. For best results in practical circuitry, R - Y and B - Y are generally recovered by the demodulators, and these outputs are combined in the proportions shown in Fig. 13 to produce G - Y.

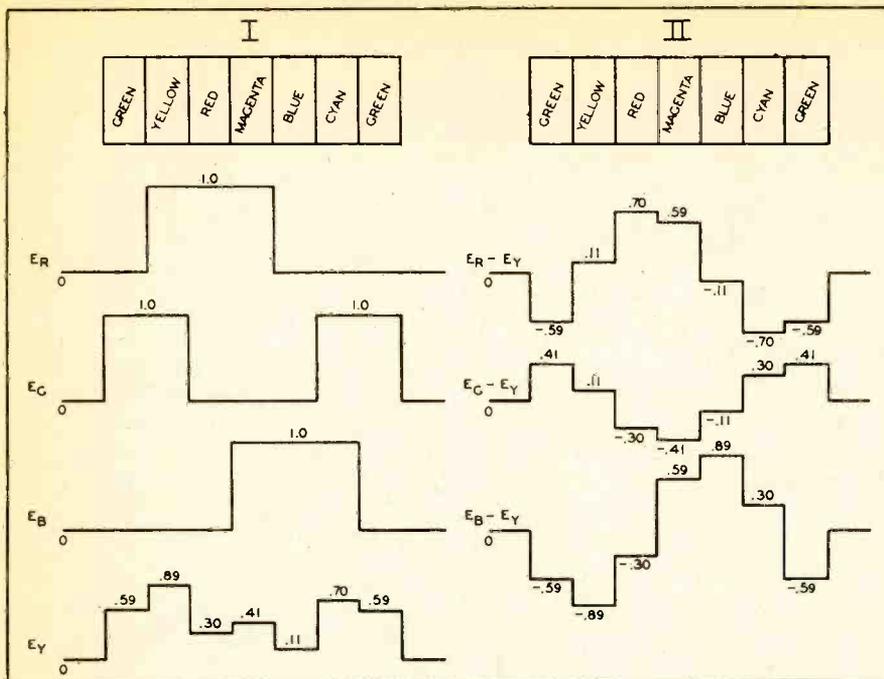


Fig. 16. Signal voltages corresponding to primary and complementary colors.

In some systems of the type just described, the outputs of the demodulators are not *exactly* $R - Y$ and $B - Y$, but are modified to meet various requirements of the stages between the demodulators and the CRT. This is true of the circuit in Fig. 14, which is used in many late-model color receivers. To produce $B - Y$ and $R - Y$ outputs from the color - difference amplifier tubes V22A and V22B, $-(B - Y)$ and $-(R - Y)$ inputs must be used in order to compensate for phase inversion in the amplifiers. In addition, since the conduction of V22A and V22B is affected by the small signal developed across common cathode resistor R177, true color-difference outputs can be obtained only by modifying the grid signals to complement this cathode signal. The cathode circuit develops a combination of X and Z signals in the correct ratio to produce $+(G - Y)$. This resultant signal is amplified without phase inversion by V23B, which functions as a grounded-grid stage.

The output signals of the color-difference amplifiers have the correct amplitudes and waveforms for matrixing with the luminance signal. This matrixing is the last step in recovering the original red, green, and blue camera-tube signals.

Adding Luminance

Modern circuits such as the one

in Fig. 14 have done away with elaborate chroma-and-Y matrixing circuits of the type used in early color sets. The picture tube itself is now used to combine the color-difference and luminance signals. The appropriate color-difference signal is fed to the control grid of each gun in the CRT, and a Y signal of negative polarity is applied to the cathode. Since the cathode and grid inputs both have a $-Y$ component, these portions of the signals do not affect the grid-cathode bias of the gun. Therefore, the bias is determined by the R, G, or B component of the color-difference signal.

This process is illustrated in Fig. 15, which shows the waveforms involved in scanning one line of a simple color-bar pattern that contains only the three primary hues. The figures are expressed per volt of camera-tube signal, and do not reflect the actual voltage levels on the CRT elements.

During transmission of the red bar, the red gun receives full drive ($E_R = 1.0$) because a Y signal of .30 adds to a $R - Y$ color-difference signal of .70. However, when the same Y signal is applied to the blue and green guns, it is cancelled by a $-.30$ color-difference signal; so there is no output from either gun. In a similar manner, scanning the green and blue bars causes full conduction of the green and blue guns in succession.

To give an idea of how the primary colors can be obtained to produce other hues, Fig. 16 shows the waveform involved in scanning a color-bar pattern containing complementary as well as primary colors.

This word *complementary* calls for a bit of explanation. When equal amounts of two primary colors are mixed, they produce another color, which is defined as the complement of the third primary. In mixing colored light sources, as is the case in color TV, the complement of red is cyan (a greenish-blue); that of green is magenta (a reddish-purple); and that of blue is yellow.

The first complementary color encountered in the bar pattern of Fig. 16 is yellow — a bright color with a high luminance value of .89. Note that the $B - Y$ signal cancels the luminance signal at the blue gun when the yellow bar is being scanned, but the $R - Y$ and $G - Y$ signals add to the luminance signal. The result is full output from the red and green guns, with no output from the blue gun. Similarly, the blue and red guns conduct equally to produce magenta, and the blue and green guns produce cyan.

If a white or gray bar were scanned, no color-difference information would be transmitted, and so the luminance signal alone would drive all three CRT guns at the proper levels to produce white or gray. Incidentally, the drive controls in the cathode circuits (similar to the background controls used in older color sets) adjust the balance of the DC cathode voltages so that the truest possible gray tones can be produced at all brightness levels. In conjunction with the drive-control adjustments, the screen controls are used to improve gray-scale tracking by adjusting the accelerating-grid voltages on individual guns.

Actual color-picture signals are much more complicated than those used as examples in this article, since natural colors include many "in-between" hues and many different levels of saturation and brightness. The compatible color TV system is sufficiently flexible and sensitive to reproduce practically all colors present in transmitted scenes. ▲

Standard Made It...



STANDARD CAN FIX IT BEST

\$11⁵⁰ Plus Parts . . . **\$13.50 Maximum Total Cost**

FREE Specially designed shipping cartons to prevent damage in transit

6 Months GUARANTEE

Only **BRAND NEW PARTS** Used • 24 Hour Service on All **STANDARD** Tuners • Latest Testing Techniques Assure Proper Alignment • \$3.00 Defective Tuner Trade-in Allowance Against a New **STANDARD** Replacement Tuner Carrying a 12 MONTH **GUARANTEE**

IN TV IT'S *Standard*

STANDARD has maintained uniform mounting centers for the last 13 years. Over 50% of the TV sets in existence today have STANDARD tuners—in the case of most other tuners one of the 8 STANDARD replacement models can be easily adapted or will fit directly in place of these units. All STANDARD replacement tuners carry a 12 Month Guarantee.

**SEE YOUR AUTHORIZED
STANDARD DISTRIBUTOR**

MORE PROFIT FOR THE SERVICE DEALER • GREATER CUSTOMER SATISFACTION
GUARANTEED BY THE WORLD'S LARGEST TV TUNER MANUFACTURER

standard kollsman INDUSTRIES INC.

FORMERLY STANDARD COIL PRODUCTS CO., INC., MELROSE PARK, ILLINOIS

November, 1961/PF REPORTER 9

publisher
Howard W. Sams

general manager
Mal Parks, Jr.

editor
Vern M. Ray

managing editor
Joe A. Groves

associate editors
Leslie D. Deane
Thomas A. Lesh

consulting editors
William E. Burke
Robert B. Dunham
George B. Mann
C. P. Cliphant
Paul C. Smith

art director
Don W. Bradley

advertising & editorial assistants
Georgeanna Caldwell
Paula Haffner
Jean Sekulski

production manager
Robert N. Rippy

circulation fulfillment
Pat Tidd, Mgr.
Constance Blond, Ass't.
Katherine Smith, Ass't.

photography
Robert W. Reed

advertising sales offices
midwestern

John Grace, advertising sales manager
PF REPORTER
2201 East 46th Street, Indianapolis 6, Ind.
CLifford 3-6441

eastern

Charles Horner
Howard W. Sams & Co., Inc.
3 West 57th Street,
New York, N. Y.
MUrray Hill 8-6350

western

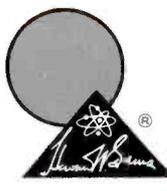
The Maurice A. Kimball Co., Inc.
2550 Beverly Blvd., Los Angeles 57, Calif.
Dunkirk 8-6178; and 681 Market Street,
San Francisco 5, Calif. EXbraok 2-3365

Address all correspondence to
PF REPORTER, 2201 East 46th Street,
Indianapolis 6, Indiana



Copyright © 1961 by Howard W. Sams & Co. Inc. PF REPORTER is a trademark of Howard W. Sams & Co., Inc. PF REPORTER may be reproduced without written permission. No patent liability is assumed with respect to use of information herein. Acceptance of advertising does not in any manner signify the products, policies and services so advertised have been approved, endorsed or recommended by this magazine.

Indexed in *Lectrodex*.
Printed by the Waldemar Press Div.
of Howard W. Sams & Co., Inc.



PF REPORTER

including **Electronic Servicing**

VOLUME 11, No. 11 **CONTENTS** NOVEMBER, 1961

Fundamentals of the Color TV System	1
Eight solid pages of facts to acquaint you with the basic principles of color television.	
Letters to the Editor	14
The Electronic Scanner	23
Chroma Bandpass and Demodulator Circuits	26
A review of circuit operation and typical troubles.	
Isolating Chroma Troubles by Symptoms	28
With a troubleshooting chart to help you pinpoint defects.	
Test Equipment for Color TV	30
What to consider in choosing the instruments you need.	
A Bout With a Color Set	32
Across the Bench—All the colors were gone, but a shop job brought them back.	
What's New in Color TV?	34
A look at some of today's color circuits.	
Color Servicing in the Home	36
Quicker Servicing—A guide to analyzing the causes of faulty color reproduction.	
Understanding Color Sync	46
The 3.58-mc oscillator and the circuits that control its frequency and phase.	
Service Promotions That Work	54
Dollar and Sense Servicing—Field reports of successful campaigns.	
Notes on Test Equipment	58
Lab reports on the Sencore Model BE113 Align-O-Pak, Waterman Primer-Scope Mark I, and Jackson Tube Tester Socket Modification Kit.	
Service Dealer Advertising Program	74
Number 11 in a series.	
Case Histories of Color TV Troubles	76
Keep these on file; history might repeat itself.	
The Troubleshooter	80
... and his answers to several color TV troubles.	
Color TV Crossword	88
Product Report	101
Free Catalog and Literature Service	104
Monthly Index	on free literature card

ABOUT THE COVER

The color TV "picture" is taking on a more rosy hue this year. Interest is perking up among manufacturers, dealers, servicemen, and the public. In recognition of this rising enthusiasm, we are devoting this entire issue to a "coverage in depth" of color TV from the serviceman's point of view.



SPRAGUE CERAMIC CAPACITORS

THE Complete LINE THAT OFFERS MORE THAN MERE "CAPACITY"

"Rated" capacitance is not enough . . . *actual* capacitance during operation is equally important. Excessively high or low values as well as capacitance change with temperature can foul up a TV or radio set. Therefore, characteristics such as Capacitance Stability, Capacitance Tolerance, and Temperature Coefficient of Capacitance must be considered in replacement applications.

That's why the Sprague Ceramic Line is varied and broad—it includes capacitors with electrical and mechanical characteristics to meet practically every replacement requirement.

See complete listings in the new Sprague Catalog C-614. Get your copy from any Sprague Distributor, or write to Sprague Products Co., 105 Marshall St., North Adams, Massachusetts.

CERA-MITE® CAPACITORS



Tiny, tough, dependable. Silvered flat-plate construction for high by-pass efficiency, high self-resonant frequency. Available in the following types to meet specific requirements:

- *General Application*, for by-pass and coupling
- *High-K*, for applications requiring guaranteed minimum capacitance values
- *Temperature-Stable*, for minimum capacitance change with temperature
- *Temperature-Compensating*, for applications requiring negative temperature coefficient
- *NPO*, for use where capacitance change with temperature is undesirable
- *AC*, rated at 125 VAC
- *Buffer*, rated at 2000 WVDC
- *Low-voltage*, for by-pass and coupling in transistorized circuitry
- *TV Yoke*, rated at 3000 and 5000 WVDC

HYPERCON® CAPACITORS

Ultra-miniature discs for use in transistorized circuitry. Designed for by-pass and coupling applications in low voltage circuits where high capacitance and low power factor are important considerations. Superior in size and performance to comparably-rated aluminum electrolytic capacitors.



"UNIVERSAL" CAPACITORS



Have multiple leads. Quick-fix capacitors for on-the-spot repairs. By using certain leads for terminals, connecting certain leads together, and removing certain leads, various ratings may be obtained. Available in General Application as well as High-K types.

DOORKNOB CAPACITORS



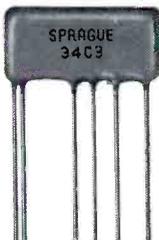
Available in 20 and 30 KV ratings. Molded guard rings lengthen surface creepage path. Complete with variety of screw-in terminals to meet all replacement requirements.

BUTTONHEAD CAPACITORS



Screw-mounting units with flat disc capacitor elements seated in hexagon head. This series includes feed-thru capacitors for filtering leads through chassis, as well as standoff capacitors for by-pass applications.

BULPLATE® CAPACITORS

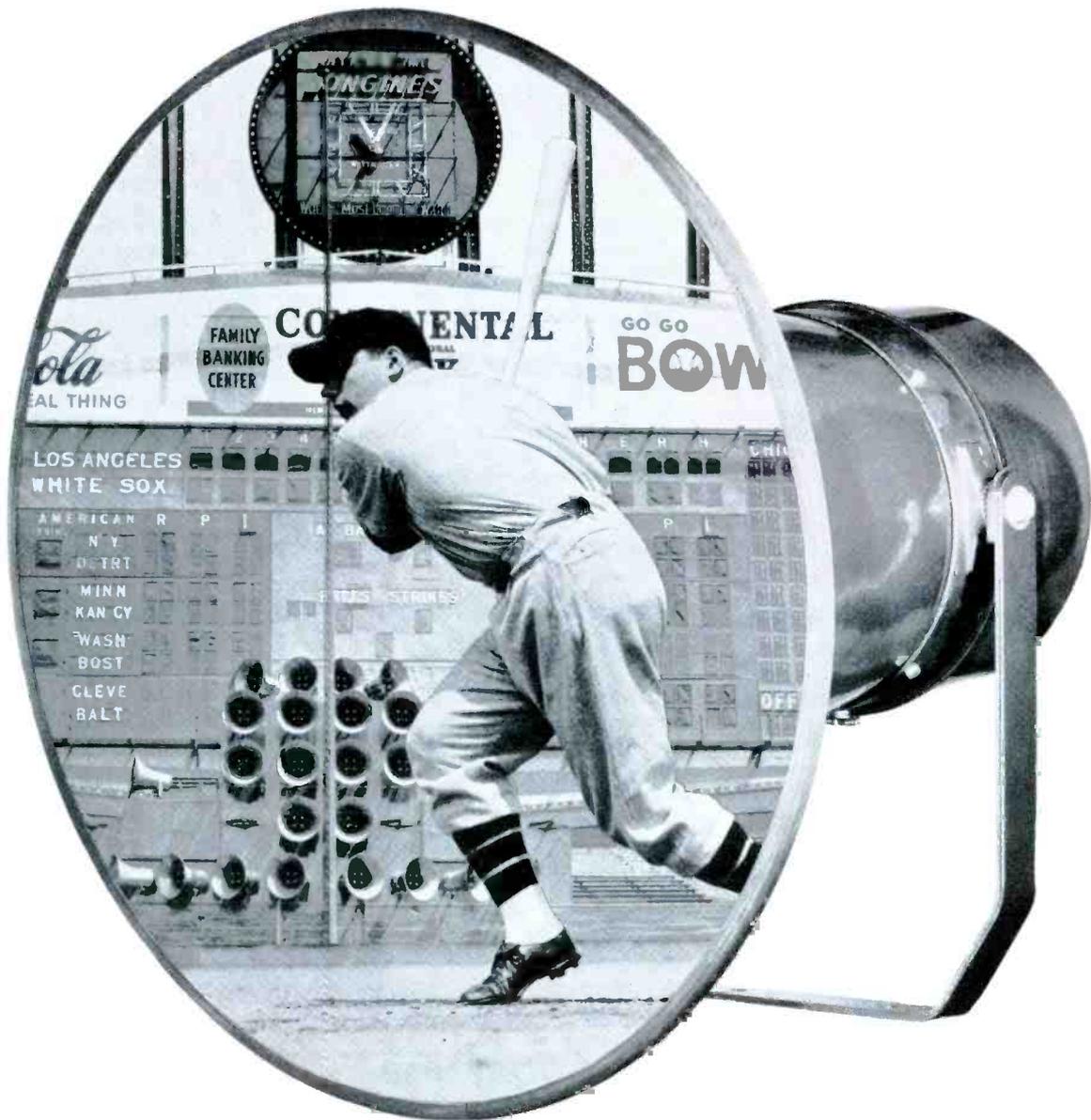


Rugged multiple-section units which combine in one compact assembly all the capacitors used in one or more stages of a radio circuit. These space-saving capacitors are ideal for miniature sets.

SPRAGUE®

THE MARK OF RELIABILITY

WORLD'S LARGEST CAPACITOR MANUFACTURER



play ball!

Heard better at Comiskey Park with University 4A4 P. A. loudspeakers*

And why was University chosen to be the voice of the Chicago White Sox explosive scoreboard? For the same reasons that have made University Loudspeakers the choice of more P. A. users than any other brand in the world: proven dependability, greater value, superior performance.

University 4A4 Superpower Projectors are excellent examples of University quality. During World War II, the military needed an extremely compact, lightweight, high power unit capable of penetrating the terrific noise levels found under combat conditions. The first 4A4 fulfilled exacting military specifications—to *perfection*. As a result of University's ever-expanding R & D program, today's 100-watt Model 4A4—and its big brother, the B-12P—are actually far superior. You will find them at leading sports stadiums, race tracks, airports . . . in church towers for the transmission of chimes and organ music . . . and in many civil defense installations. They are simple to install, fool-proof in operation, and immune to weather conditions of every kind. Perhaps they could be the answer to your P. A. needs?

But whether you need superpower projectors, top quality drivers, trumpets, paging or weather-proof high fidelity speakers . . . portable super-hailers, explosion-proof or underwater speakers—check University *first*. Most P. A. users do.

Write today for complete 4A4 specifications and P. A. catalog.
Desk U-II, University Loudspeakers, Inc., White Plains, N. Y.

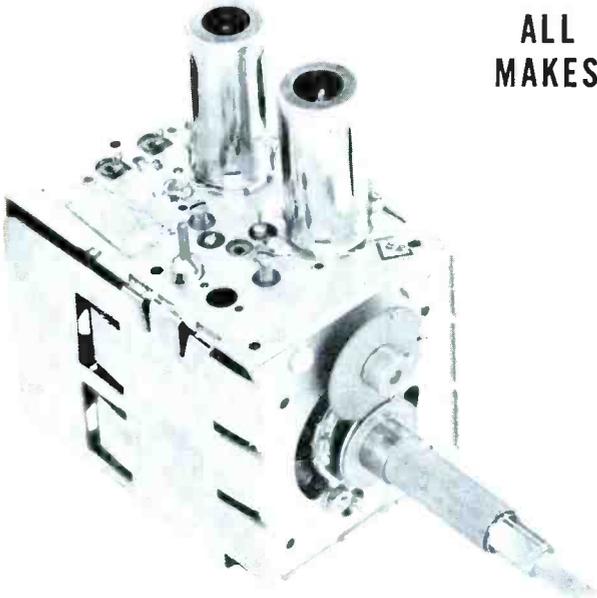
*Integrated in a Dukane Sound System, installed by Rich Sound Engineers, Chicago, Illinois.



A Division of Ling-Temco-Vought, Inc.

Tarzian offers

FAST, DEPENDABLE TUNER REPAIR SERVICE



ALL
MAKES

ONLY
\$850
INCLUDING

**ALL PARTS
and LABOR**

**24-HOUR SERVICE
6-MONTH WARRANTY**

**Tuners Repaired on
Approved, Open Accounts**

**See your distributor, or
use this address for fast,
factory repair service**

It just makes sense that a manufacturer of tuners should be better-qualified, better-equipped to offer the most dependable tuner repair and overhaul service.

Sarkes Tarzian, Inc., pioneer in the tuner business, maintains a complete, well-equipped Factory Service Dept.—assisted by Engineering personnel—and staffed by specialized technicians who handle **ONLY** tuner repairs . . . on **ALL** makes and models.

Tarzian-made tuners received one day will be fixed and shipped out the next. Cost is only \$8.50 and \$15 for UV combinations. That includes **ALL** parts and labor, and a 6-month guarantee against defective workmanship and parts failure due to normal usage. Replacements available at low cost on tuners beyond practical repair.

Ⓢ Tarzian-made tuners are identified by this stamping. When inquiring about service on other tuners, always give tube complement . . . shaft length . . . filament . . . voltage . . . series or shunt heater . . . IF frequency . . . chassis identification. All tuners repaired on approved, open accounts. Check with your local distributor for Sarkes Tarzian replacement tuners, replacement parts, or repair service.

SERVICE MANAGER • TUNER DIVISION • DEPT. 3A



SARKES TARZIAN INC

*east hillside drive • bloomington, indiana
edison 2-7251*

MANUFACTURERS OF TUNERS . . . SEMICONDUCTORS . . . AIR TRIMMERS . . . FM RADIOS . . . AM-FM RADIOS . . . AUDIO TAPE . . . BROADCAST EQUIPMENT and SHISH-KABOB GRILLES

ATR PRODUCTS FOR MODERN LIVING

ATR UNIVERSAL INVERTERS
A. C. Household Electricity Anywhere... CAR, BOAT or PLANE.

- Tape Recorders • TV Sets
- Dictating Machines • Radios
- Public Address Systems
- Electric Shavers • Record Players • Food Mixers • and Emergency Lighting.

NET
6U-RHG (6 V.) 125 to 150 W. Shp. Wt. 27 lbs. \$66.34
12U-RHG (12 V.) 150 to 175 W. Shp. Wt. 27 lbs. \$66.34

Auto Plug-in Home-Type Portable
ATR BATTERY CHARGERS
NO INSTALLATION... PLUG INTO CIGARETTE LIGHTER RECEPTACLE!
Keeps car battery fully charged in your own garage! Needed more now than ever before—makes motor starting easy! Operates directly from standard 110 volts A.C. current.

612CA4 (4 amp.) 6/12 V. Shp. Wt. 6 lbs. NET \$19.46
612CA6 (6 amp.) 6/12 V. Shp. Wt. 8 lbs. NET \$22.46
612CA10 (10 amp.) 6/12 V. Shp. Wt. 10 lbs. NET \$27.71

ATR SHAV-PAKS
Keep Clean-Shaved! Plugs into Cigarette Lighter Receptacle. Keep in Glove Compartment. Operates Standard A.C.

- ELECTRIC SHAVERS
- Small Timing Devices

In CARS, Buses, Trucks, Boats, or Planes.

6-SPB (6 V.) 15 W. Shp. Wt. 2 1/4 lbs. NET \$7.97
12-SPB (12 V.) 15 W. Shp. Wt. 2 1/4 lbs. NET \$7.97

ATR ELECTRONIC TUBE PROTECTORS
Will Double or triple the life of all types of electronic tubes, including TV picture tube.
Automatic in operation, for use with any electronic equipment having input wattage of 100 to 300 watts. Fuse protected, enclosed in metal case for rugged construction and long life.

MODEL 250 (Wall Model) 115 V. A. C. Shp. Wt. 1 lb. DEALER NET \$2.63

ATR MODERN TABLE RADIOS
Trim, modern clock radio in ebony or ivory plastic. Powerful 5 tubes including rectifier AM radio chassis with built-in "Magna-Plate" antenna. Full-toned 4" PM speaker. Popular features include: Musical Alarm—radio turns on automatically at any pre-set time; Sleep Selector—lulls user to sleep; Automatic Appliance Timer—outlet on back of radio times any electric appliance automatically (up to 1100 watts). Cabinet 10 1/2 in. wide, 5 in. high, 5 1/2 in. deep. Wt. approx. 8 lbs.

ATR HAND WIRED—NO PRINTED CIRCUITRY "TILT-A-STAND" RADIO
MOUNT ON THE WALL—UNDER A SHELF—OR SET ON A TABLE. PERFECT for every room in YOUR home.
Power-packed 5 tubes including rectifier chassis. Built-in loop antenna. Automatic volume control. Full 4" Alnico 5 speaker. Distinctive Roman numerals on dial. Size: 9 1/2" W x 4" D x 5 1/2" H. AC/DC. U.L. approved. Beautiful bakelite cabinet—Resists heat. Shipping Weight 5 1/2 lbs.

Model T-91 Clock Radio, Black NET \$22.45
Model T-91 Clock Radio, Ivory NET 23.15
Model T-87 (Tilt-A-Stand), Black NET 17.47
Model T-87 (Tilt-A-Stand), Red NET 18.10

See Your Electronic Parts Distributor Write Factory For Free Literature

ATR ELECTRONICS, INC.
Formerly: American Television & Radio Co.
Quality Products Since 1931
ST. PAUL 1, MINNESOTA—U.S.A.

LETTERS TO THE EDITOR

Dear Editor:

I am a new subscriber to your magazine and find it very enlightening. In your September *Letters* section, there is an item mentioning a recommended tube-stock list for servicemen. Would it be possible to obtain a copy of this list?

THOMAS J. DAME

Cohoes, N.Y.

But you thought we went "all out" to answer your request, when you saw "Stock Guide for TV Tubes" in the October issue. Actually, the Stock Guide is a regularly-scheduled feature which appears twice a year, normally in April and October. Although we do our best to keep it down to one page, the latest edition was expanded to keep you informed on more of the newly-introduced tube types.—Ed.

Dear Editor:

I somehow managed to squeeze my name into the appropriate spaces on your subscription order blank. A publishing business should know better than to use such a piddling little coupon for something as important as subscriptions. There isn't nearly enough space for conveniently supplying the information sought. I suspect that the guy who makes up your schematic illustrations also does coupons.

GEORGE KARMAS, Ph.D.

Bound Brook, N. J.

Didn't you know? The coupon is designed to serve as part of a training course. If an applicant can fill out the blanks as directed, he qualifies to service transistor radios!—Ed.

Dear Editor:

Earlier this year, you asked for ideas from readers on possible uses for a pair of synchros. Here's one for the coming holiday season. The enclosed diagram is of an action-light display I built last year for a Christmas program at our church.

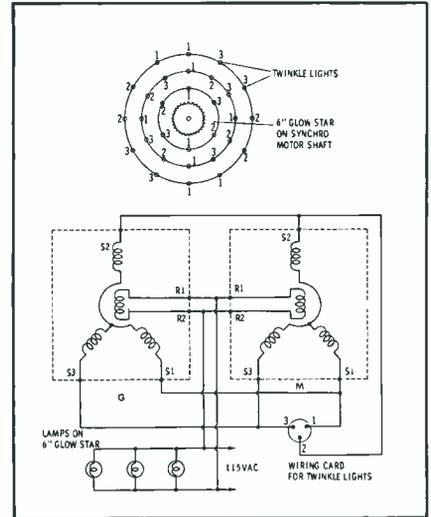
I took a polished aluminum sheet about 2' in diameter, and drilled 30 holes in three concentric circles for mounting medium-sized "twinkle lights." By drilling the holes to exactly the right size and countersinking them, I was able to use the glass envelope of the lights as insulation from the aluminum. For decoration, I mounted each light through the center of a 3" glow star, and trimmed the display with Christmas-tree ornaments and bright green tinfoil "leaves."

Connecting the lamps in three groups

as shown in the first drawing, I connected them to the three terminals of a wiring card as follows: Group 1 to terminals 1 and 2; group 2 to terminals 2 and 3; group 3 to terminals 1 and 3. Then I connected the card to the stator terminals of the synchro motor as detailed in the second drawing. Mounting the motor in the center of the display, I attached a 6" glow star to the rotor shaft. I fastened three more lights to the back of this star in a triangular pattern, and connected them in parallel across the rotor leads of the motor.

The synchro generator was remotely located, and its rotor shaft was driven by a motor geared down to produce from 5 to 20 rpm. Here are the various actions which resulted:

The lights on the 6" star pulsed six times per revolution, as the star rotated



clockwise. The inner circle of lights appeared to turn counterclockwise, the middle circle went clockwise, and the outer circle went counterclockwise. In addition, the whole display appeared to rotate clockwise.

J. E. KINGSTON

Seattle, Wash.

But you had heads turning, too.—Ed.

Dear Editor:

Can you give me any information on servicing an electric blanket that doesn't heat up?

A.M. ROWLEY

Jackson, Mich.

The recent Sams book, How to Repair Small Appliances, gives helpful information on this subject. As for methods of "cooking" the unit to be sure you've made a lasting repair, we suggest you wait for colder weather.—Ed.

Dear Editor:

I used some of the "Homeowner's Antenna Handbooks" you offered in your February, 1959 issue, and know they sold some antennas for me. I'm wondering if any more copies of this booklet are still available, as my supply is long gone. If you do have some left, please let me know and tell me the price.

LLOYD HOFFART

Lloyd's Radio & TV
Auburn, Nebr.

• Please turn to page 21

Picture of a Service-Dealer making a

\$6.96 profit

in 7 minutes
installing a
JFD exact replacement
antenna installation
for an RCA portable TV

the place: Any service-dealer shop.

the time: Every working day.

the product: Two JFD Exact Replacement No. TA398 Antennas —one model of 74 (was 62) different O.E.M. antennas for portable TV sets, available from your JFD distributor.

the facts: RCA set using two JFD TA398 Antennas requiring replacement

Your Actual Selling Price (2 @ \$4.95 ea.)	\$9.90
Dealer Cost at 40% off (2 @ \$2.97 ea.)	5.94
Profit on Sale	3.96
Installation Charge	3.00

your profit **\$6.96**

No cut-down "rabbit-ear" profit here. You make a decent profit on the sale *and* a profit on the installation. Your customer gets the *exact* antenna replacement for his portable TV. No call-backs. No drug store competition ever.

the aids: Self-merchandising floor and counter displays... antenna kits ... 1961 portable TV Antenna Cross Reference Guide... streamers, newspaper mats, direct mail literature... listings in Sams Photofact folders.

the moral: See your distributor for your JFD Exact Replacement Antenna kits and promotion-pak. Remember, next to receiving tubes, the antennas of portable and "tote-able" sets require the most frequent replacement.

THIS COUPON HAS STARTED THOUSANDS OF SERVICE-DEALERS IN TODAY'S PROFITABLE \$3,500,000 PORTABLE TV ANTENNA REPLACEMENT BUSINESS. MAIL IT IN TODAY!

JFD

THE BRAND THAT PUTS YOU IN COMMAND OF THE MARKET

JFD ELECTRONICS CORPORATION

6101 Sixteenth Avenue, Brooklyn 4, New York

JFD International, 15 Moore Street, New York, New York

JFD Canada, Ltd., 51 McCormack Street, Toronto, Ont., Canada

JFD ELECTRONICS CORPORATION
6101 Sixteenth Avenue, Brooklyn 4, N. Y.

Gen'lmen:

- I want to participate in the JFD Exact Replacement Profit Plan. Send me full details.
- Also send me the name of my local JFD distributor.
- Send FREE JFD 1961 Exact Replacement Wall Chart.

The name of my local JFD distributor is:

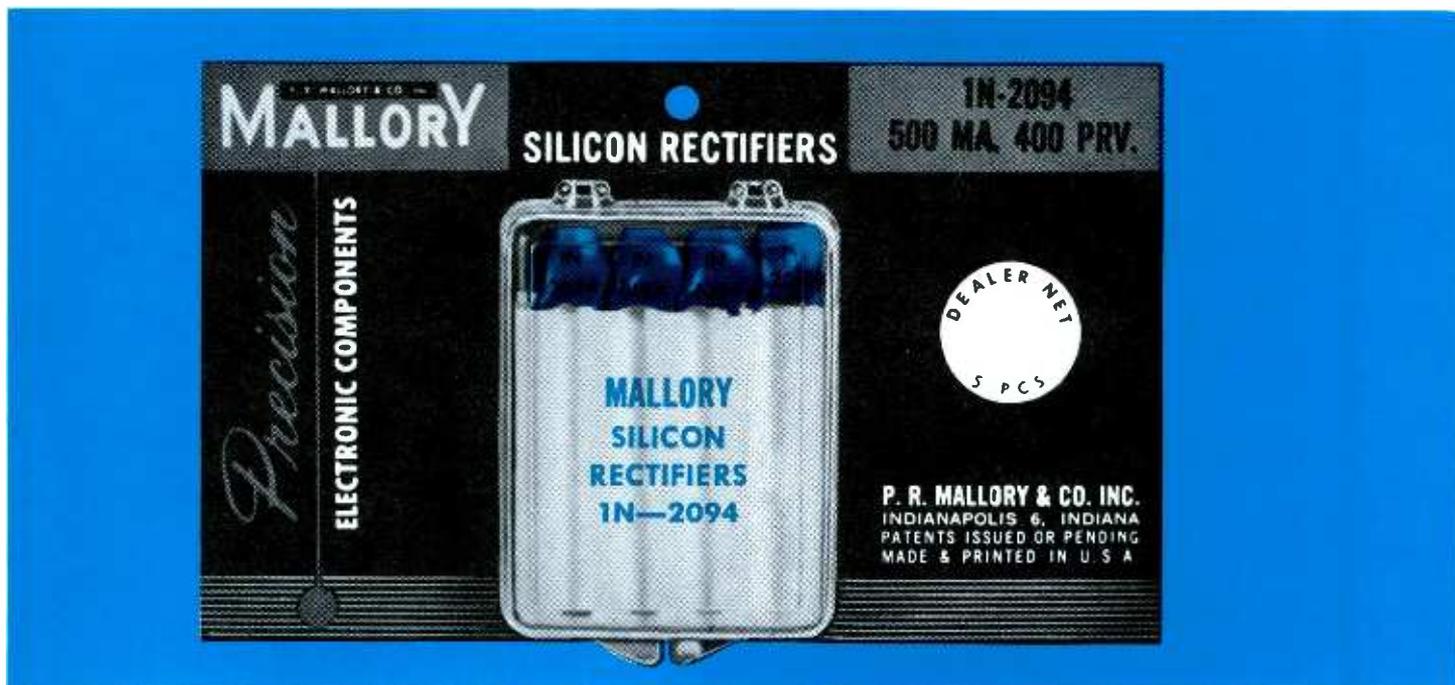
NAME _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

Now in transparent "Skin-Pack" that sells on sight!

MALLORY SILICON



For top performance *every time*, use Mallory silicon rectifiers. From 50 to 600 PRV, you'll get all of the rating you pay for. You can stake your reputation on the quality of these rectifiers. They meet the standards required for military types, yet you don't have to pay premium prices. You'll get 750 ma up to +50°C and 500 ma at +85°C. Quality is

so high you won't even need equalizing resistors in most cases.

Available in parallel lead "T" type and axial lead "A" type from your nearest Mallory distributor, five to a pack, in a reuseable jewel box, on a handy file card.



ELECTROLYTIC CAPACITORS

Famous FP-WP metal can types, reliable TC tubulars, and tiny TT tubulars.



VIBRATORS

Sure-start Gold Label® and every other type for auto or mobile communications.



PVC CAPACITORS

Premium quality Mylar* Capacitors in handy zip-lip package.

*Reg. Trademark E. I. du Pont de Nemours, Inc.



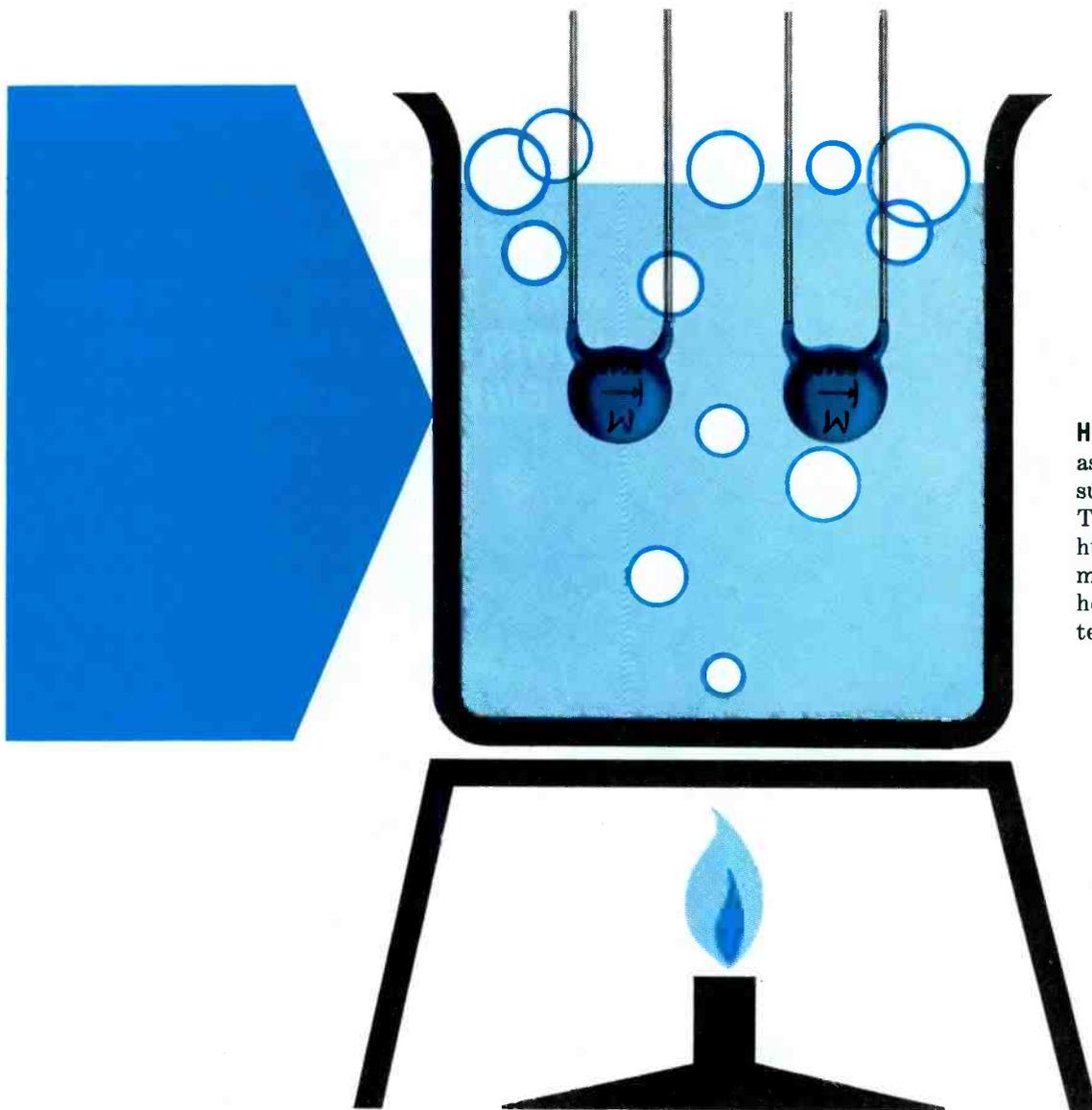
STA-LOC® CONTROLS**

30 second delivery on every imaginable control.

**U.S. Patent 2,958,838

RECTIFIERS STOP CALL-BACKS

... premium quality at no extra cost



HIGH HUMIDITY PROTECTION is assured by the unique encapsulating material. The Type T withstands four times the humidity cycling required by military tests . . . takes 500-hour boiling water immersion test without failure.



DISCAPS®

The standard of the ceramic capacitor field.

®Trademark Radio Materials Company, a Mallory Division



MERCURY BATTERIES

Get the details on the New Mallory Battery Program today.

Distributor Division, Indianapolis 6, Indiana

P. R. MALLORY & CO. Inc.
MALLORY

In Canada: A. C. Simmonds & Sons, Ltd., Toronto 7, Ontario

Why the WINEGARD ELECTRONIC MOST EFFECTIVE TV ANTENNA...

**DESIGNED TOGETHER
TO WORK TOGETHER... WINEGARD
POWERTRON ANTENNA AND
BUILT-IN AMPLIFIER!**

TRANSISTORIZED!



MODEL SP-55X

"By FAR world's most powerful all-channel antenna"

WHY? BECAUSE . . .

-  **IT CAPTURES MORE SIGNAL** than any other all-channel antenna ever made. Patented design, electro-lens director system, dual "TAPERED T" driven elements, 30 precision-tuned elements in all.
-  **IT'S THE ONLY TRUE ELECTRONIC ANTENNA.** Only the Winegard Powertron is built with the amplifier as part of the driven element—not an "add-on" attachment.
-  **IT ELIMINATES ALL SIGNAL LOSS** that normally occurs between the driven element and the amplifier due to transmission and coupling mis-match.
-  **IT BOOSTS WEAK SIGNALS UP OUT OF THE SNOW** far better than any other antenna or antenna-amplifier combination made.

 **FOR VIVID COLOR, HIGH DEFINITION BLACK AND WHITE AND LONG DISTANCE RECEPTION,** nothing can compare to the Super Powertron. Thousands have been installed all over the country and our files are full of testimonials from grateful TV viewers and Service-Technicians alike.

 **WINEGARD IS THE ONLY MANUFACTURER THAT MAKES BOTH ANTENNAS AND RF AMPLIFIERS.** Because of this you can feel confident of getting the very best. But don't take our word for it—let your eyes and ears and field strength meter tell the story.



MODEL P-55
Powertron — transistorized, 14 elements.



MODEL P-55X
Powertron with Pack — Transistorized, 21 elements.



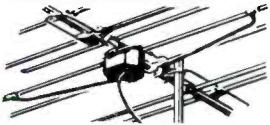
MODEL SP-55X
Super Powertron — transistorized, 30 elements.

POWERTRON is by far WORLD'S

Not 60%...Not 70%...but over 95% efficient

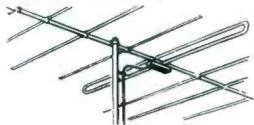
OUTFEATURES - OUTPERFORMS ORDINARY ANTENNAS WITH "ADD-ON" TYPE SIGNAL BOOSTERS!

THIS IS BETTER -



Exclusive amplified "Tapered T" driven element for perfect match and lowest possible signal-to-noise ratio. Only Powertron has it.

THAN THIS -



Not an after-thought "add on" signal booster hung on an ordinary antenna - not an old fashioned mast mounted booster.



ONLY POWERTRON HAS BOTH 300 OHM TWIN LEAD OR 75 OHM COAX TERMINALS ON BUILT-IN AMPLIFIER.

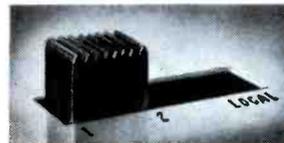


ONLY POWERTRON GIVES YOU YOUR CHOICE OF TRANSISTORS OR TUBES (TUBE MODELS 300 OHM ONLY).

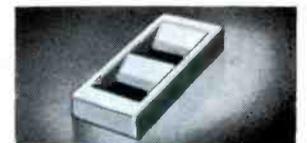
POWERTRON HAS COMPLETELY AC POWER SUPPLY



Transistorized Model has rectifier and filter in power supply - not in amplifier, where servicing is difficult. No batteries. Costs 27c to operate for full year. Battery types require \$5 to \$9 in batteries a year to operate continuously at maximum efficiency.



ONLY POWERTRON HAS RANGE CONTROL SWITCH TO PREVENT OVER-DRIVING TV SETS ON EXTRA STRONG CHANNELS.

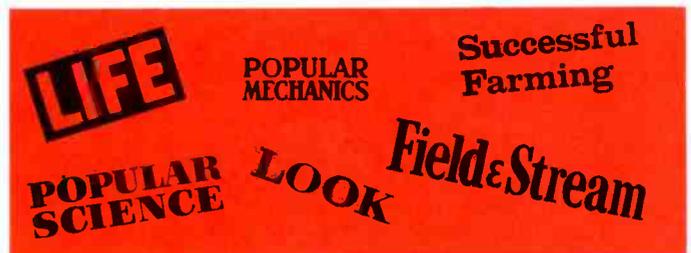


ONLY POWERTRON HAS AC PLUG-IN OUTLET FOR TV SET BUILT INTO THE POWER SUPPLY.

POWERTRON IS 100% CORROSION-PROOFED - ANTENNA IS GOLD ANODIZED, ALL HARDWARE IRRIDIZED, AMPLIFIER HOUSING OF HIGH IMPACT PLASTIC.

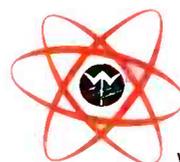
ONLY THE POWERTRON CAN DO ALL THIS!

1. Powertron will drive up to 10 TV sets and each set will have a better picture than an ordinary antenna will deliver to one set.
2. Powertron will drive a TV signal through one-half mile of lead-in with signal to spare—permits you unprecedented flexibility for remote installations.
3. Powertron will virtually eliminate snow and interference even on an old TV set.
4. Powertron will deliver superlative color reception far better than a non-electronic antenna.
5. Powertron brings in stations beyond the reach of non-electronic antennas—delivers greatest reception distance.



AND WINEGARD POWERTRON is the only antenna presold to your customers—nationally advertised in the biggest consumer advertising campaign yet! So stock up now—take advantage of the demand Winegard is building for you!

Write for free technical bulletins.



Winegard

ANTENNA SYSTEMS

Winegard Co., 3009-11A Kirkwood, Burlington, Iowa

NOW! ONE SOURCE TO BUY FROM... ONE NAME

TO SELL — ELECTRO-VOICE!

300
EXACT
REPLACEMENT
NEEDLES

Complete line
to fill every need

150
EXACT
REPLACEMENT
CARTRIDGES

for every modern type,
every major brand

90 replaceable-needle
cartridges

60 plug-in, permanent-
needle cartridges

**THE
INDUSTRY'S
ONLY COMPLETE
"LOOK-ALIKE" LINE
OF BOTH
NEEDLES AND
CARTRIDGES!**



Here, at last! The industry's first complete line of both needles and cartridges of every type! Not just a few general-purpose models, but exact type-for-type, model-for-model, "look-alike" replacements for every modern type, every major brand!

It's the greatest merchandising break-through since needles and cartridges became "big business." And only Electro-Voice, with over 35 years experience in electro-acoustics exclusively, could accomplish it.

What an opportunity for you to consolidate your inventory! . . . to step-up sales through instant, convenient service! . . . and enjoy complete coverage of your entire cartridge and replacement-needle requirements from one source. Saves time, money . . . simplifies inventory . . . and speeds your ordering. And complete cross-reference catalogs, wall charts and guides make needle or cartridge selection quick and positive!

 Your E-V distributor is now stocking the complete E-V needle and cartridge line. Ask him for your FREE cross-reference guides or write today for literature.

ELECTRO-VOICE, INC.,
Needles & Cartridge Div., Dept. 1117R
Buchanan, Michigan

Electro-Voice®

Letters

(Continued from page 14)

We still have a limited number of copies available on a "first come, first served" basis. In quantities of 50 or more, price is 3c each. For orders of 1000 or more, 2c each.—Ed.

Dear Editor:

Although *PF Reporter* is the best service magazine I have ever read, I would like to see it include several more things:

1. A radio-tube stock guide.
2. Short-cuts and time-savers in servicing. (I know several that I have never seen printed in your magazine.)
3. An edition containing all the oscilloscope waveforms covering the entire TV receiver. (You have these in practically every issue, but it is inconvenient to look through all the different issues to find what I want.)

I'd keep such a magazine on my bench for reference, and I'm sure there are others who would do the same.

RALPH SCHROER

Lima, Ohio

Replying in the same 1-2-3 order:

1. Have you seen the "Radio and Hi-Fi Tube Guide" in our July, 1960 issue? It lists all post-World War II types that are important enough to keep in stock, including those for auto radios and hi-fi amplifiers as well as for portable and home radios. We don't publish stock lists as often for radio tubes as for TV tubes since stock requirements change more slowly.

2. Send 'em in! Although we no longer have a regular department for "short-cut" service hints, we can always find room for original and useful ideas.

3. The series of Sams books, 101 Key Troubleshooting Waveforms by Bob Middleton, is made to order for you. Volumes

1 through 4 cover horizontal AFC-oscillator, horizontal sweep, vertical sweep, and sync circuits in that order. Besides typical waveforms, the books include abundant information on how to connect the scope and interpret the results of tests.—Ed.

Dear Editor:

Mr. Charlie Bennett (October Letters) evidently is not an electron chaser. He must have a full trash bin of junked TV sets.

H. HOGAN

A & H Electronics
Savannah, Ga.

Now is a good time to repeat that opinions expressed by readers in this column are not necessarily those of the staff! We don't challenge Mr. Bennett's electronics "savvy," even though we're glad to have someone sticking up for the "electron-chasing" methods we recommend.—Ed.

NEW TRANSISTOR TV-FM WINEGARD TENNA- BOOST

MOUNTS ON ANY ANTENNA

NEXT BEST THING TO THE
WINEGARD ELECTRONIC
POWERTRON TV ANTENNA

MOUNTS ON
ANTENNA

ON MAST

ON WALL

Model
MA-300

\$**34⁹⁵**
only LIST

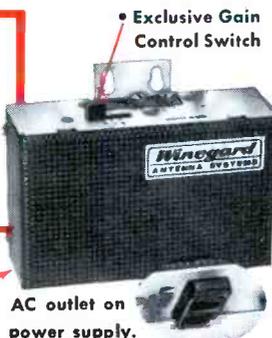
INSTALL IT... FORGET IT!

ALL ELECTRIC, ALL-AC POWER SUPPLY costs less than 27c a year to operate. Many exclusive features.

No costly, nuisance batteries!



Built-in two set coupler.



AC outlet on power supply.

19 DB GAIN! CUTS SNOW...BOOSTS SIGNAL!

Now you can make any TV or FM antenna work better by magnifying signals with the new Winegard transistor Tenna-Boost.

Tenna-Boost has up to 19 DB gain, no peaks and valleys. Ultra low noise. Linear frequency response. VSWR input better than 1.5:1 across all frequencies. Output VSWR 1.8:1 or better. This fine frequency response plus the very low VSWR make Tenna-Boost excellent for color.

Winegard's exclusive input band-pass filter eliminates interference from citizen's band, Hams, garage door openers, etc. Only TV and FM signals are amplified.

All metal parts are anodized, irridized or stainless steel. Completely weather-proof, trouble-free. Install it... forget it.

There's a big difference in antenna amplifiers! Ask your distributor or write for technical bulletin.

FOR THE ULTIMATE IN
TV RECEPTION

Winegard Transistorized Electronic
Powertron TV Antennas. 3 Models
to Choose From.



Winegard

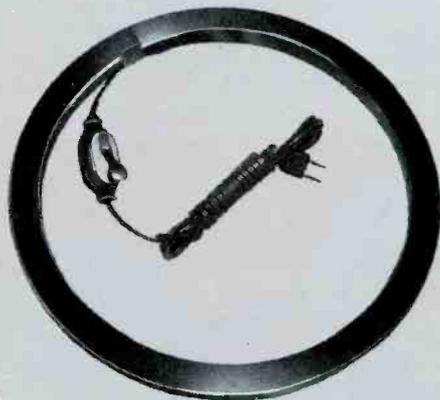
ANTENNA SYSTEMS

3009-11B Kirkwood • Burlington, Iowa

ARE YOU READY TO SERVICE

COLOR TV?

Walsco Repair Kit no. 2599x puts you in business... *For Only \$21⁹⁰*



2590



2596



2595



2548



2589

Save \$4⁶⁰
Reg. \$26.50

The 5 essential Service Tools all in one kit...

CAT. NO.	TOOL	USE
2590	Degaussing Coil	eliminates stray magnetic fields for easy purity adjustment
2595	Grid Grounding Box	grounds kinescope control grids... each switch and cord color coded for quick connection
2548	Interlock Cheater	protects you from shock hazard... permits insertion of a voltage probe
2589	Alignment Tool	two-in-one tool for alignment of concentric controls... saves time
2596	Color Viewer	three viewing filters simplify phase and matrix adjustments, let you handle many service calls in-the-home



COLOR TV TUBE MICROSCOPE

Precision pocket-size scope that magnifies dots 25 times for SIMPLE and ACCURATE adjustment of purity magnet, yoke, and rim magnets.

CATALOG NO. 2594
DEALER NET **1950**

and *FREE!* useful Color TV service book included with each kit



Zenith, and other leading color TV set manufacturers, recommend using Walsco Degaussing Coils and Color TV Accessory Tools in equipment servicing. And only Walsco is ready now to outfit you with all the tools you need!

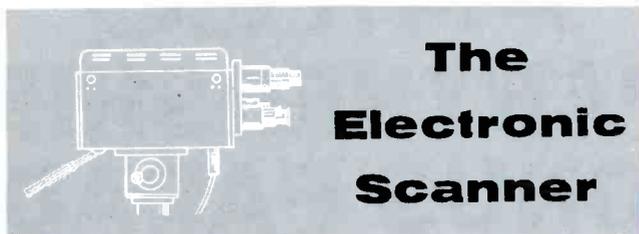
For more information, write for Specification FR3554.



WALSCO ELECTRONICS CO.

a division of GC-Textron Electronics, Inc.

400 S. WYMAN ST., ROCKFORD, ILL.



The Electronic Scanner

200 Attend Color Clinic at Harrisburg

A 2½-hour servicemen's clinic on "Problems of Servicing Color TV at a Profit" was recently held in the sales rooms of **D & H Distributing Co.**, Harrisburg, Pa. Jointly sponsored by **D & H** and **Hickok Electrical Instrument Co.**, the clinic was conducted by **Hickok's** Tom Clements and Harry Fallon.

G-E Expands Color-CRT and Receiving-Tube Lines

Three types of tricolor picture tubes—the 21AXP22A, the 21CYP22A, and the 21FBP22—are now available through **General Electric** tube distributors, according to a recent announcement. In addition, Thomas S. Knight, Dealer Products Manager for **G-E's** Electronic Components Division, stated that 55 types of receiving tubes were added to the **G-E** line as of September 1.

Castle Opens Tuner Service in New Jersey



Gunnar B. Hansen, director of **Castle TV Tuner Service, Inc.**, has announced the opening of a modern TV-tuner servicing plant in Cliffside Park, N.J. The new eastern plant offers distributors and servicemen the same specialized service on all types of tuners as **Castle's** Chicago and Toronto facilities.

JFD to Expand Antenna-Manufacturing Facilities



A 25,000-square-foot plant is to be constructed at Oxford, N.C., to house all engineering and production facilities for the lines of exact-replacement portable-TV antennas and other indoor antennas made by **JFD Electronics Corp.** To be known as **JFD-Southern, Inc.**, the new subsidiary is said to be the first in a series of nationwide expansion moves by the parent company.

Company officers shown looking over the plans are (left to right) V. P. Harvey Finkel, plant manager Morris Goldberg, president Albert Finkel, V.P. Edward Finkel, and Jerry Berger, manager, contract division.

Toshiba Color Set Scheduled for Spring Introduction

A 28-tube, 14" color TV set has recently been announced by **Tokyo Shibaura Electric Co.** According to reports, the 14" tricolor tube used in the set has three guns and employs a shadow mask. The receiver is expected to be placed on the market next spring, but no price has been announced.

Technicians Encouraged to Capitalize on Color Opportunities

Speaking to graduates of a special three-week color-service training course, H.F. Bersche—Manager, Distributor Products Department, **RCA Electron Tube Division**—urged them to start capitalizing on the current opportunities offered in color TV. The course, held at Harrison, N.J., was sponsored by **RCA distributor Krich-New Jersey, Inc.**

Jerrold Buys TACO

Sidney Harman, President of **Jerrold Electronics Corp.**, recently announced the firm's purchase of **Technical Appliance Corp. (TACO)** for \$2.7 million. Present **TACO** management personnel will retain their existing duties. This is **Jerrold's** second major expansion in less than a year; the company acquired **Harman-Kardon, Inc.** last February.

New Combination Offer from Perma-Power



A cultured-pearl heart pendant on a gold-filled chain is currently being included in each package of **Perma-Power "Vu-Brite"** TV picture-tube brighteners—either the C-401 (parallel) or C-402 (series) type. This promotion, timed to coincide with both the holiday gift season and the peak of demand for brighteners, will continue until December 15th.

New transistor Home TV and FM System!

Winegard BOOSTER-PACK & 'SIX-SET' COUPLER



BOTH for the price of the amplifier
\$34.95*
A \$42.90 value



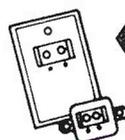
DRIVE UP TO 6 TV AND FM SETS

Cut snow . . . improve contrast . . . deliver sharper, clearer pictures to each set. New low noise, high gain transistor combined with advanced circuitry gives Winegard AT-6 "Booster-Pack" a flat gain of 16 db on low and FM bands . . . a flat 14 db gain on high band.

Shock-proof, full AC chassis with AC isolation transformer (NOT AC-DC). Draws 1.2 watts. Gain control switch prevents overdriving sets on local stations. No heat. Can be mounted remote from coupler. Also ideal as single set booster.

New, Winegard 300-ohm "Six-Set" coupler has low insertion loss, positive isolation between sets. No need to terminate unused outputs.

You get both AT-6 "Booster-Pack" and LTS-63 "Six-Set" for the price of "Booster-Pack" alone: a \$42.90 value for only \$34.95 list. Ask your distributor.

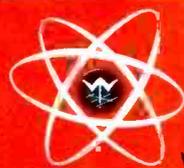


For real convenience, add Winegard flush or surface mount 300-ohm plug-in outlets. Even folks with only one TV set appreciate being able to move it from room-to-room.

For finest all-channel reception, use a Winegard "Teletron" antenna with your "Booster-Pack".



*Limited Time Offer



Winegard

ANTENNA SYSTEMS

Winegard Co., 3009-11C Kirkwood St., Burlington, Iowa



Do ALL Your Christmas Shopping at Your Philco Distributors... FREE OFFERS for you!

PHILCO® PARTNERSHIP BONUS PARADE



FREE OFFERS

We are celebrating 31 years of cooperation between Philco and the Independent Service Dealer with even better FREE OFFERS than ever before. Remember... Philco offers you these free gifts with your total purchase of Philco Branded Tubes, Parts, and Accessories!

Once in a Lifetime Offer!

Imported White Cashmere Sweater with Genuine MINK Shawl Collar

Extravagantly trimmed with wide shawl collar of light Autumn Haze, dark Autumn Haze or white Ranch Mink! 100% full fashioned cashmere cardigan. Rhinestone button on front, cuffs. Sizes 34 to 40.



AD #3923

FREE

with your purchase of \$1200 worth of Philco Branded Tubes, Parts, Accessories



HALLMARK

or Plain (AD #3932)

Men's Genuine Jet Black ONYX 10K Solid Gold Ring

A most elegant-style that every man would be proud to wear. Plain top or initial in gold.

FREE

with your purchase of \$250



With Initial (AD #3935)



AD #3920

Men's Zipper Jacket

32" length, water repellent, quilt lined. Knit collar, cuffs, pocket welts. "Natural" color, 34 to 46.

FREE

with purchase of \$200

AD #3914

TOY SHAGGY DOG

FREE with your purchase of \$40



AD #3932

Tom Thumb TOY CASH REGISTER

FREE

with your purchase of \$60



ALL OFFERS GOOD UNTIL DECEMBER 15, 1961

FREE OFFERS

Climb on the Bandwagon . . . Join the Parade!
Get Your Share of These Terrific FREE OFFERS . . .

Now . . . Your Total Order of Philco Branded Tubes, Parts, Accessories . . . Is Credited toward the FREE Items You Want!

HAMILTON-COSCO

Folding Table and Chair Set

Upholstered metal table, contour back upholstered chairs. Two tone, Tan frame, Mocha fabric.

Table Only (AD #3771)

FREE with \$110 order

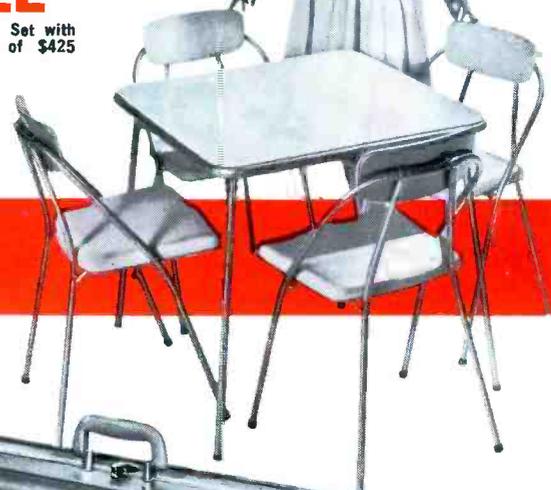
2 Bridge Chairs (AD #3772)

FREE with \$170 order

FREE

Complete 5-Pc. Set with your purchase of \$425

AD #3785



Million Miler Men's and Ladies' LUGGAGE

Solid, seamless, scuff proof. Weather resistant U.S. Royalite, fiberglass reinforced. Feather-weight, aluminum dust-proof closure.

FREE with purchases of Philco Branded Tubes, Parts, Accessories

FOR MEN

COMPANION AD #3757	21"	FREE	with \$245 order
TWO SUITER AD #3756	24"	FREE	with \$375 order
THREE SUITER AD #3755	26"	FREE	with \$425 order

FOR WOMEN

TRAIN CASE AD #3759	14"	FREE	with \$245 order
ROUND HATBOX AD #3763	16"	FREE	with \$225 order
OVERNIGHT CASE AD #3760	21"	FREE	with \$245 order
WARDROBE AD #3764	24"	FREE	with \$375 order
PULLMAN AD #3761	26"	FREE	with \$375 order



Million Miler Air Exec ATTACHE CASE

18" x 14" x 5".
Removable file,
removable desk.

FREE

with purchase of \$245

AD #3758



AD #3930

Las Vegas Executive Game Chest

10½" Roulette Wheel, Bowling Dice Game, Dice, Dominoes, Chess, Checkers, Chips, Cards, Horse Race Game, Chess Board, directions and carrying case.

FREE

with purchase of \$150



AD #3933

Tom Thumb TOY BANK VAULT FREE

with your purchase
of \$40

Sportcraft DART GAME FREE

with your purchase
of \$65



AD #3918



Tom Thumb Toy Typewriter FREE

with your purchase
of \$200

AD #3929

SEE YOUR PHILCO DISTRIBUTOR

CHROMA

BANDPASS

& DEMODULATOR CIRCUITS

This coverage will familiarize you with typical circuits and the troubles which most often develop . . . by Warren J. Smith

A considerable percentage of color-service bench jobs are concerned with chroma bandpass amplifiers and demodulators. These circuits, despite their apparent simplicity, can harbor a surprising variety of troubles. Familiarity with the differences in chroma-circuit arrangements is of prime importance to the service technician, because conflicting symptoms may be observed when similar failures occur in different color sets.

Bandpass-Amplifier Circuits

The bandpass amplifier is actually nothing more than a narrow-band video amplifier tuned to pass the sidebands of the 3.58-mc color sub-carrier. Fig. 1 is a schematic of a typical one-stage bandpass circuit of recent vintage, also showing how the chroma and luminance signals are taken from the first video amplifier. In the chroma channel, note that the composite video signal is coupled through small capacitor

C102 (which attenuates the lower video frequencies) to chroma take-off coil L22. The latter is tuned to accentuate a band of frequencies between approximately 3 and 4 mc, including the color signals to be amplified. The 3.58-mc color-burst signal, also developed across L22, is fed through C103 to the burst amplifier for use in color synchronization. The burst signal must be kept out of the bandpass amplifier, to prevent the possibility of its causing yellowish interference in the color picture. For this purpose, the chroma bandpass amplifier is cut off during horizontal retrace time by positive pulses applied to the cathode from the horizontal blanking amplifier.

During black-and-white reception, the color-killer stage develops a negative bias voltage across R137 and C101, which is applied to the grid circuit of the bandpass amplifier to hold this stage in cutoff.

The amplified chroma signal is coupled to the demodulators through transformer L23, which contributes to shaping the over-all bandpass response. The demodulators are driven through a color-saturation control which permits adjustment of the chroma-signal amplitude. A low-impedance control circuit is employed to minimize the attenuating and phase-shifting effects of shunt capacitance at the relatively high frequencies being used.

Two-Stage Circuit

Some color sets, both current and older models, use two bandpass-amplifier stages. The extra gain pro-

• Please turn to page 82

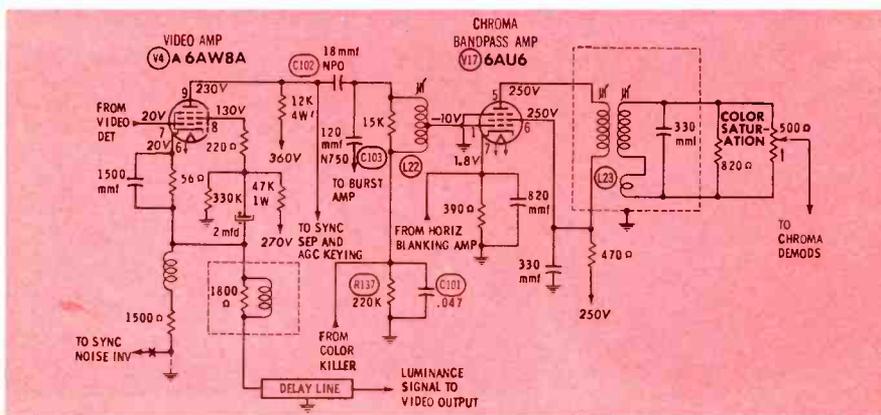


Fig. 1. Typical one-stage chroma bandpass amplifier from recent-model set.

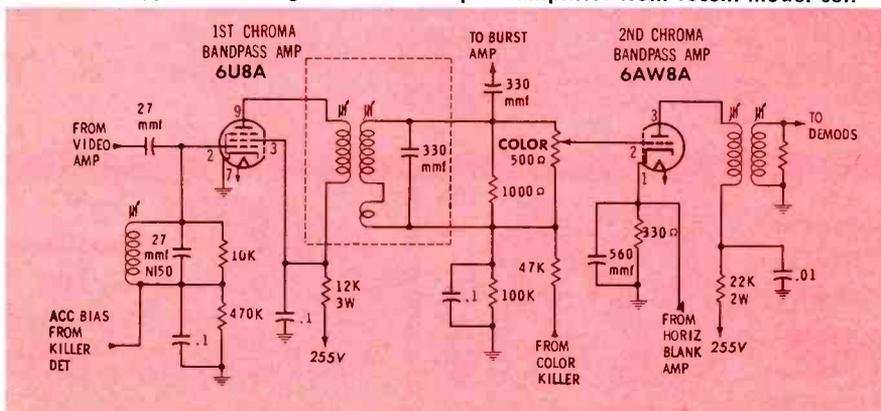
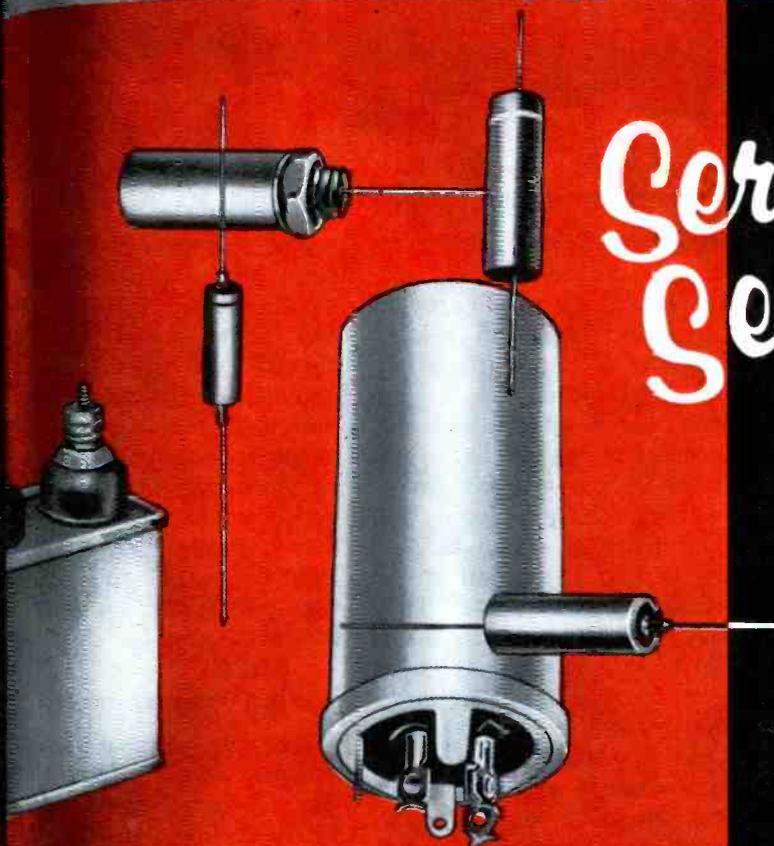


Fig. 2. Two-stage bandpass amplifier with automatic chroma control.

CORNELL DUBILIER

Service Selector



HIGHLY RELIABLE
ELECTRONIC COMPONENTS
AND SYSTEMS

AUTHORIZED DISTRIBUTOR

Tubular — ELECTROLYTICS

Twist-Prong — ELECTROLYTICS

Disc — CERAMICS

Receiving — MICAS

Transmitting — MICAS

Tubular — MYLAR

Tubular — METALIZED PAPER

Interference — FILTERS

VIBRATORS

POWER SUPPLIES

Antenna — ROTORS

Test — INSTRUMENTS

CDE

new! 40 pages of profit-building CAN DO!

Available now. Ask your CDE representative, or write: Cornell-Dubilier Electronics, Div. of Federal Pacific Electric Co., 50 Paris St., Newark 1, N. J.



A logical analysis will tell you where to start looking for the defect . . . by Joe A. Groves

Pale, washed-out color, loss of burst sync, wrong hues, complete absence of color — all these symptoms fall into the category of chroma trouble. In order to localize the causes of these symptoms in the shortest possible time, it is imperative that you develop a logical troubleshooting procedure.

The first thing to do is find the general trouble area. Since misadjusted controls, trouble in the AGC, RF, IF, or video circuits, and even antenna-system defects, can produce color-trouble symptoms, such possibilities should be checked prior to bench testing. Also, in this discussion, we are assuming all tubes have been tested. For further information on this subject, see "Color Servicing in the Home" in this issue.

On the bench, trouble can be conclusively isolated to the chroma circuits (Fig. 1) by injecting a video signal from a color-bar generator to the video amplifier circuit. If the set fails to produce a normal color display, you can be sure there

is trouble in the chroma section.

Once you have determined that something is wrong in the chroma circuits, the next step is to isolate the trouble to a certain stage or group of stages. After this is accomplished, simple voltage and resistance measurements will help you pinpoint the defect. Chroma troubles are most easily isolated by thinking in terms of circuit blocks as shown in Fig. 1. Stirring up a mental image of such a block diagram may serve your needs adequately in using this time-tested approach; on the other hand, you may prefer to rely on a drawing. In either case, the blocks will help you decide where to make the most meaningful checks to compare with known-good test results.

In Fig. 1, notice that the various signal paths are shown by means of different types of lines. The thin solid lines show the luminance and blanking signal paths that are also common to black-and-white reception; the medium solid lines show the paths of the detected chroma

(color) signals; the dashed lines point out the reference-oscillator and synchronizing-circuit paths; and the heavy solid lines show the circuits that receive the composite chroma signal. Once you become thoroughly familiar with the various circuit paths, you'll have reached an important milestone in servicing chroma troubles. You'll also have a clearer understanding of the logic behind Chart I, which lists the test points normally used in troubleshooting the chroma section.

What Waveforms to Expect

Knowing normal signal paths will prove to be of little value unless you know what kind of signals you're dealing with. This is why an oscilloscope is so vitally important for troubleshooting. Naturally, unless you are servicing several color sets each day, you won't be able to remember all of the humps and hollows of the complex waveforms you'll find in the color stages following demodulation; but when you check the waveforms anywhere up to and including the demodulator inputs, you should quickly be able to tell whether or not you are receiving the proper signal.

Some of the standard troubleshooting waveforms are shown in Fig. 2. The pattern of Fig. 2A is typical of what you should find at the grid of the burst amplifier. Referring to Fig. 1, you'll note there are two signals fed to this stage. The high-amplitude keying pulse from the horizontal section is easily recognized in Fig. 2A; however, without knowing that the ripple along the base of the waveform is the chroma signal, you could easily

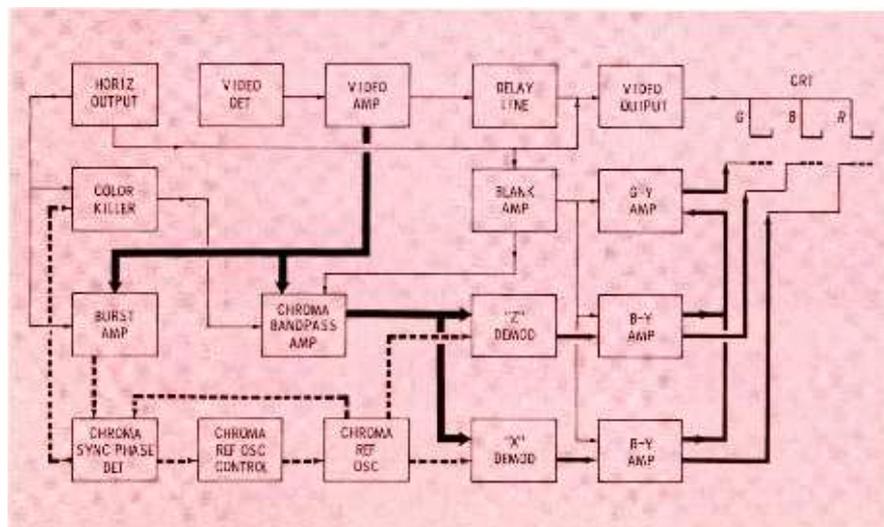


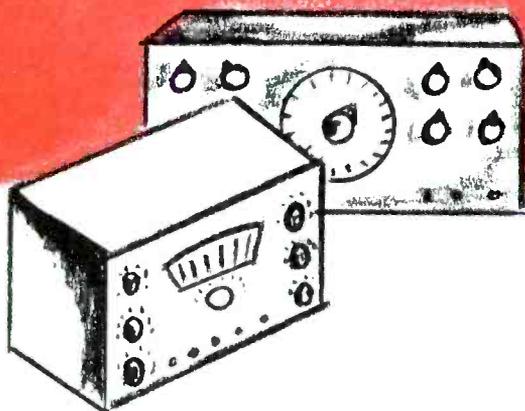
Fig. 1. Learn the signal paths shown on this block diagram to help isolate trouble.

Please turn to page 93

Chart I—Step by Step Procedure for Pinpointing Trouble After Isolating to Chroma Section

SYMPTOM	TEST SETUP	TEST POINT	ANALYSIS	EVALUATION
No color	Inject video signal from color-bar generator to output of video detector; use oscilloscope and VTVM as indicated.	<ol style="list-style-type: none"> 1. Bandpass amp. grid 2. Bandpass amp. stage 3. Color killer stage 4. Demodulator inputs 5. Demodulator inputs 	<p>Check for presence of proper chroma waveform.</p> <p>Check for proper voltages at all tube elements.</p> <p>Check for presence of proper plate waveform; measure voltages at all tube elements.</p> <p>Check for presence of chroma input signal.</p> <p>Check for reference oscillator input signal.</p>	<p>If absent, check chroma path from video amplifier. If present, proceed to next step.</p> <p>If plate, screen, or cathode voltages are extremely low, make resistance measurements. If grid bias is excessive, proceed to next step.</p> <p>If waveform is absent, check coupling circuit from flyback. If voltages are abnormal, make individual component tests in appropriate circuit.</p> <p>If absent, check circuit from the bandpass amplifier. If present, proceed to next step.</p> <p>If absent, check voltages in reference oscillator and control circuit; check individual components in appropriate circuit.</p>
Washed-out color	Same as above.	Same as above	Same as above.	Trouble caused by reduced signal amplitude. Check peak-to-peak amplitude of above waveforms, measure voltages at tube elements, and check individual components in appropriate circuit.
One primary color absent or predominant	Same as above.	<ol style="list-style-type: none"> 1. Picture tube base 2. Affected color amplifier circuit 3. Demodulator feeding affected color circuit 4. Demodulator feeding affected color circuit 	<p>Make gray-scale adjustments; check the CRT; measure grid, cathode, and G2 voltages.</p> <p>Check for proper voltages at all tube elements.</p> <p>Check for proper voltages at all tube elements.</p> <p>Check for presence of chroma and reference oscillator signals.</p>	<p>If any test is unsatisfactory, make additional checks in appropriate circuit. If all tests produce normal indications, proceed to next step.</p> <p>If voltage is abnormal, make resistance measurements and check individual components in appropriate circuit. If voltages are normal, proceed to next step.</p> <p>If voltage is abnormal, make resistance measurements and check individual components in appropriate circuit. If voltages are normal, proceed to next step.</p> <p>Make individual component tests in coupling circuit that fails to provide a signal.</p>
All colors present, but all hues incorrect	Same as above.	<ol style="list-style-type: none"> 1. Reference oscillator control stage 2. Demodulator outputs 3. Chroma sync phase detector stage 4. Burst amplifier stage 	<p>Check for proper voltages at each tube element.</p> <p>Make chroma sync phase adjustments; check shape and amplitude of output waveforms.</p> <p>Check shape and amplitude of waveforms; check for proper voltages at each tube element.</p> <p>Check for presence of proper grid waveform; check voltages at each tube element.</p>	<p>If voltage is abnormal, check individual components in affected circuit. If normal, proceed to next step.</p> <p>If any coil fails to respond to adjustment, check components in associated circuit. If no indication, proceed to next step.</p> <p>If reference signal is weak, check coupling circuit. If burst signal is absent or distorted, proceed to next step.</p> <p>Check for presence of both chroma and keying signals. If either is absent, check associated circuit. If voltage is abnormal, check resistance and individual components.</p>
Poor color sync	Same as above.	<ol style="list-style-type: none"> 1. Reference oscillator section 2. Phase detector stage 3. Phase detector stage 4. Burst amplifier stage 	<p>Make chroma sync phase (AFPC) adjustments.</p> <p>Remove tube; adjust reference oscillator and control circuits.</p> <p>Check shape and amplitude of waveforms; check for proper voltages at each tube element.</p> <p>Check shape and amplitude of grid waveform; check for proper voltages at each tube element.</p>	<p>If unsatisfactory results, proceed to next step.</p> <p>If color can't be locked in, make voltage measurements and component tests in reference oscillator and control circuits. If lines stop, reinstall tube and proceed to next step.</p> <p>If no reference oscillator signal, check coupling circuit. If burst signal shows signs of chroma, or it is absent, proceed to next step.</p> <p>If keying or chroma signal is absent, check appropriate coupling circuit. If voltage is abnormal, check individual components.</p>

Answers to basic questions such as, "What do I need?" and "Where and how do I use it?" by Les Deane



test equipment

for Color TV

Fifteen years ago, the average TV serviceman had never heard of a flyback and yoke checker, a CRT rejuvenator, or a test-pattern generator. In this pre-TV era, his most advanced signal tracers and generators had outputs only up through the FM band, and he seldom had occasion to measure anything over a couple of hundred volts—let alone 20 kv.

When television took the country by storm, radio technicians braced themselves for this new servicing opportunity. Many attended TV schools or service clinics; others relied on correspondence courses or textbooks for a TV education. After

acquiring the necessary theoretical knowledge, they took to the field for practical experience. At this point, their utmost concern was the type of test equipment they would need to do the job.

Today, many servicemen are finding themselves in the same situation on color TV. They have most of the test instruments needed for use on black-and-white receivers, but are not sure if these are suitable for color, or if additional instruments are necessary. To help settle these questions, let's take a long look at the special requirements of color-receiver servicing.

Most of the components used in

color circuitry are pretty familiar—capacitors, resistors, transformers, coils, tubes, etc. Therefore, checking individual components seldom presents any special problem. A conventional ohmmeter, capacitor tester, substitution unit, or tube tester is just as valuable in troubleshooting color circuits as in servicing any other electronic apparatus.

On the other hand, test instruments available for signal-tracing and alignment (sweep and marker generators, other signal generators, and oscilloscopes) do not always meet the special requirements of color TV servicing. Fortunately, many general-purpose TV-troubleshooting instruments produced during the past several years have been designed with color servicing in mind; however, it is important to check the specifications of individual units to make sure they have all the features needed for analyzing color sets.

The line-up of color test equipment is not complete without a couple of special-purpose instruments—the color-bar generator and pattern generator. These units are absolutely necessary for correctly performing some phases of color TV setup and alignment; they are also extremely helpful for troubleshooting.

Getting Down to Business

Now that we've considered what kinds of instruments are needed by the color TV specialist, let's turn our attention to the problem of choosing particular pieces of equipment. The following sections describe the major categories of instruments, one by one. Necessary or desirable specifications and fea-

Instruments Available for Servicing Color Sets

COLOR-BAR GENERATORS	PATTERN GENERATORS	CRT TESTERS	INSTRUMENT MFR.	WIDE-BAND SCOPES	SWEEP GEN. (VIDEO RANGE)	MARKER GEN. (VIDEO RANGE)
		T-471	ANCHOR			
		440	B & K			
		36-516	GC ELECTRONICS			
			EICO	460	368 360	324 322
656 660	656 660	CR 33	HICKOK	675 770	288X 615	288X 615
			JACKSON	CRO-2 600	TVG-2	
		800	MERCURY			
			PACO	S-55	G-32	G-30
E-440	E-420		PRECISION APP.	ES-150 ES-550	E-400	E-200C E-75
WR-61B WR-64A	WR-46A WR-64A		RCA	WO-91A		WR-49B
430	434		SIMPSON	458		
			TRIPLETT	3441-A	3434-A	
			WATERMAN	S-16-A		
250			WINSTON			

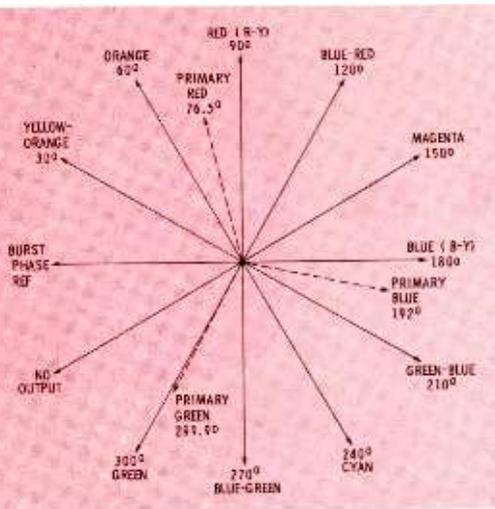


Fig. 1. Vector diagram shows relationship of various hues to burst reference.

tures are spelled out, and the principal uses of each unit in color servicing are outlined. Also, the chart accompanying this article identifies the major manufacturers who currently produce each type of test instrument employed in color work.

In addition to the major instruments that are a "must" for color troubleshooting and alignment work, numerous accessory items are available to speed and simplify color TV repairs. Many of these are illustrated just to the right of this column.

Color-Bar Generators

Although basic troubleshooting can be accomplished by using a color program from a local station as a signal source, a color-bar generator is more satisfactory for two reasons: It is always available, and it is much more reliable as a known standard for test signals and screen displays.

Three general types of bar generators are on the market. The first two, both called *rainbow generators*, supply an unmodulated 3.58-mc output that simulates a chroma signal. The third type of instrument, more elaborate than the other two, generates a complete NTSC color-bar test pattern, containing both luminance and amplitude-modulated chroma signals.

The simpler type of rainbow generator produces a continuous output that constantly varies in phase with respect to the reference-oscillator signal in the receiver. The result is a multicolored pattern on the picture tube—not a group of distinct

• Please turn to page 66

Test adapters for three-gun color tubes are available for universal applications or for use with specific tube testers.

Bench servicing of color chassis is much easier if you have a set of extension cables—for the CRT, yoke, convergence assembly, and high voltage.

Probes are a "must" for accurate test indications. In color servicing, you'll need RF and high-voltage units for your meters, plus both low-capacitance and detector probes for your scope.

A degaussing coil is almost indispensable for obtaining good color purity. This large coil assembly eliminates stray magnetic fields in and around the CRT.

This little item is handy for checking convergence and purity in a color receiver. When series-connected between the CRT base and chassis, it permits each color gun to be turned off or on.

Multiple bias supplies are currently available from several manufacturers. These small instruments are called for during color TV alignment.

Since color TV owners want to prolong the life of the expensive three-gun picture tube as much as possible, a color CRT brightener is a good item to have on hand.

A bout with a



Since color TV owners have a pretty good piece of hard-earned change tied up in their receivers, I usually try and make most of our color service calls myself. This particular afternoon was no exception, especially since the customer had complained of intermittent and then complete loss of color.

Arriving on the scene, I found the RCA Chassis CTC7A with an excellent black-and-white picture, but tuning it for a station-generated color stripe produced not one flicker of color at any setting of the fine-tuning, tint, and color controls. Fortunately, this owner was not one to monkey with the AGC, background, screen, and killer threshold

controls, even if he knew where they were. Therefore, I did not take the trouble to check these controls, but proceeded to set up my color-bar generator (a crystal-controlled, keyed-rainbow type). Disconnecting the antenna leads and hooking up the generator, I tuned the receiver and generator to channel 3. The only pattern that came into view was a series of 10 faint, *colorless* bars. Thus, whatever the trouble was, at least I knew the antenna wasn't damaged or turned the wrong way.

Thinking that an RF-IF trouble (such as interelement leakage or low emission in a tube) might be killing the chroma signal, I decided

to make one more signal-injection test. I removed the first video amplifier tube, plugged a tube mount in its place (Fig. 1), and fed a color video signal from the bar generator into the grid terminal. The result was identical to the first test—10 washed-out stripes without a trace of color. This at once eliminated the tuner and IF's as probable troublemakers, thus allowing me to concentrate on the two video (luminance) amplifiers and the various tubes in the chroma circuitry. Warming up my transconductance tube tester, I began to check all tubes in the color section, both video amplifiers, and the picture tube. Disconcertingly, most were quite good, although I did get an extra flicker or two on the short test from the 6U8A chroma reference oscillator. However, applying additional filament voltage failed to confirm any leakage. I thoughtfully replaced the tube in its socket, knowing that a substitute (unless carefully selected) would require a complete touch-up of the chroma sync and phase adjustments in the circuit of Fig. 2—reactance-tube plate coil L29, oscillator plate transformer L30, trimmer C111, and burst phase transformer L28.

Shifting my tactics, I took advantage of the tube mount still in the video amplifier socket, and checked the DC voltages at the screen and plate terminals with my 20,000-ohms-per-volt VOM. This test confirmed that B+ was what it should be.

To the Shop!

I explained to the customer that all tubes and main operating voltages were apparently good, but that there was a component breakdown somewhere in the video amplifier

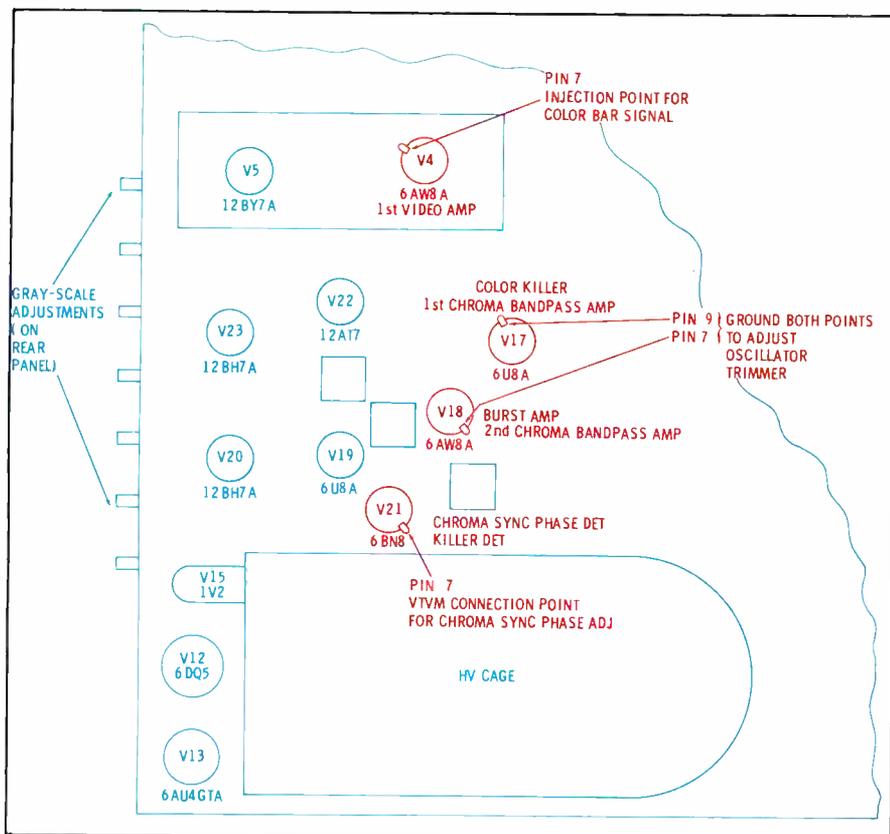


Fig. 1. Color test points provided by tube-socket adapters in RCA CTC7A.



Color Set

or color section. "I'm sorry," I said, "but to do this job right, I'll have to take the receiver into the shop." Since I hadn't yet stocked a spare color-CRT setup that would allow me to bring in the chassis separately, I added, "I'll send two of my boys around in the truck and have them pick it up."

About 10 the following morning, the color receiver arrived, cabinet and all. I promptly pulled the chassis, put a couple of drop cloths on top of the cabinet, and hooked up the chassis to the CRT assembly. By slightly repositioning and resoldering the deflection-yoke leads, I was able to make all connections without disturbing the position of yoke—thereby avoiding a need for complete reconvergence after the job was done. I was also careful to make a good solid contact between the high-voltage supply and the CRT high-voltage anode, in order to prevent corona and arcing.

Signal-Tracing

Setting up the color-bar generator and wide-band scope, I again fed a keyed rainbow signal to the grid of video amplifier V4A, and inspected the results at the grid of first chroma-bandpass amplifier V17. This waveform (Fig. 3) plainly showed that 10 pulses of 3.58-mc signal, corresponding to the row of color bars, were being fed to the bandpass amplifier from the plate of V4. An 11th pulse, the color burst, was also present, although hidden by the vertical-axis scale markings in Fig. 3. The signal was a healthy 4 volts peak to peak.

The output of the second band-pass amplifier had a 12-volt amplitude, with the same waveshape as shown in Fig. 3. Nothing wrong here, either—so I traced the path of the burst signal back from the first bandpass transformer L25 (Fig. 2) to the burst amplifier V18A, and measured the amplified burst pip at the plate of this tube. It also looked good, as illustrated in Fig. 4—170 to 200 volts peak to peak, depending on control adjustments. So I went on to the plate of the chroma reference-oscillator control tube V19A. The signal here (Fig. 5) looked like a perfectly symmetrical oscillator waveform, but its amplitude was only 3 volts peak to peak. Now I appeared to be getting somewhere, for I knew that the control tube normally *shouldn't* have the same output-signal waveshape as the oscillator. Over at the plate of V19B, the oscillator section

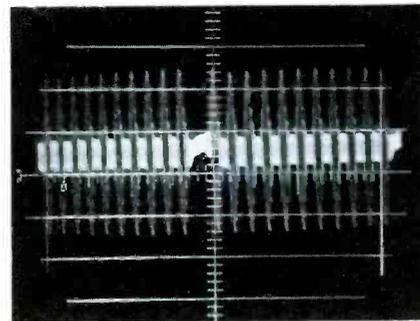


Fig. 3. Keyed rainbow signal as seen at grid of first bandpass amplifier.

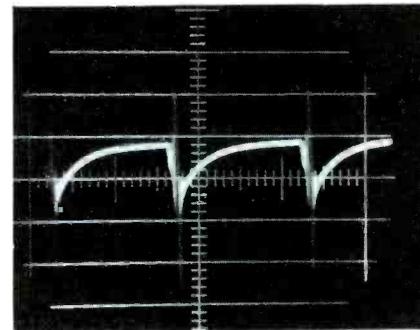


Fig. 4. Normal color-burst signal produces spikes at burst-amplifier plate.

of the tube, I could see that I was hot on the trail of the trouble. Whatever you might call the waveform at this point (Fig. 6), it wasn't a clean 3.58-mc oscillator signal. Furthermore, it was only 15 instead of 60 volts peak to peak. My DC scope also showed something else wrong at the plate. The waveform should have bounced up toward the top of the screen to indicate 275 volts DC, but it actually came to rest at a DC level of only 5 volts.

Repairs Were Easy

My guess was that something had

•Please turn to page 97

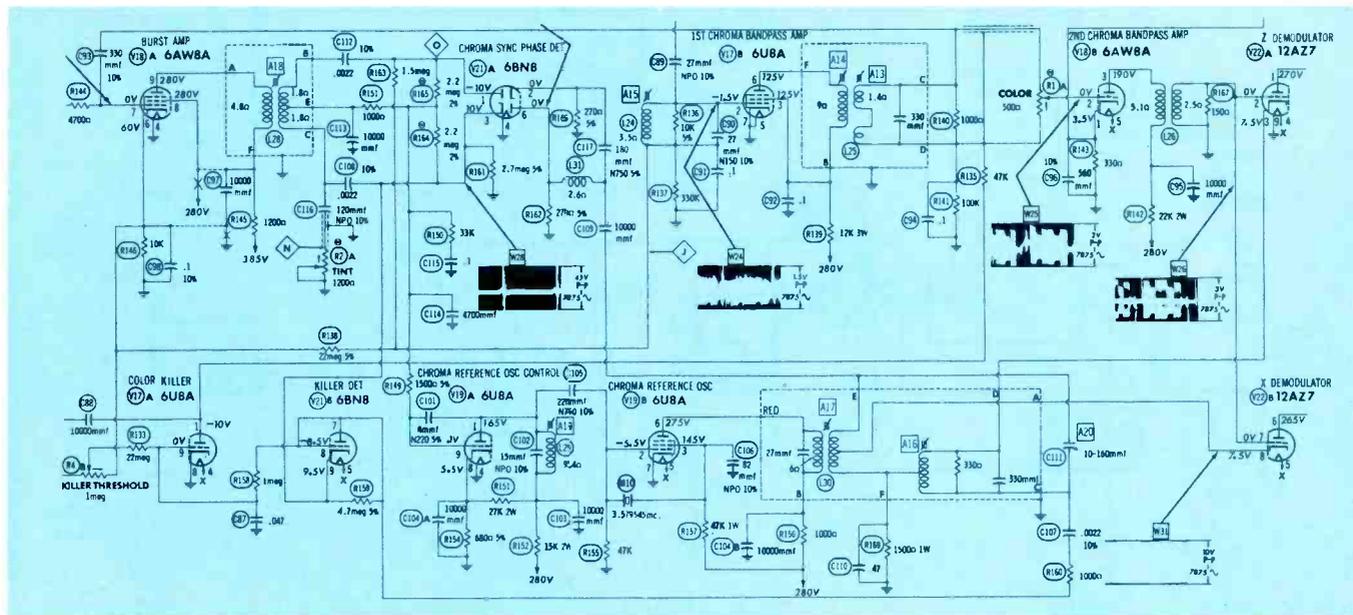


Fig. 2. Five different adjustments affect the chroma-phase alignment of the RCA Chassis CTC7A.



Color Servicing in the Home

Fundamentally, the home-call troubleshooting procedure for color TV receivers is the same as for black-and-white sets. You begin by carefully analyzing the screen to identify the symptom, and then ask yourself which sections of the receiver could develop faults leading to this condition. However, since you have to consider more factors in diagnosing what is wrong with a color set, you need to be especially critical in your observations. Misinterpreting a symptom can cause you to waste much time.

The first step in any color service job is to tune the set in to a monochrome signal and check the quality of the black-and-white picture. Since good color reproduction is impossible without proper luminance information, you must take care of all deficiencies that show up on monochrome operation before you can successfully attack the color problem.

Most such troubles can be handled exactly the same as in servicing conventional black-and-white sets. One important exception concerns the special components used

to prevent color contamination—the purity magnets, static and dynamic convergence adjustments, and color-temperature (screen and background) controls. These items occasionally need adjustment—particularly if the set is moved to a new location, the CRT is replaced, the position of components on the neck of the CRT is disturbed, or gradual drift occurs with aging. However, symptoms of misadjustment are easily recognized and corrected according to procedures specified in service manuals. Adjustments should definitely be made in the home, so the actual operating conditions can be taken into account.

Magnetization of the CRT is not as severe a problem as in the early days of color, but a degaussing coil (Fig. 1) is still handy to have available for home calls. A quick job of demagnetizing the face and surrounding area of the picture tube may lick a color-purity problem and make it unnecessary to adjust any internal magnets or controls. Even if degaussing doesn't help, at least it doesn't do any harm and doesn't take long.

Once you have satisfied yourself that the set is producing a good-quality black-and-white picture, you can usually assume that the trouble is confined within the chroma section of the receiver—so you can concentrate on this section. (The only important exception to this rule is an antenna, RF, IF, or video trouble that discriminates against the color signal.) At this point, you need to decide which one of several possible color troubles is present in the set. The customer's complaint, and visual evidence from a color

broadcast or test stripe, may provide an answer. However, for really accurate diagnosis, the most valuable service aid you can employ on home calls is a color-bar generator. This piece of equipment not only furnishes a reliable signal with which you're thoroughly familiar, but also frees you from dependence on transmitted patterns.

We can classify the observed color symptoms into four groups for convenient discussion: No color, weak or washed-out color, wrong colors, and loss of color sync. Each category calls for a slightly different troubleshooting approach.

No Color

If no tints of any kind can be seen in the picture when the color-bar signal or a color program is fed to the receiver, several controls should be checked for proper settings. The color-gain control (sometimes called a SATURATION or COLOR LEVEL control) may be turned too low for existing signal conditions, so try advancing its setting and see if color comes into view. Be suspicious if the knob must be turned



Fig. 1. Use of degaussing coil is first step in correcting poor color purity.

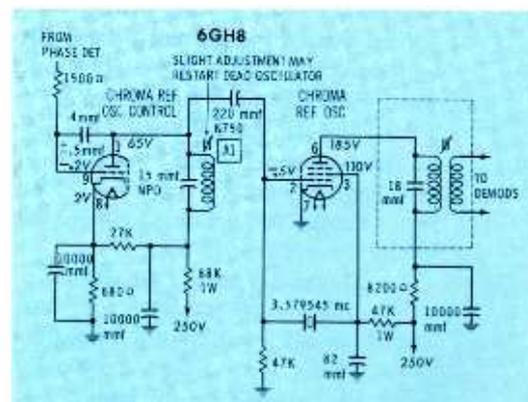


Fig. 2. Slightly retouching A1 sometimes restarts a "stalled" color oscillator.

Can you afford to guess

AT SWEEP, SYNC OR HIGH VOLTAGE TROUBLES?

WHEN IT'S SO EASY TO WALK THE TROUBLE RIGHT OUT OF THESE TIME CONSUMING CIRCUITS STEP BY STEP



SYNC. CIR. & H. SYNC. DISCRIM.	VERT. OSC.	VERT. OUTPUT	VERT. OUTPUT XFORMER.	VERT. DEFLEC. YOKE
HORIZ. OSC.	HORIZ. OUTPUT	HORIZ. FLYBACK XFORMER	2nd ANODE VOLTAGE CIRCUIT	HORIZ. DEFLEC. YOKE



NEW, IMPROVED SENCORE SWEEP CIRCUIT ANALYZER MODEL SS117

PUSH BUTTON TESTING . . .
for Color and Black and White

How many times do you ask, "Why do I take so long finding that sweep trouble?" How often have you wondered whether weak horizontal sync was caused by defective sync circuit, horizontal oscillator, or sync discriminator? Can you quickly isolate adequate width or low 2nd anode voltage to the oscillator, output, flyback transformer, or yoke? How many times have you changed a good yoke by mistake?

The SS117 will pinpoint troubles like these in minutes with tried and proven signal injection, plus yoke substitution for dynamic in-circuit tests. Error proof push button testing enables you to make all tests from the top of the chassis without removal from cabinet for maximum speed and profit on every job.

Here are the checks the SS117 makes . . .

- Horizontal Oscillator: Checked by substituting 15,750 variable output universal oscillator from SS117. Signal can be injected at any spot from horizontal output grid to horizontal oscillator to determine defective component.
- Horizontal Output Stage: Checked by reliable cathode current and screen voltage checks made with adapter socket and two push buttons,
- Horizontal Output Transformer: Checked for power transfer in circuit and read as good or bad on meter.
- Horizontal Deflection Yoke: Checked by direct substitution with adjustable universal yoke on SS117.

- Vertical Oscillator: Checked by substituting 60 cycle synchronized oscillator.
- Vertical Output Transformer: By simple signal injection for full height on picture tube.
- Vertical Deflection Yoke: By signal substitution for full height on picture tube.
- Sync Stages: Checked by synchronizing triggered horizontal SS117 oscillator from any stage. If oscillator synchronizes, sync is O.K.
- 2nd Anode Voltage: A new dynamic check using simulated picture tube load. C.R.T. does not need to be operating for current tests. No interpretations—read direct from 0 to 30 KV.
- External Circuit Measurements: By applying from 0 to 1000 volts AC or DC to external meter jacks. Meter will read DC or peak-to-peak volts. 0 to 300 milliamp scale also provided for measuring horizontal fuse current.
- New features include: Large 0 to 300 microamp meter for minimum circuit loading; all-steel carrying case with full mirror in adjustable cover; two 115 volt AC outlets in cable compartment.

Size: 10¼" x 9¼" x 3½". Wt. 10 lbs.

Model SS117

Dealer Net **\$89⁵⁰**



Sencore Sam says . . . How can you miss . . .

EACH PACKAGED UNIT CONTAINS:

- An Easy to Follow Instruction Book Especially Prepared and Edited by H. W. Sams.
- A complete 33 RPM, 10 inch Permanent Record on "How to Simplify Sweep Circuit Trouble Shooting."

SEE YOUR AUTHORIZED SENCORE DISTRIBUTOR

SENCORE

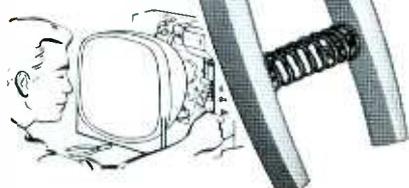
ADDISON, ILLINOIS

Heat absorbing

"THIRD HAND"

EASES
CLOSE
WORK
IN
TIGHT
PLACES

Actual
Size



SELF-GRIPPING

CHANNEL LOCK

No. 46

HEATSORB CLAMP

(HEAT SINK)

A specially designed "heat sink" that prevents heat damage to electronic components during soldering operations. Also serves as handy, self-gripping "third hand" that holds and retrieves small parts in close work. Precision-made of light weight aluminum . . . easy to handle . . . cannot rust . . . Best of all, it's reasonably priced. *Be sure it's a genuine Channel-lock. Look for the trademark on the handle. Write for catalog showing complete line of pliers. Made Only By Champion DeArment Tool Company, Meadville, Pennsylvania.*

very far clockwise before color appears; this may indicate an abnormally weak chroma signal entering the receiver, or weak amplifiers, or both.

Also check the KILLER THRESHOLD control, which regulates the bias on the color killer. If this bias is too low, the incoming color signal is unable to cut off the killer tube, and thus cannot unblock the chroma channel. Although the control setting is not often disturbed by color-set owners, it's well worth checking for the troubleshooting information it can provide.

Some models have a COLOR ON-OFF switch, frequently ganged with one of the controls just described. It shouldn't be in the OFF position, but it might be!

One other control should also be checked. It's so obvious that you may miss it—the fine-tuning control on the tuner. At some settings, the local oscillator in the tuner may be misadjusted so that frequencies 3-4 mc away from the picture carrier (containing the color information) are greatly attenuated or almost completely blocked, even though most other frequencies are allowed to pass through the video IF strip. The set will then produce a fairly good black-and-white picture, but no color.

A defective antenna — with a loose lead, wrong orientation, or poor frequency response on the channel being received — may also cause poor pickup of color without seeming to weaken monochrome reception. The action of the antenna can be checked by observing set performance with a signal fed into the antenna terminals from the col-

or-bar generator. (To avoid some very misleading indications, make sure that the RF output of the generator is not high enough to cause overloading, and that the generator and TV tuner are set to the same channel.) If normal color can then be produced, but poor color is seen on programs, the antenna system is obviously at fault.

Should the color-bar signal fail to produce color on the screen, further isolation testing is necessary. Loss of color could be due to faulty frequency response in the RF, IF, video detector, and possibly the video amplifier, as well as to trouble in the chroma section. To pin down the source, apply the video-frequency output of the bar generator (no RF or IF carrier) to the grid of the first video amplifier. In late-model sets, this chroma take-off test point is generally accessible through a test jack or terminal on the exposed side of the chassis.

If this test causes color to appear, proceed to check the RF-IF tubes. On the other hand, if a bar signal injected into the video amplifier fails to produce colors on the CRT, the first step is to check tubes in the chroma section. As indicated in Chart I, most of these are capable of developing defects that will interrupt either the chroma signal or the locally-generated 3.58-mc reference signal; naturally, a loss of either signal means "no color." The only tubes not likely to produce this symptom are the color-difference amplifiers that apply the color signals to the grids of the picture tube.

Incidentally, adjusting the 3.58-mc oscillator slug (Fig. 2) may fire off a balky oscillator and produce

Chart I—Normal Test Points for Isolating Chroma Trouble

FUNCTION	TUBE TYPE USED: (P) (T) (D)— PENTODE, TRIODE, DIODE SECTION	CHECK IN CASE OF:			
		WEAK OR NO COLOR	SOME COLORS MISSING	WRONG COLORS PRESENT	LOSS OF COLOR SYNC
chroma bandpass amp	6AU6, 6AWBA (T), 6EA8 (P), 6GH8 (P), 6U8A (P)	✓			
chroma demodulator	6JH8, 12AZ7, 12BH7	✓	✓		
color difference amp	6CG7		✓		
color killer	6AWBA (T), 6BN8 (T), 6EA8 (T), 6U8A (T)	✓			
burst amp	6AWBA (P), 6EW6	✓			✓
reference osc & reactance tube	6EA8, 6GH8, 6U8A	✓		✓	✓
chroma sync phase def	6AL5, 6BN8 (D)	✓		✓	✓

NEW

From a deluxe

VTVM to a VOM with the flick of a switch!

Typical examples where a VTVM performs best . . .

- minimum circuit loading
- very high resistance measurement
- measuring peak to peak voltage
- alignment, AGC trouble shooting or ratio detector touch up
- reading 2nd anode voltage
- transistor radio voltage measurements

Typical examples where a portable VOM is best . . .

- instant action when you can't wait for warm up and stabilization. The VTVM can be warming up while you are using the VOM.
- working on a hot TV chassis
- checking anything remote where power isn't available such as antennas, auto, etc.
- reading DC current

And look at these specifications!

Voltage

5 AC and DC ranges from 0 to 1000 volts on both VTVM and VOM
 5 peak to peak ranges from 0 to 2800 volts peak to peak on VTVM
 Zero center scale on VTVM

Resistance

6 ranges from 0 to 1000 megohm on VTVM
 2 ranges from 0 to 1 megohm on VOM

Current

one easy reading scale from 0 to 1000 milliamp on VOM

Batteries

one 1.5 volt "D" cell

Accuracy

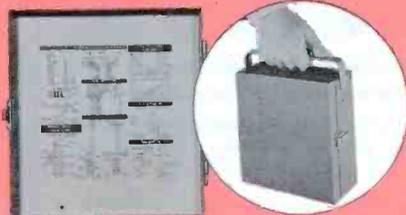
3 percent on DC volts; 5 percent AC volts with a 6 inch, 200 micrcamp, 2 percent meter.

Circuit Loading

10 megohms on VTVM, 15,000 ohms on VOM low range, 5 megohms on highest range.

Special Servicing Features for the Man on the Go!

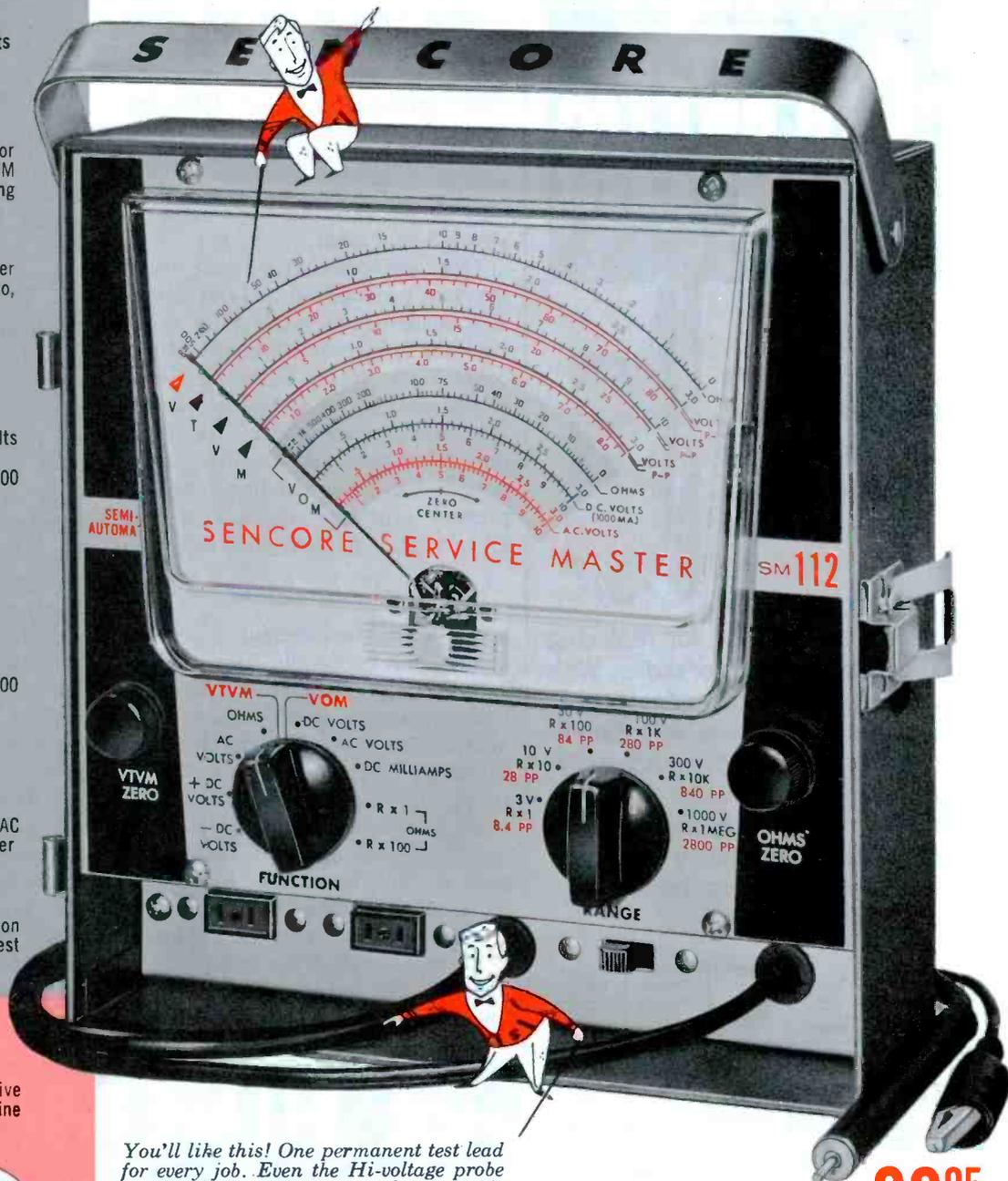
Unbreakable steel case and protective removable cover. No leads to drag or line cord to "hank".



Inside the cover is a real surprise: short cut technical data to make every job easier and faster . . . standard transformer lead color code, fuse resistor burn out voltage, transistor testing guide, etc.

For the First Time in Electronic History . . . a VTVM with laboratory accuracy for bench, lab, or anywhere 115 volt AC current is available . . . flick the function switch and it's a portable VOM that you can use anywhere, anytime.

Look! Another Sencore first . . . automatic scale indication. What a time saver! Rotate the controls and watch the indicating lights follow you. You can't go wrong!



You'll like this! One permanent test lead for every job. Even the Hi-voltage probe fits on the end of it. And look at this storage compartment for test lead and line cord. The two 115 volt AC outlets sure come in handy on service calls!

69⁹⁵

Model SM112 Only

No more than a complete VTVM alone!

Ask your Sencore distributor for the New Combination VTVM-VOM - there is no other!

MADE IN AMERICA



BY AMERICANS

SENCORE

ADDISON, ILLINOIS

BIG LINE OF SMALL SPEAKERS

UTAH'S SEVEN
BASIC "MINIATURES"
FIT BOTH IMPORTED
AND DOMESTIC
TRANSISTOR RADIOS



Here's the solution for replacing speakers in transistor radios. With this complete line of midget speakers (American made with American parts) Utah provides a dependable source for replacements. Wafer-thin baskets, 12 ohm V.C. impedance—for performance equal or better than original speakers.

Model No.	Size	Total Diam.	Basket Depth	Total Depth
SP2T	2" Round	2"	7/8"	1 1/4"
SP22T	2 1/4" Round	2 1/4"	1/4"	3/4"
SP25A	2 1/2" Square	2 1/2" Square	1/2"	1 1/4"
SP25T	2 1/2" Round	2 1/2"	3/8"	7/8"
SP27T	2 3/4" Round	2 3/4"	1 1/2"	1 3/4"
SP27A	2 3/4" Round	2 3/4"	1 3/8"	1 1/4"
SP3T	3" Round	3"	1 1/2"	1 3/4"



color. If so, change the oscillator tube and adjust the circuit.

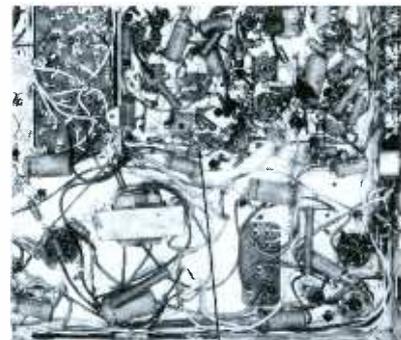
Weak, Washed-Out Color

This second symptom is actually just a milder form of the condition in which colors are lost altogether. The color signal is present, but not in sufficient amplitude to form the proper ratio with the luminance signal. You should check the same controls, tubes, etc., as you would if there were no color at all; but you should expect to find relatively slight misadjustments or tube defects. Antenna faults or mistuned RF-IF circuits which could cause "color drop-out" in fringe areas may simply produce weak color in strong-signal areas.

One chroma-circuit fault very likely to produce washed-out colors is a weak bandpass-amplifier tube. Another is incomplete cutoff of the color killer during color transmissions, resulting in excessive bias on the bandpass amplifier. Resetting the killer-threshold control may remedy the latter condition, but to prevent callbacks, make sure the killer tube is not gassy or leaky.

Wrong Colors

At least two distinct types of troubles are generally lumped under the single complaint, "The colors are wrong"; so it's necessary to analyze this type of symptom very carefully. Your most helpful "quick check" is to adjust the hue (tint) control while watching the picture. See if all tones can be made to appear normal; better yet, use a signal from a color-bar generator and attempt to reproduce the sequence of colors specified for your instrument. If you cannot obtain correct hues, stop and ask yourself, "Do all



RUN LEAD TO OTHER SIDE OF CHASSIS FROM THIS POINT

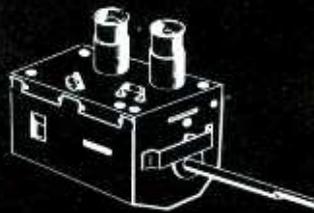
Fig. 3. For easier AFC adjustment, solder extension lead to the point shown.

the colors seem to be there?" If not—for example, if the picture is noticeably deficient in shades of red—this suggests that one or more CRT guns are receiving insufficient color-signal drive because of a defect during or after chroma demodulation. The most likely trouble is a failure of one color-difference amplifier, or a malfunction affecting only one of the two demodulator stages.

If all colors are present, but appear in the wrong places on the screen, this implies that the 3.58-mc reference oscillator is producing a signal of the wrong phase. The hue control can normally produce a certain amount of phase shift. If it doesn't, or if it must be set near the end of its range to obtain correction, substitute for the reference oscillator/control tube and chroma sync phase detector. When replacing these tubes, be sure to readjust the slugs in the associated circuits. In recent color TV models, you can easily reach the necessary test points for performing touch-up adjustments in the home according to a simplified procedure using only a bar generator and VTVM, plus a couple of jumper wires. (For addi-

TV TUNERS ^{*} REBUILT OR EXCHANGED

ALL TYPES



\$9.95

Including all parts and labor
(except broken wafers—billed at cost)

- Normally shipped same day received
- 90 day full guarantee
- U/V combinations \$17.95

FREE—!! Mailing carton sent to you on request

Phone REpublic 3-9189

L. A. TUNER EXCHANGE

4611 West Jefferson Blvd.
Los Angeles 16, California

Wake Up

A new day is dawning in electronics.



Transistors are here to stay... they are now being used everywhere; in radio, television, Hi-Fi, intercom, and in nearly all new electronic equipment...

Why put off transistor circuit servicing any longer... there's gold in them thar hills. But you must be equipped to do the job fast and efficiently. Here are the tools that you will need.



NEW SENCORE TRANSI-MASTER

This Tester will analyze the entire circuit in minutes and test transistors in-circuit or out of circuit. Here is how you can pin point troubles step by step with the TR110.

First, check the batteries with the 0 to 12 volt meter. If the batteries are O.K., check the current drain with the 0 to 50 milliamp meter. A special probe is provided so that you do not need to break the circuit. Excessive current indicates a short; low current indicates an open stage or cracked board. All PF schematics indicate average current.

If trouble is not located by now, isolate the trouble to a specific stage by touching the output of the harmonic generator to the base of each transistor and note spot where sound from speaker (or scope where no speaker is used) stops or becomes weak. The generator becomes a sine wave generator for audio stages to help find distortion.

If trouble points to a transistor, check it in a jiffy with the exclusive in-circuit power oscillator check provided by the TR110. A special probe is also provided for this.

If the transistor checks bad in-circuit, remove it and give it an out of circuit check with the oscillator check or the more accurate DC check. The DC check is provided for comparison reasons, experimental or engineering work and to match transistors in audio output stages. Beta (current gain) is read direct or on a good-bad scale for service work.

DEALER NET. ONLY **\$49⁵⁰**



Tests all transistors in-circuit or out-of-circuit

Model TR110

It's a COMPLETE TRANSISTOR TESTER

- SIGNAL TRACER • VOLTMETER
- BATTERY TESTER • MILLIAMMETER



NEW SENCORE TRANSISTOR AND DIODE CHECKER

Here is a low cost tester that has become America's favorite. The TR115 provides the same DC out of circuit checks as the TR110; leakage and current gain. Beta (circuit gain) can also be read direct or as good or bad. Opens or shorts in the transistor are spotted in a minute. The TR115 checks them all from power transistors to the small hearing aid type. Japanese equivalents are listed also. This famous tester is used by such companies as Sears Roebuck, Bell Telephone and Commonwealth Edison. New circuits enable you to make service checks without set-up charts even though charts are provided for critical checks.



Model TR115
Dealer Net
\$19⁹⁵



SENCORE BATTERY ELIMINATOR AND TROUBLE SHOOTER

For replacing batteries during repair. Many servicemen say that they wouldn't service transistor circuits without this power supply. The tried and proven PS103 is a sure fire answer. It can be used to charge the nickel cadmium batteries as well. Dial the desired output from 0 to 24 volts DC and read on meter. Low ripple insures no hum or feedback. Total current drawn can also be read on the PS103 by merely flicking the function switch to milliamps. The PS103 is the only supply that will operate radios with tapped battery supplies such as Philco, Sylvania and Motorola. No other supply has a third lead.



Model PS103
Dealer Net
\$19⁹⁵

Now in stock at your Authorized Sencore Distributor



SENCORE

ADDISON, ILLINOIS

NEW SAMS BOOKS

NEW & REVISED—2nd EDITION
OF THE HOWARD W. SAMS

Transistor Substitution Handbook

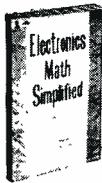


- ★ OVER 7500 DIRECT SUBSTITUTIONS
- ★ OVER 1000 NEW SUBSTITUTIONS

Includes basing diagrams, polarity identifications and manufacturers for over 3100 transistor types... PLUS over 7500 direct substitutions!

Completely revised for maximum help in selecting suitable transistor replacements. Special section shows 700 American replacements for Japanese transistors, PLUS a semiconductor diode and rectifier guide showing over 600 substitutions. Explains why substitution is possible; when it is appropriate and when not; precautions to observe. Covers all types of transistors, U.S. and foreign, for every type of use. 96 pages; 5 1/2 x 8 1/2" Only **\$1.50**

Electronics Math Simplified



Now—Alan Andrews provides a simplified approach to an understanding of the advanced arithmetic, algebra, and trigonometry required for a solid background in basic electronics. Gives step-by-step examples relating to problems dealing with resistance, capacitance, inductance, wire measurements, frequency, tube characteristics, transformers, modulation, meters, antennas, etc. Includes practical exercises, with answers in special Appendix. Invaluable to anyone studying for second and first-class FCC phone licenses. Ideal for home study or classroom. 224 pages, 5 1/2 x 8 1/2". Only... **\$4.95**

with answers in special Appendix. Invaluable to anyone studying for second and first-class FCC phone licenses. Ideal for home study or classroom. 224 pages, 5 1/2 x 8 1/2". Only... **\$4.95**

BASIC ELECTRONICS SERIES:

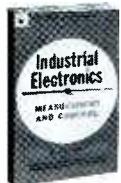
Detector & Rectifier Circuits



Latest volume in Capt. T. M. Adams' unique series which shows dynamic circuit diagrams in four colors demonstrating exactly what happens during each moment of circuit operation. Accompanying text describes each "moving" circuit action as shown in the diagrams. Eight chapters: Rectification & Detection; Half-Wave Rectifier Circuits; Full-Wave Rectifier Circuits; Diode Detector Circuits; Diode Detector with AVC; Grid-Leak Detectors; Discriminator Circuits; Ratio Detector Circuits. 128 pages, 5 1/2 x 8 1/2". Only **\$2.95**

Circuits; Diode Detector with AVC; Grid-Leak Detectors; Discriminator Circuits; Ratio Detector Circuits. 128 pages, 5 1/2 x 8 1/2". Only **\$2.95**

Industrial Electronics Measurement & Control



Ed Bukstein describes the electronic devices most commonly used for industrial measurement and control. Explains techniques for measuring: pressure; illumination and color; temperature, humidity, liquid level, time and speed; frequency, dimensions, rate of flow, etc. Describes methods for electronically controlling: time delay, tempera-

ture; motor speed; weld current; positioning; illumination; tension; etc. Covers devices such as Bourdon tubes, servomanometers, radiation pyrometers, binary counters, ratemeters, radioactivity gauges, anemometers, etc. Provides a ready and valuable reference source for industrial engineers, technicians, and maintenance personnel. 192 pages, 5 1/2 x 8 1/2". Only... **\$3.95**

HOWARD W. SAMS & CO., INC.

Order from your Sams Distributor today, or mail to Howard W. Sams & Co., Inc. Dept. L-31
1720 E. 38th St., Indianapolis 6, Ind.

Send me the following books:

- Transistor Substit. Handbook Vol. 2 (SSH-2)
- Electronics Math Simplified (MAT-1)
- Detector & Rectifier Circuits (BED-1)
- Indust. Electronics Measure, & Control (IND-1)

\$ _____ enclosed. Send Free Book List

Name _____

Address _____

City _____ Zone _____ State _____

IN CANADA: A. C. Simmonds & Sons, Ltd., Toronto 7
(outside U.S.A. priced slightly higher)

tional information on this in-home adjustment method, see "Across the Bench" in this issue.) If some of your customers have earlier models, you might consider installing extension leads the next time their sets are in the shop, to facilitate future adjustments. For instance, in the RCA Chassis CTC7, a jumper could be connected between the chroma AFC diode resistors (Fig. 3) and brought out to the exposed side of the chassis. This test point, plus a few tube-socket adapters, would allow you to perform basic chroma-sync adjustments with the chassis in the cabinet.

Loss of Color Sync

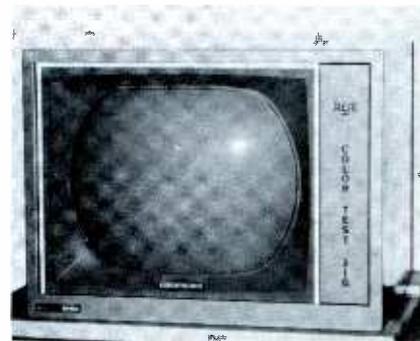
The final symptom to be discussed is the most nearly "self-localizing" of all chroma troubles. It overlaps with the "wrong colors" symptom to some extent, but is distinctly different in that the colors are broken up into horizontal or diagonal stripes or patches not corresponding to the video information. The trouble is simply that the reference oscillator is not operating on the correct frequency. If the color patches are stationary, the oscillator is locked in on some erroneous frequency; this is like an exaggerated case of the phase error described in the last section. Replacement of the oscillator/control tube or chroma phase detector may clear up the problem.

If the patches are not stationary, but constantly drift—producing a sort of "juke-box" effect—this means the oscillator is not synchronized with the incoming color-burst signal. As in black-and-white horizontal sync problems, the fault may be either a deficiency in the oscillator network itself, or a weak sync signal reaching the phase detector. Therefore, you should not stop at replacing the oscillator and phase detector tubes, but should also check the burst amplifier.

If Tubes Don't Help

The amount of in-home color servicing you can do, beyond checking controls and tubes, depends on the nature of the trouble and on the troubleshooting techniques you apply. You can obtain useful information about many

troubles by making voltage checks at a number of points which are accessible without pulling the chassis. In some cases, you may even be able to reach and replace a bad part without undue fuss. However, it's often better to haul a color set into the shop than to attempt in-home repairs and wind up with the chassis, tools, and test equipment spread all over the customer's living room.



Shop Color Tube

When servicemen join in a gab session, and the talk rolls around to color TV, you'll often find that the conversation dwells as much on the size and handling of color TV cabinets as on the technical details of the circuits.

"Do you send out two men to pull a color set into the shop?"

"I try to do all the work I can in the home to avoid lugging the cabinets around."

"Have you tried pulling just the chassis and using your scope as an indicator?"

As a solution to the problem of providing bench service for color sets, RCA Parts and Accessories Div. of Camden, N.J. has just announced the availability of a *Color Test Jig*. Identified as stock number 11A1015, the unit consists of a tri-color CRT and associated components mounted in a special cabinet for bench use. Thus, if you're looking for a new way to deal with the physical problems of color TV service, the test jig offers a complete CRT bench setup.

In the parts line, RCA has developed a basic replacement stock for both the CTC10 and CTC11 chassis, and is now offering a kit of parts complete with a rack. Five extension cables have also been made available to meet various needs for use in servicing color TV receivers. ▲

BUY "ET"



THE TRANSISTOR LINE THAT TUNG-SOL TAILORED TO YOUR NEEDS

- LOW INVENTORY ■ HIGH TURNOVER
- RELIABILITY ■ PROFIT
- CUSTOMER SATISFACTION

"ET" is your guide to the compact transistor line engineered and packaged specifically for entertainment replacement. You can make just about every radio and TV replacement from only a handful-size inventory. Eleven PNP and NPN types replace hundreds of older numbers.

Each package is plainly marked with the type of service as well as the part number to save you time in selecting the units you need. Every Tung-Sol

transistor is fully warranted. Tung-Sol takes *your* responsibility seriously and spares no effort to provide the very highest in transistor performance. So make your transistor purchases with an eye to convenience, profit and customer satisfaction. Tell your supplier you'd rather have Tung-Sol "ET" transistors. Write for the Tung-Sol Transistor Interchangeability Guide. Tung-Sol Electric Inc., Newark 4, New Jersey

 **TUNG-SOL®**

A TYPE FOR EVERY JOB

PNP TYPES

Low power

- ET1 Mixer/oscillator/converter
- ET2 IF amplifier
- ET3 AF amplifier 6v.
- ET4 AF amplifier 12v.
- ET5 AF amplifier 9v.

Medium power

- ET6 AF power amplifier

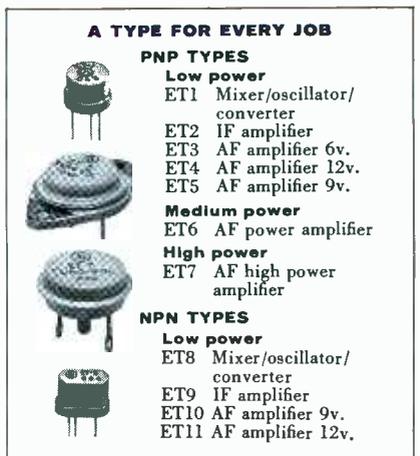
High power

- ET7 AF high power amplifier

NPN TYPES

Low power

- ET8 Mixer/oscillator/converter
- ET9 IF amplifier
- ET10 AF amplifier 9v.
- ET11 AF amplifier 12v.



ANNOUNCEMENT:

TACO joins JERROLD

**to bring you an antenna line that will put new power
in TV/FM reception... and in your antenna sales**

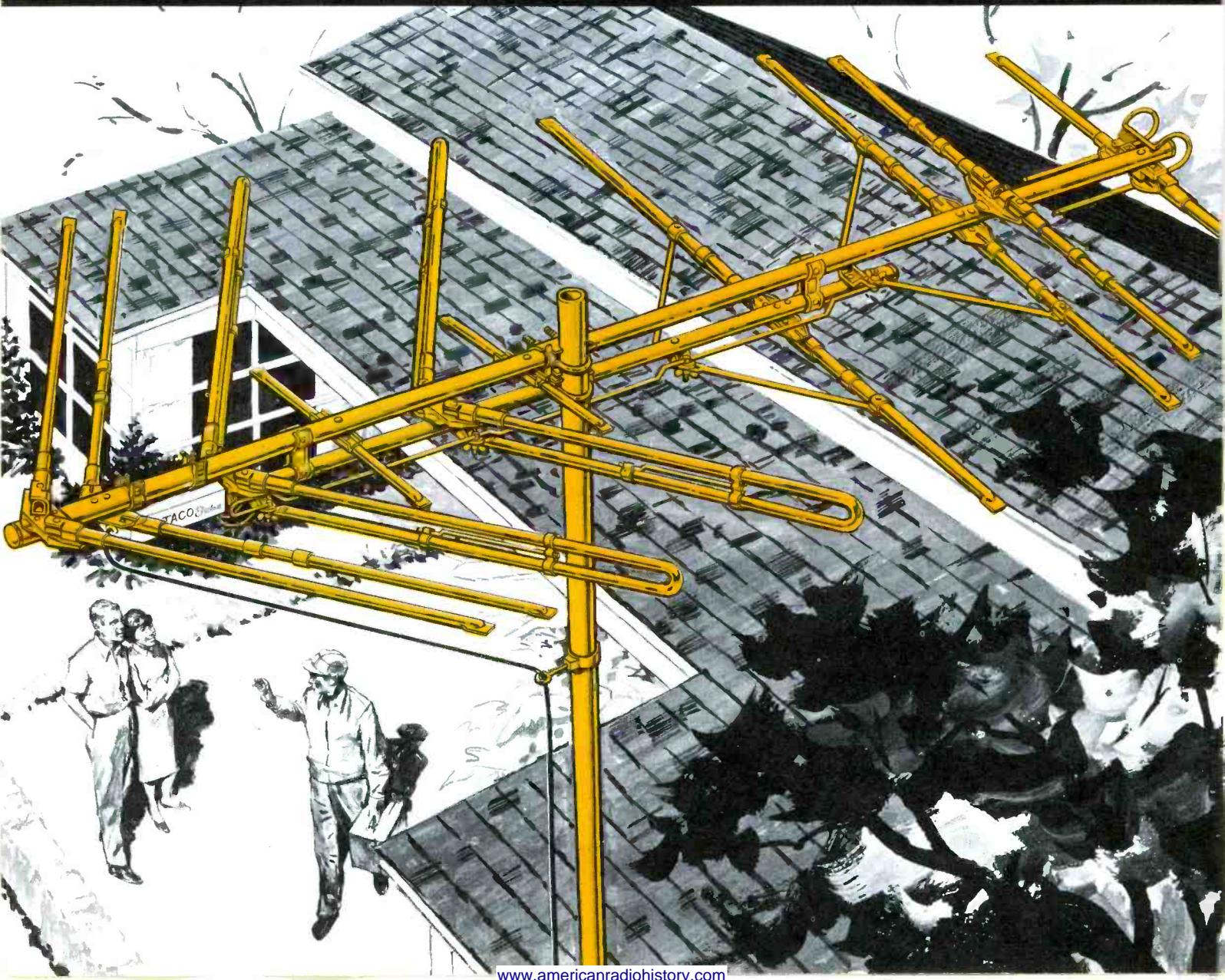
This news is of the greatest importance to you if you sell and install home television antennas.

There's a great new leader in the antenna business. TACO, internationally recognized by industry, the military, and the TV serviceman as the manufacturer of the best-performing, most rugged of antennas, is now a part of JERROLD ELECTRONICS CORPORATION, the industry's leader in TV/FM reception aids.

How does this news affect you? How will the new Taco-

Jerrold combination help you sell more antennas—better antennas—than ever before?

Here's how: By giving you, in the T-BIRD and the T-BIRD ELECTRA, the very best antenna line in the business today—a line having all the quality and precision that Taco builds into tough satellite-tracking, defense, and commercial antennas... a line that's tops in engineering, in performance, in pricing, in packaging, in promotion, and in aids to you.

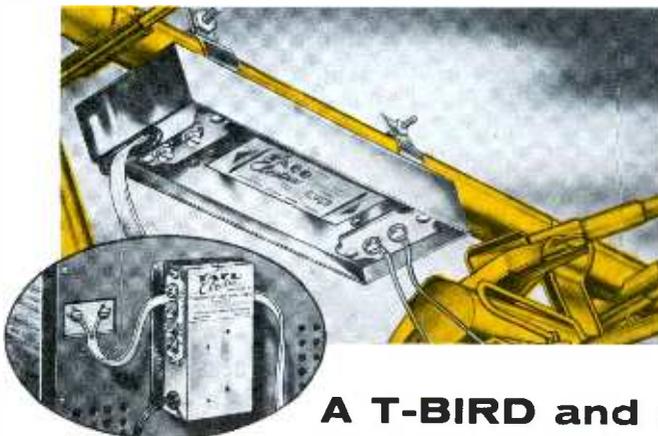
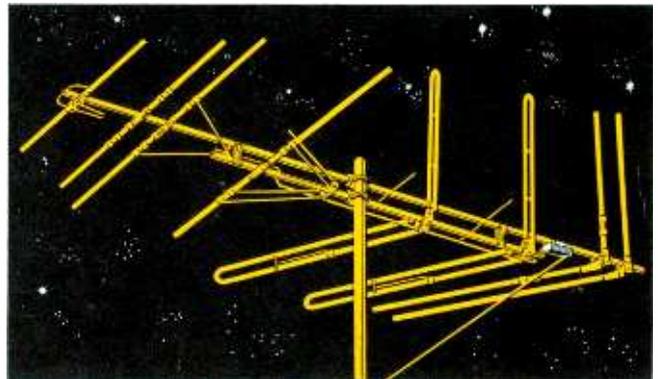


HOW THE NEW



combines the leading talents in electronics and antenna design

- Built rugged like all TACO antennas, the T-BIRD and T-BIRD ELECTRA use 7/16" tubing, sturdiest in the industry.
- "Delta" ("T"-match) feed system gives sharpest forward pattern — on every channel. Better than 10:1 front-to-back ratio.
- 100% rustproof. Gold-anodized and iridited (a conductive coating). Exclusive stainless-steel U-bolts.
- Engineered to eliminate unnecessary elements or harnesses that add weight and invite wind damage.
- Chrome-alloy aluminum used throughout—twice as strong as other antennas.
- Complete pre-assembly makes installation fast, sure and permanent.



- TACO transistor preamplifier, designed by Jerrold, is matched to perform ideally with T-BIRD ELECTRA.
- Highest gain on both high and low channels, lowest System Noise Figure.
- No batteries, no polarity problems when connecting downlead.
- Remote a-c power supply feeds two sets.
- No maintenance worries—put up the T-BIRD ELECTRA and forget it!
- Every TACO antenna carries, in writing, a one-year warranty.

A T-BIRD and a T-BIRD ELECTRA for every home

With six models of T-BIRD (non-powered) and three models of T-BIRD ELECTRA (powered) antennas, TACO gives you the right antenna for every suburban-to-fringe-area requirement. Performance, reliability, and long life found in no other antenna at any price.

G990-8
The world's most powerful electronically-amplified antenna. Gets pictures and sound where others fail. Supplies the finest signal source for multi-set installations.
List \$109.75

G990-6
Just right for installations not requiring the ultra-powerful gain of the G990-8. Will provide sparkling clear, sharp pictures in black-and-white or color, on one, two, or more sets.
List \$91.75

G990-5
Lowest-price T-BIRD ELECTRA. Offers all the inherent advantages of transistor amplification plus a matched system of amplifier and antenna. Brings in stations beyond the reach of ordinary antennas.
List \$79.75

WATCH TACO GO!

The new T-BIRD and T-BIRD ELECTRA are without doubt the line to watch in the big months ahead. When you're handling the TACO line, you'll be watching from the driver's seat. So don't be passed by—get all the facts on T-BIRD and T-BIRD ELECTRA antennas — the line that's making antenna history! Ask your distributor, or write for details.



TECHNICAL APPLIANCE CORPORATION

A Subsidiary of Jerrold Electronics Corporation
Dept. JTD-2, Sherburne, New York

UNDERSTANDING COLOR SYNC

by Thomas A. Lesh

How chroma phase-detector and reference-oscillator circuits operate.

Chroma information is applied to the composite color-TV signal by both amplitude- and phase-modulating a 3.58-mc subcarrier, which in turn modulates the picture carrier. However, only the sidebands of the chroma signal are actually transmitted; the subcarrier itself is suppressed at the transmitter. Before demodulation can be performed by the receiver, the subcarrier must be duplicated by a 3.58-mc local oscillator. The color-sync section of

the receiver (see typical circuit, Fig. 1) includes this oscillator, plus the control circuitry necessary to keep it in step with the subcarrier generator at the transmitter.

A sample of the original subcarrier, called the burst signal, is transmitted immediately after each horizontal sync pulse in the composite color signal to provide for color synchronization. Burst amplifier V18 acts as a "color-sync separator" to recover the burst from the composite

signal. This tube is fed a combination of burst and chroma information (Fig. 2A) from the video amplifier or chroma-bandpass section. It also receives a keying pulse (Fig. 2B) which permits it to conduct only during horizontal retrace time; therefore, the output of V18 contains only the color burst (Fig. 2C).

The amplified color-burst signal is developed across burst transformer L26, which is tunable for maximum transfer of signal energy from pri-

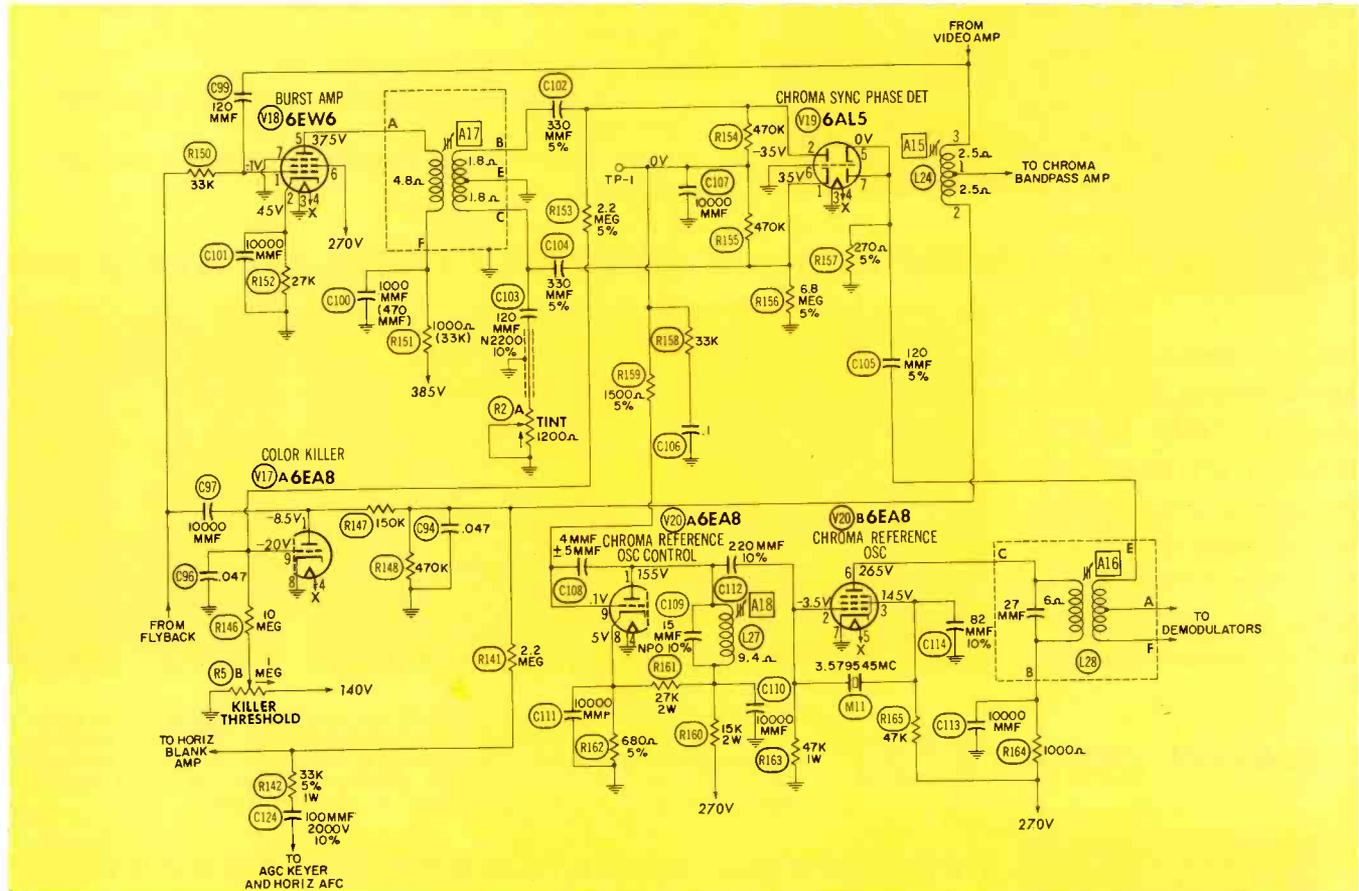


Fig. 1. Typical reference-oscillator, control, and phase-detector circuits.

TESTS
All TV and Radio
Tubes—Old and New

TESTS
the Nuvistors

TESTS
the New 12-Pin
Compactrons

TESTS
the New 10-Pin Tubes

TESTS
European Hi-Fi Tubes,
Voltage Regulators, and
Most Industrial Types

TESTS
for True Dynamic
Mutual Conductance (Gm)

**OBSOLESCENCE
PROOF**
Designed for Maximum
Use Today and
Tomorrow



**NEWEST
FINEST
MONEY-MAKER**
*for Professional
Servicemen*

Multiple-Socket Speed with Gm Accuracy **PLUS** OBSOLESCENCE PROTECTION

Model 700 DYNA-QUIK

*Fastest, Most Complete
Most Up-to-Date*

DYNAMIC MUTUAL CONDUCTANCE TUBE TESTER

*See your B&K Distributor,
or Write for Catalog AP18-R*

TESTS BOTH OLD AND NEW TUBE TYPES—SELLS MORE TUBES PER CALL
Again you benefit from proved B&K techniques! This up-to-date, obsolescence-proof, professional instrument is designed for maximum use today and tomorrow. Provides multiple-socket section to quick-check most of the TV and radio tube types the true dynamic mutual conductance way—plus simplified switch section to check new tube types in Dyna-Quik emission circuit. Also includes provision for future new sockets.

Makes test under set-operating conditions. Checks each section of multi-section tubes separately. Checks for all shorts, grid emission, leakage and gas. Makes quick "life" test. Exclusive adjustable grid emission test provides sensitivity to over 100 megohms.

Makes complete tube test in seconds. Checks average set in a few minutes. Discovers weak tubes that need replacement. Satisfies more customers. Sells more tubes. Saves call-backs. Insures your reputation.

Patented automatic compensation for line voltage variation. Large 4½" plastic meter with easy-to-read "Replace-Good" scale. Lists most commonly used tube types with settings directly on socket panel for fastest operation. Complete listing in reference chart in cover. Phosphor-bronze contacts for long life. 7, 9, and 10-pin straighteners on panel. Operates on 117 volts 50-60 cycle a.c. Hand-some leatherette-covered carrying case. Size: 16½" x 15¾" x 5¾" deep. Net wt: 15½ lbs.

Net, \$169⁹⁵

NEW TUBE INFORMATION SERVICE

Available every 3 months, on subscription,
for all B&K Dyna-Quik Tube Testers



B & K MANUFACTURING CO.

1801 W. BELLE PLAINE AVE • CHICAGO 13, ILL.
Canada: Atlas Radio Corp., 50 Wingold, Toronto 19, Ont.
Export: Empire Exporters, 277 Broadway, New York 7, U.S.A.

Now . . .
Superb UHF
Reception
(Channels 70-83)
Where Other
Methods
Fail



BLONDER-TONGUE ULTRA BOOSTER

Mast-Mounted UHF Booster

with remote power supply

The Ultra Booster has proved itself under fire in the MPATI* area where it is being used in school TV systems to receive the Stratovision educational TV broadcasts. In case after case, where schools were unable to get usable pictures – the UB solved the problem and provided clear reception.

The UB is another product from the world's most experienced UHF product manufacturer, Blonder-Tongue. There's nothing like it on the market today. Mast mounted to take advantage of the maximum signal-to-noise ratio available at the antenna, it provides 14 db minimum gain for UHF channels 70 to 83. The UB uses two low-noise frame grid tubes. The remote power supply sends a 'safe' 24 volts of AC power to the mast mounted UB amplifier on the same downlead which carries the signal. The UB is enclosed in a weather-proof housing with a swing-down chassis for easy servicing.

The applications of the UB are unlimited – in master school systems in the MPATI area – for homes (on channel 70-83) where all other means of providing sharp, clear UHF reception have failed – and in translator areas to extend the range of UHF translator transmission where VHF signals are repeated by UHF translators. Model UB, list \$84.50.

If you are in a UHF area, contact the world's most experienced manufacturer of UHF products. Free 8-page catalog, write dept. PF-11.

*Midwest Program on Airborne Television Instruction.

engineered and manufactured by

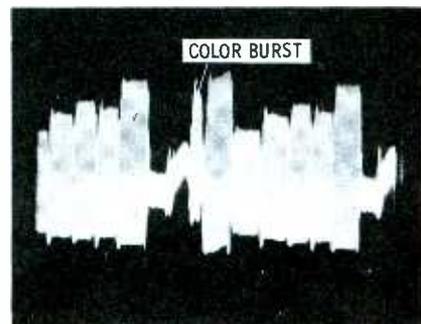
BLONDER-TONGUE
 9 Alling St., Newark, N. J.

Canadian Div.: Benco Television Assoc., Toronto, Ont. Export: Morhan Export Corp., N. Y. 13, N. Y.
 home TV accessories • UHF converters • master TV systems • closed circuit TV systems

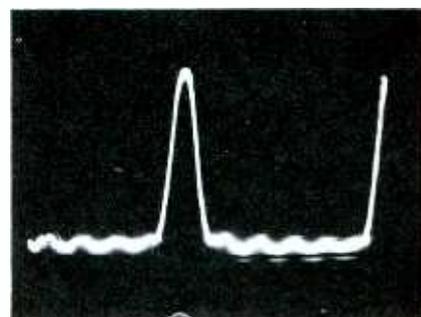
mary to secondary. The signal induced in the secondary is applied to phase detector V19, where its phase is compared with that of an output signal from the 3.58-mc reference oscillator V20B. Any error in the frequency or phase of the reference-oscillator signal is detected by V19, and a correction voltage is applied to control stage V20A. This correction voltage causes the control stage to alter oscillator operation until it is running at the proper frequency and phase.

Chroma Reference Oscillator

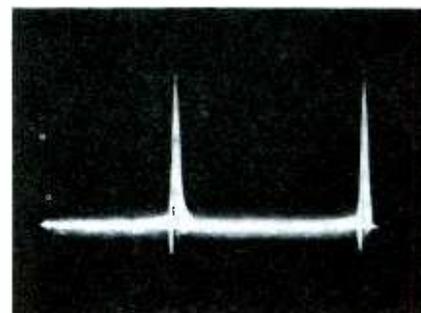
Before considering exactly how V20A exerts control, we should more closely examine the operation of the reference oscillator. The 3.58-mc output of this stage must enable the receiver to accomplish the reverse of the modulation process which takes place at the transmitter. Since the chroma information is originally obtained by combining two 3.58-mc signals which differ in



(A) Combined chroma burst input.



(B) Keying-pulse input.



(C) Amplified burst output.

Fig. 2. Burst-amplifier waveforms.

DOUBLES YOUR EFFECTIVE MANPOWER



Fix "Tough Dogs" Fast!

Save Half Your Time!

Step Up Your Profit!

B&K NEW
MODEL 1076

TELEVISION ANALYST

for Black & White and Color



Check all circuits—Pinpoint any TV trouble...in minutes

**By Easy Point-to-Point Signal Injection,
You See the Trouble on the TV Screen and
Correct it—Twice as Fast and Easy!**

There's no longer any need to "lose your shirt" (and customers)—and worry about the lost hours you never recover—on "tough dogs" or even intermittents. The remarkable B&K Analyst enables you to inject your own TV signal at any point and watch the resulting test pattern on the picture tube itself. Makes it quick and easy to isolate, pinpoint, and correct TV trouble in any stage throughout the video, audio, r.f., i.f., sync, and sweep sections of black & white and color television sets—including intermittents. Makes external scope or wave-form interpretation unnecessary. Most useful instrument in TV servicing! Its basic technique has been proved by thousands of successful servicemen the world over.

The Analyst enables any serviceman to cut servicing time in half, service more TV sets in less time, really satisfy more customers, and make more money.

Model 1076. Net, \$29995

Available on Budget Terms. As low as \$30.00 down.

Combines all the features of both
the Model 1075 and Model A107

- | | |
|--|--------------------------------------|
| COMPLETE R.F. and I.F. | HI-VOLT INDICATOR |
| VIDEO TEST PATTERN | YOKE and HI-VOLTAGE TRANSFORMER TEST |
| COMPOSITE SYNC | Also Now Provides: |
| FM MODULATED AUDIO | SWITCH-TYPE TUNER |
| COLOR PATTERNS | NEGATIVE BIAS SUPPLY |
| HORIZONTAL and VERTICAL PLATE and GRID DRIVE | AGC KEYING PULSE |
| B+ BOOST INDICATOR | PICTURE TUBE MODULATION |



B & K MANUFACTURING CO.
1801 W. BELLE PLAINE AVE • CHICAGO 13, ILL.
Canada: Atlas Radio Corp., 50 Wingold, Toronto 19, Ont.
Export: Empire Exporters, 277 Broadway, New York 7, U.S.A.

See Your B&K Distributor or Write for Bulletin AP18-R

QUICK PROFITS!

with this New **Mosley**
2-SET COUPLER

E
A
S
I
E
R

T
O

I
N
S
T
A
L
L

2 SETS --- 1 ANTENNA
with the New
MOSLEY PC-2 COUPLER
for TV and FM

Mosley PC-2 Two-Set Coupler
MADE IN U.S.A.

TV ANTENNA
FM

SET 1 SET 2

MOSLEY PC-2
2 SET ANTENNA
COUPLER
MADE IN U.S.A.

ANT FM

Low Loss Printed Circuit
Factory Full-Proof Connections
Performance Engineered

List Price

You'll enjoy installing the new PC-2 two-set coupler because your work and time will command a better price.

These neat new couplers, with a compactly engineered printed circuit design, provide high inter-set isolation and low forward loss — result more satisfied customers. PC-2 Dealer Net, \$1.42 each and Suggested List, \$2.37 each.

Pick up one of these handy cards at your Mosley distributor or write.



4610 NORTH LINDBERGH BLVD.
BRIDGETON, MISSOURI

phase by 90°, the local oscillator in the receiver must also provide two out-of-phase signals. These are fed from the oscillator plate circuit to a pair of chroma demodulators, which are keyed into conduction during peaks of their respective 3.58-mc signals. (The receiver of Fig. 1 utilizes the negative peaks, since the signals are fed to the cathodes of the demodulators.) By this process, the amplitude of the incoming chroma signal is sampled at two specific times in each cycle, to determine what proportion of the incoming signal at a given instant was contributed by each of the two original signals. From this information, the demodulators and later circuits are able to reconstruct the three color-difference signals used for driving the control grids of the tricolor CRT.

The oscillator (pentode section of V20) is a crystal-controlled, electron-coupled type. Its tuned plate circuit includes the primary of L28. The secondary of this transformer contains a phase-shifting network (adjustable in older sets, but not in newer models) which establishes the proper phase angle between the two outputs of the oscillator circuit.

Oscillator-Control Stage

The 3.58-mc crystal signal in the reference - oscillator grid circuit is applied to the plate of control tube V20A. A small amount of this signal is also fed back through C108 to the grid of the control tube, resulting in the development of an AC grid voltage which leads the signal voltage from the crystal. Thus, V20A acts as a capacitive reactance shunting the crystal circuit.

V20A conducts continuously. Its nominal level of plate-current conduction — and hence the nominal

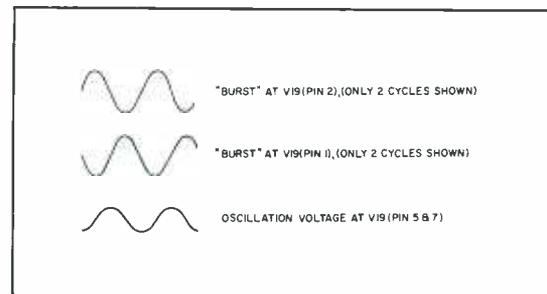


Fig. 3. Reference signal is normally in quadrature with incoming signals.

value of capacitance it contributes to the resonant circuit of the oscillator—corresponds to a grid voltage of approximately zero. When a positive or negative DC error voltage is fed from phase detector V19 to the grid of V20A, the plate current increases or decreases by an amount calculated to bring about the desired shift in oscillator phase. A positive-going change in grid voltage serves to increase the effective capacitance across the crystal circuit, thereby retarding the oscillator; a negative-going grid voltage has the opposite effect.

Phase Detector

The phase detector is similar to those commonly used with horizontal sweep systems. The burst input appears across the secondary of L26, the signal at terminal C being equal in amplitude to the signal at terminal B, but 180° out of phase with it. The feedback from the oscillator is taken from terminal E of L28 and fed to pins 5 and 7 of V19 through C105. The system is said to be in balance when the oscillator signal fed to the phase detector is in quadrature (90° out of phase) with the two burst voltages, as shown in Fig. 3. Under these circumstances, the oscillator signal goes through zero as the burst signal reaches maximum. The two

PRECISION TUNER SERVICE

P. O. BOX 272 1200 S. WALNUT ST.
BLOOMINGTON, IND. EDISON 99653

7.50
V or U
COMBO PLUS
9.95 POSTAGE

6 MONTH WARRANTY

All Types T.V. Tuners Cleaned, Repaired and Aligned to Factory Specifications. Same day in shop service on most Tuners. Price Includes Minor Parts, Major Parts at Cost Price. We use Original Parts if possible. State Make Model and Enclose all Parts and Tubes. Pack Well and Insure.

ALSO HAVE LARGE STOCK OF EXCHANGE TUNERS, WRITE FOR TYPES AND PRICES.

INDIVIDUAL
WIDE-VIEW
SCALE FOR
EACH RANGE
GIVES

Quick, Direct, Error-Free Readings *without Multiplying!*



New VTVM DYNAMATIC 375 Automatic Vacuum-Tube Voltmeter

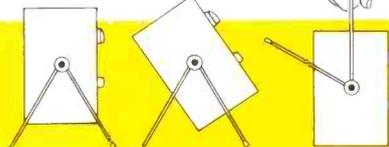
- Individual Full-Size Scale for Each Range
- Range Switch Automatically Sets Correct Scale
- Only One Scale Visible at Any One Time
- All Scales Are Direct Reading
- No Multiplying . . . No False Readings
- Includes DC Current Ranges, too

Here's another exciting first by B&K. With direct-reading single scales, this professional automatic VTVM makes it easier, faster than ever to read the exact answer accurately on the correct scale . . . without reading difficulty, calculation, or chance of error. Greatly simplifies true reading of peak-to-peak voltages of complex wave forms in video, sync and deflection circuits, pulse circuits, radar systems, etc.

All scales are direct reading. Every scale is the same full size, and only one scale is visible at any one time. Once you set the range switch properly, it is impossible to read the wrong scale.

The DYNAMATIC 375 utilizes a single DC-AC ohms probe, anti-parallax mirror, and other desired features . . . to make accurate measurements with utmost convenience and reliability in laboratory, factory production, or service shop.

Includes sturdy swivel stand which permits tilting "375" to any desired viewing angle, swings up as convenient carry-handle.



See Your B&K
Distributor
or Write for
Catalog AP18-R

Ranges: DC Volts	0 - 1.5, 5, 15, 50, 150, 500, 1500
AC Volts (rms)	0 - 1.5, 5, 15, 50, 150, 500, 1500
AC Volts (peak-to-peak)	0 - 1.5, 5, 15, 50, 150, 500, 1500
DC Current	0 - 5 ma, 50 ma, 500 ma
Ohms	0 - 500 ohms, 5 k, 50 k, 500 k, 5 meg, 50 meg, 1000 meg

Input Resistance: 11 megohms on all DC ranges

Accuracy: $\pm 3\%$ full scale AC and DC

Meter Movement: Sensitive 100 microampere

Precision Multiplier Resistors with $\pm 1\%$ accuracy

Anti-Parallax Mirrored Scale for precise readings

Easy-to-See Iridescent Knife-Edge Pointer

Single DC-AC Ohms Probe (supplied)

Includes $1\frac{1}{2}$ volt Battery. Operates on 117 volts 50-60 cycle AC

Sturdy, handsome metal case with convenient combination swivel stand and handle. Size: $10\frac{3}{4}$ " x $6\frac{3}{4}$ " x 4" deep. Net wt: 8 lbs.

Model 375 Net, \$89⁹⁵

B&K MANUFACTURING CO.

1801 W. BELLE PLAINE AVE • CHICAGO 13, ILL.

Canada: Atlas Radio Corp., 50 Wingold, Toronto 19, Ont.

Export: Empire Exporters, 277 Broadway, New York 7, U.S.A.



diode sections of the phase detector conduct equally at this time; thus, the net DC-voltage output of the stage (measured at TP-1) is approximately zero. A careful examination of an operating circuit will show that this zero output is maintained just as long as the signals are in quadrature. Any tendency to deviate from this condition produces a voltage output from the phase detector which brings about a correction in oscillator phase.

Troubleshooting

Since the color-sync section forms

a closed-loop system similar to a horizontal AFC - oscillator circuit, the procedures used for analyzing troubles in this section must allow for the effects of feedback.

"Breaking the loop" (by removing the error voltage from the grid of the control tube) is a useful test method for isolating a defect to either of two circuit blocks within the color-sync section—the oscillator and control tube, or the burst-input circuit and phase detector. In the circuit of Fig. 1, this test can be most conveniently done by

grounding TP-1. The result should be a nearly stable color pattern, with only gradual shifting of hues. If severe loss of color sync is still evident, the oscillator and control stage should be checked to find out the reason for off-frequency operation. On the other hand, an improvement in color stability is a clue to look for such troubles as unbalance in the phase detector or insufficient burst-signal amplitude.

The three or four slug adjustments in the various color-sync circuits should be checked early in the troubleshooting procedure, especially if the fault is only a minor phasing error which produces stable but incorrect hues in the picture. Such problems can easily be caused by slight misadjustment of a slug in the burst transformer, control-tube plate coil, or oscillator transformer.

Of course, tubes should be checked even before readjustment of the circuit is attempted. However, tube replacement alone is not likely to produce a complete repair, since one or more slugs may require readjustment to compensate for differences between tubes.

Troubles which do not respond to either tube replacement or circuit adjustment can be tackled by conventional troubleshooting methods, beginning with waveform and voltage analysis, and following through with individual component checks in the suspected stage. ▲

THE INDUSTRY'S STANDARD
Most Widely Used Today
by Professional Servicemen

SAVE CUSTOMERS MAKE MONEY



FAMOUS DELUXE  CRT 440 

For Black & White and Color

"Most valuable and useful" . . . "Wouldn't be without it" . . . "Pays for itself over and over again" . . . servicemen say. Quickly checks and corrects television picture tube troubles in a few minutes right in the home without removing tube from set. Gives new life to weak or inoperative tubes. Checks for leakage, shorts, open circuits and emission. Removes inter-element shorts and leakage. Repairs open circuits and low emission. Restores emission and brightness. Life Test checks gas content and predicts remaining useful life of picture tube. Makes new tube sales easier. Completely self-contained. Rich leatherette-covered carry-case. Net, \$74.95

TESTS AND REJUVENATES
all picture tubes at correct filament voltage from 1 to 12 volts

TESTS AND REJUVENATES
110° tubes and the new 19" and 23" tubes

TESTS AND REJUVENATES
color picture tubes. Checks each gun of color tube separately

UP-DATE YOUR B&K CRT WITH THESE ACCESSORIES

Model C40 Adapter. For use with previous Models 400 and 350 CRT's—to test and rejuvenate TV color picture tubes and 6.3 volt 110° picture tubes. **Net, \$9.95**

Model CR48 Adapter. For use with previous Models 400 and 350 CRT's—to test and rejuvenate 110° picture tubes with 2.34, 2.68, and 8.4 volt filaments. **Net, \$4.95**

Subscribe to New Picture Tube Information Service

See Your B&K Distributor, or Write for Catalog AP18-R

B&K MANUFACTURING CO.
1801 W. BELLE PLAINE AVE • CHICAGO 13, ILL.
Canada: Atlas Radio Corp., 50 Wingold, Toronto 19, Ont.
Export: Empire Exporters, 277 Broadway, New York 7, U.S.A.





Moving to a New Location?

If so, notify us by the 15th of the month to assure uninterrupted delivery of PF REPORTER.

Please be sure to give us both your old and new address, including your postal zone number. (Or better yet, enclose a current mailing label with your new address.) Send to:

PF REPORTER
Circulation Dept.
2201 E. 46th Street
Indianapolis 6, Ind.

GET YOUR First Class Commercial F.C.C. LICENSE IN 12 WEEKS!

Is the course proven?

A high percentage of our fulltime resident students get their 1st class licenses within 12 weeks from the time they start the course. Intensive FCC license training is our specialty — not just a sideline.

Is the course complete?

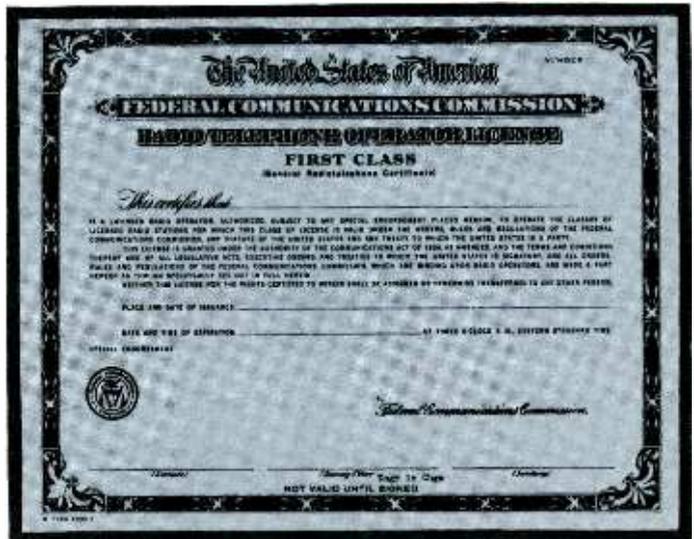
The Grantham course covers all the required subject matter completely. Even though it is planned primarily to lead directly to a first class FCC license, it does this by TEACHING you electronics.

Is the course "padded"?

The streamlined Grantham course is designed specifically to prepare you to pass certain FCC examinations. All of the instruction is presented with the FCC examinations in mind. If your main objective is an FCC license and a thorough understanding of basic electronics, you want a course that is right to the point — not a course which is "padded" to extend the length of time you're in school. The study of higher mathematics or receiver repair work is fine if your plans for the future include them, but they are not necessary to obtain an FCC license.

Is it a "coaching service"?

Some schools and individuals offer a "coaching service" in FCC license preparation. The weakness of the "coaching service" method is that it presumes the student already has a knowledge of technical radio. On the other hand, the Grantham course "begins at the beginning" and progresses in logical order from one point to another. Every subject is covered simply and in detail. The emphasis is on making the subject easy to understand. With each lesson, you receive an FCC type test so you can discover daily just which points you do not understand and clear them up as you go along.



Is the course guaranteed?

The now famous Grantham Guarantee protects your investment. When such "insurance" is available at no extra cost, why accept less?

Is it a "memory course"?

No doubt you've heard rumors about "memory courses" and "cram courses" offering "all the exact FCC questions." Ask anyone who has an FCC license if the necessary material can be memorized. Even if you had the exact exam questions and answers, it would be much more difficult to memorize this "meaningless" material than to learn to understand the subject. Choose the school that teaches you to thoroughly understand — choose Grantham School of Electronics.

THE GRANTHAM FCC License Course in Communications Electronics is available by CORRESPONDENCE or in RESIDENT classes.

Grantham Schools

1505 N. Western Ave.
Los Angeles 27, Calif.
(Phone: HO 7-7727)

408 Marion Street
Seattle 4, Wash.
(Phone: MA 2-7227)

3123 Gillham Road
Kansas City 9, Mo.
(Phone: JE 1-6320)

821 - 19th Street, N.W.
Washington 6, D. C.
(Phone: ST 3-3614)

FIRST CLASS F.C.C. LICENSE IN 12 WEEKS

Grantham resident schools are located in four major cities — classes in F. C. C. license preparation are offered at all locations. New day classes begin every three months, and new evening classes begin four times a year

MAIL COUPON NOW — NO SALESMAN WILL CALL →

Accredited by the National Home Study Council

(Mail in envelope or paste on postal card)

TO: GRANTHAM SCHOOL OF ELECTRONICS

1505 N. Western • 408 Marion • 3123 Gillham Rd. • 821-19th, NW
Los Angeles • Seattle • Kansas City • Washington

Please send me your free booklet telling how I can get my commercial F.C.C. license quickly. I understand there is no obligation and no salesman will call.

Name _____ Age _____

Address _____

City _____ State _____

I am interested in: Resident Classes

Home Study

19-S

by JOE A. GROVES

Service Promotions that Work!

More and more service dealers are becoming aware of the value of promotional campaigns directed at stimulating some special aspect of their service business. Many have found that well-planned and executed promotions can bring in much-needed revenue to smooth out slumps in service income, get the ball rolling when a new service has been added, or increase the total volume of service business enough to justify hiring another man. If you're planning a special promotion for any reason, you'll find that the following examples of successful programs offer some ideas well worth considering.

At the beginning, it must be pointed out that these are special concentrated efforts, keyed to promoting some specific activity—not consistent year-in-and-year-out advertising programs. Different campaigns will naturally vary in length according to their reasons for being. Also, decisions as to the medium used, total cost, timing, and intended audience are inseparably tied to the special needs of each individual case.

Color TV Service

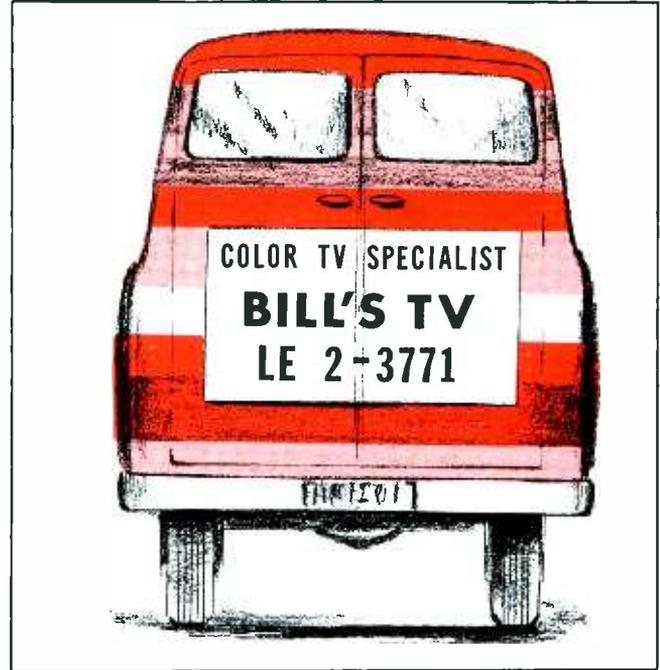
For our first example, let's take a look at the color-TV promotion staged by Bill (who prefers to remain anonymous). His shop is a one-man operation in a metropolitan area. For two or three years the local TV stations had been increasing their color programming, and several of the larger dealers had been doing a fair job of selling color sets. However, no service shops in his trading area had done much to promote color service work. It seemed like a good time to start a push for color TV service.

Bill knew he couldn't expect enough color calls within the first year to pay for an all-out drive, and he didn't have enough capital to float a costly promotion for an extended period of time. Therefore, he

planned his program around a direct-mail campaign to be sent to a select group. Also, he took advantage of the fact that his service truck would be seen by thousands of people as he went about his daily work.

He transformed his ordinary panel truck into a rolling billboard that attracted attention from every quarter. Working with a sign painter, Bill selected a complete rainbow of the brightest, most vividly-colored paints he could obtain. He then had his entire truck painted like a rainbow, leaving large white rectangles on each side and the back for a boldly-lettered sign.

For his mail campaign, Bill searched the phone book for the names and addresses of all doctors, dentists, and lawyers in his trading area. In addition, he obtained the mailing list from as many "working" organi-



zations as he could (such as the Jaycees, Lions, Rotarians, etc.). To complete his list, he added the names of other merchants in his area. He then had an odd-job typist prepare personalized form letters to send to each group of prospects. In the letters to doctors and dentists, he offered his services and talked of the elaborate test equipment at his disposal for **diagnosing** and **analyzing** color TV troubles. On the other hand, letters to lawyers stressed the **schooling** he'd received and his **vast library** of service information. Letters to club members and merchants pointed to the **established reputation** in the field of black-and-white TV service, and cited the added color service as an example of natural growth.

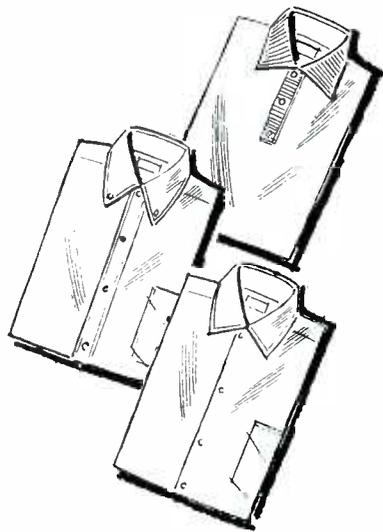
Approximately a month after the letters went out, Bill followed up with evening phone calls to inquire if the people on his mailing list were watching a popular show in color. From the answers he received, he obtained a list of known color-TV owners for use in future phases of his campaign. For those who didn't own a color set, he built his follow-up messages around various black-and-white TV themes — adding a P.S. that he stood ready to serve them when they obtained color sets.

When Bill evaluated his promotion at the end of six months, he found it to be definitely worthwhile.

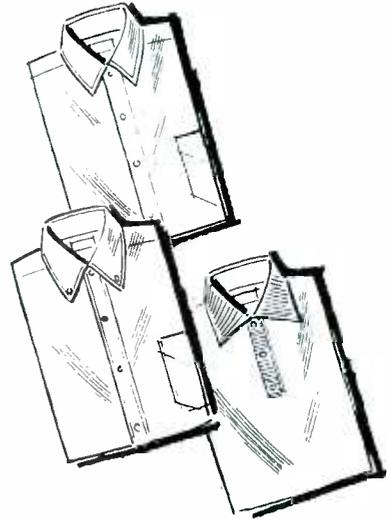
KEEP YOUR SHIRT ON!



*gladly...
it's a
HATHAWAY*



Now, for a limited time only, your participating RCA Electron Tube Distributor has available a selection of Hathaway dress and sport shirts as premiums. It goes without saying that a Distributor who supplies you with dependable RCA entertainment receiving tubes should offer premiums that have also established a reputation for quality. The Hathaway line is noted for its fine craftsmanship, and you'll be proud to own one or more of their top-quality shirts.



SEE YOUR PARTICIPATING RCA DISTRIBUTOR FOR RCA ELECTRON TUBES WITH QUALITY THAT'S BUILT-IN TO STAY-IN / AND ASK HIM ABOUT

HATHAWAY



The Most Trusted Name in Electronics

Electron Tube Division, Harrison, N. J.

NEW CB VERSATILITY

WITH **EICO**®

New Deluxe Citizens Band Transceivers give you everything you need for fast, reliable, economical communication



	kit	wired
Model 770: 117 VAC only.	\$69.95	\$99.95
Model 771: 117 VAC and 6 VDC*	79.95	109.95
Model 772: 117 VAC and 12 VDC*	79.95	109.95

*Including Posi-Lock® Mounting Bracket (Pat. Pend.)

Front panel selection of one of 3 transmit crystals with continuous receiver tuning over all 23 CB channels, or a fourth transmit crystal with appropriate receiving crystal. Press-to-talk button on microphone; transmit-receive switching accomplished by high-quality relay with minimum capacity between contacts to prevent current leakage at RF frequencies. Superhet receiver with RF stage for high sensitivity & proper signal-to-noise ratio. 1750 KC IF strip for unequalled image rejection & freedom from oscillator "pulling" on strong signals. IF strip realigned so that only "touchup" alignment without instruments is needed. Current metering jack in series in cathode circuit allows checking of input power to transmitter final & adjusting it to FCC limit. 13-tube performance (4 dual function tubes, 4 single function tubes, plus germanium diode). Adjustable squelch control (in addition to automatic noise limiter). Optimum adjustment to any popular CB antenna assured through use of variable pi network in output. AVG. 3" x 5" oval PM speaker. Supplied complete with 8 tubes & 1 transmit crystal (extra crystals \$3.95 each).

The entire transmitter oscillator circuit and RF final in every EICO transceiver, kit and wired, is premounted, prewired, pretuned, and sealed at the factory (about 3 hours of skilled labor, precision adjustments and testing), complying with FCC regulations (section 19.71, part d). This permits you to build the kit and put it on the air without the supervision of a commercial radiotelephone licensee.

You profit with EICO Test Equipment & Hi-Fi



DC-5 MC
5" Scope ±460
Kit \$79.95
Wired \$129.50



New Transistorized
Stereo/Mono
4-Track
Tape Deck
Wired Model
RP100W \$299.95
Semi-Kit Model
RP100K,
Electronics in
Kit form.
\$299.95

An exclusive EICO product designed and manufactured in the U.S.A. (Pat. Pend.)



Electronic Instrument Co., Inc. 3300 N. Blvd., L.I.C. 1, N.Y.
ADD 5% IN THE WEST © 1961

Export Dept., Roburn Agencies Inc., 431 Greenwich St., New York 13, N. Y.



Standard 760 Series
of CB Transceivers
from
Kit \$59.95 Wired \$89.95



NEW FM-AM Stereo Tuner ST96
Kit \$89.95 Wired \$129.95 inc. FET



NEW 70-Watt Integrated
Stereo Amplifier ST70
Kit \$94.95 Wired \$149.95

NEW 40-Watt Integrated
Stereo Amplifier ST40
Kit \$79.95 Wired \$129.95

Over 80 products to choose from.
Write for free Catalog PF-11 &
name of nearest distributor.
Most EICO distributors offer
budget terms.

Therefore, he continued it on the original basis, and now reports a steadily growing number of color-TV customers who have exhibited a high degree of loyalty.

Organ Tuning

From eastern Pennsylvania comes the story of a technician we'll call Jim—another serviceman who expanded his activities by means of a promotional campaign. The clue for his successful program was provided by a customer who called to request slight adjustments to the tuning of her electronic organ. She explained that it had recently been retuned. The job had been done with technical accuracy, she added, but the instrument just didn't sound quite as pleasing as it once did.

Jim, who happened to have a good ear for music, was intrigued by this case. If one organ owner wasn't quite satisfied with the pitch of an instrument, why wouldn't others feel the same way? He did considerable research, and learned to tune organs not just as a mechanical routine, but also to insure pleasing musical effects. Before long, he developed "custom organ tuning" into a full-fledged specialty business.

To find prospects for this service, he checked with music stores, dealers, and music teachers to obtain a list of organ owners. He decided to make personal phone calls to these people, and selected the hour from 9 until 10 in the morning for his initial contacts. Jim's initial conversation simply suggested the possibility of "custom-tuning," quoted the cost, and arranged to call back the following evening between 6:30 and 9—after the family had had time to talk over the idea.

The success of Jim's promotion doesn't mean that every other serviceman should go out and start retuning organs. Most of us would just make more competition for Crazy Otto! However, this story does illustrate how you can profit from promoting a service specialty for which you are particularly well qualified.

Antenna Repair

John, a technician in the Midwest, was in a different situation. Rather than planning a promotion for a new activity, he maintained his normal income level through the summer slump by means of a well-timed campaign for antenna repair business.

John lived in a rural area where he could bank on spring winds and rains causing considerable antenna damage. In order to gain a head start on his competitors, he conceived the idea for a pre-Easter push on antenna parts. He knew from previous year's records that his normal summer antenna repair business grossed a meager \$300, and yet he felt this volume could be more than doubled if he hit on the right idea. Realizing he would sooner or later have to raise prices to keep profits from slipping, he decided to try a program with the theme, "Sign up now for summer antenna repair and save," announcing that his prices would be increased as of May 1.

In choosing his advertising media, John reflected on the merits of a spring auto-radio tune-up campaign he'd announced in the daily paper of his county seat the year before. It had drawn considerable auto-radio repair, so the newspaper was selected as one of the advertising media to be used. In deciding how much to spend on his promotion, he figured his anticipated return (\$600) and decided on a 10% advertising bud-



get. This gave him \$60 to work with. Since he was a consistent advertiser in the paper, he was able to run three-inch, two-column display ads every week during Lent at a low contract rate. In addition, he was able to have a thousand handbills printed. Some were distributed from house to house in selected neighborhoods; others were tucked under windshield-wiper blades on cars parked in the downtown business district.

The ads and handbills carried eye-catching photos of various antenna installations in need of major repairs. The copy accompanying the photos announced the coming increase in the price of his antenna work, and offered summer service at current prices if service was contracted for prior to May 1. He specified that each customer would have to present a copy of the ad to obtain the special rate, thus setting up a valid means of determining the effectiveness of his advertising dollar. How did it turn out? Antenna service directly attributed to the campaign grossed nearly \$1000.

And So It Goes

Another dealer gave his service business a shot in the arm by preparing printed stickers that carried his name and phone number in addition to the numbers for police, fire department, and ambulance service. He arranged to have several supermarkets drop a sticker in every sack at the check-out counter. In a similar cooperative venture, gas-station operators checked the radios in the cars they serviced and provided a radio-TV shop owner with the names of customers who needed auto-radio repair.

We could spend all day recounting successful campaigns like these, but the examples already mentioned should be sufficient to show what it takes to make a promotion click. The program must be tailored to a specific type of needed service; the message must present a logical reason for the customer to accept the offers; realistic goals and advertising budgets must be established; and the results must be carefully studied to make future programs more effective. When a service promotion is built on these precepts, it's almost certain to bring gratifying returns. ▲

HUNTING FOR CHRISTMAS GIFTS FOR YOUR FRIENDS AND ASSOCIATES IN ELECTRONICS. YOU'LL FIND NO MORE USEFUL, APPRECIATED REMEMBRANCE THAN A GIFT SUBSCRIPTION TO PF REPORTER. TWELVE TIMES A YEAR IT WILL SERVE AS A REMINDER OF YOUR THOUGHTFULNESS.

ALL CHRISTMAS GIFT SUBSCRIPTION RECIPIENTS WILL BE SENT A SPECIAL GIFT ANNOUNCEMENT CARD SHOWING NAME OF DONOR — TIMED TO REACH HIM AT CHRISTMAS.

To give you an idea of what your gift "package" will contain, here's just a sample of the features planned for the next issue.

- Circuit Voltages Tell the Story**
- Solving IF Transformer Troubles**
- Test Setups for Servicing Two-Way**
- Troubleshooting Diode AFC Systems**
- Burglar's-Eye View of Service Shops**
- FM-Stereo and the Serviceman**
- Eliminating TVI**

P.S. LEAVE THIS WHERE YOUR WIFE WILL NOTICE IT AND PERHAPS SANTA WILL SURPRISE YOU WITH AN EXTENSION OF YOUR OWN SUBSCRIPTION.

CHRISTMAS GIFT ORDER FORM



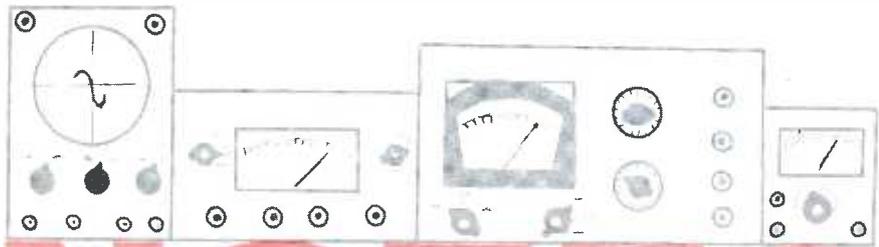
Take this coupon to your distributor, or mail to:
Howard W. Sams & Co., Inc.
 2201 E. 46th St., Indianapolis 6, Ind.

Please enter _____ gift subscriptions as shown at \$4.00 per year for 1 subscription, \$7.00 for 2 subscriptions, and \$2.00 per year for each additional subscription.

Donor's Name & Address

Bill Me Remittance Enclosed Extend Present Subscription

Send to:
 Name _____ Name _____
 Address _____ Address _____
 City & State _____ City & State _____
 Name _____ Name _____
 Address _____ Address _____
 City & State _____ City & State _____



NOTES ON TEST EQUIPMENT

by Les Deane

Batteryless Bias

A bias source is indispensable in a service shop for such jobs as alignment and AGC troubleshooting. It would be more accurate to say that bias sources (plural) are indispensable, since it is often necessary to feed two separate bias potentials to different points in the same receiver. Recognizing this frequent need for a dual bias supply, Sencore, Inc., of Addison, Ill. has introduced the instrument pictured in Fig. 1. The two independently variable DC outputs of the BE113 *Align-O-Pak* are obtained by rectifying and filtering the AC line voltage; no batteries are employed.

Specifications are:

1. *Power Requirements* — 117 volts, 50/60 cps, AC only; power consumption negligible; output isolated from power line; ON-OFF switch provided on panel.
2. *Bias Outputs* — two DC voltages (negative or positive), continuously variable from 0 to 20 volts; three color-coded leads supplied.
3. *Regulation* — maximum DC output change 20% for AC line variation of from 105 to 125 volts; maximum ripple content approximately 1/10 of 1%.
4. *Panel Controls* — two-watt potentiometer for adjusting each output voltage; 0- to 20-volt calibrations provided on panel.
5. *Size and Weight* — 1¾" x 4½" x 3½", 1 lb.



Fig. 1. Sencore *Align-O-Pak* contains two independent 0-20V bias sources.

The Model BE113 derives its dual DC outputs from a simple AC-to-DC conversion circuit composed of a small power transformer, a single-plate selenium rectifier, and a three-section electrolytic filter capacitor. Both voltage controls are connected in parallel across the output. The -A and -B output leads, connected to the movable taps of the controls, have a negative potential with respect to a third lead coded COM (common). Thus, when the common lead is connected to chassis ground, two independent negative supplies are made available.

Since the common lead is insulated from the chassis of the bias supply, it can safely be attached to a point other than ground. This feature makes it convenient to obtain positive as well as negative bias potentials from the unit. If one of the negative output leads is connected to the chassis, the other negative lead and the common lead both become positive source points. The voltage obtained at the common lead is then determined by the setting of the control that corresponds to the grounded lead. The voltage at the second negative lead can also be varied (with the other control), but cannot be greater than the voltage established between the common and grounded leads.

The *Align-O-Pak* is strictly a bias supply, so it naturally is not designed to provide enough output current for powering any type of equipment. However, there are plenty of uses for the bias-voltage sources, either singly or both at the same time. The dual-bias feature is often needed in servicing sets with keyed AGC systems, since many test procedures require applying different bias potentials to the RF and IF amplifiers. The second DC source can also come in handy for clamping some auxiliary point suspected of being involved in an AGC-sync problem (such as the grid of a triode-type sync noise inverter) at the same time the AGC line is being clamped. Still another need for two bias voltages at once occurs during alignment of many color TV sets.

Most service work requires values of bias from about -3 to -15 volts DC — well within the output range of the *Align-O-Pak*. Incidentally, while using

the BE113 in the lab, I noted that the voltage calibrations on the panel are accurate enough to be relied on for setting up specific values of voltage.

"Mini" Waveformer

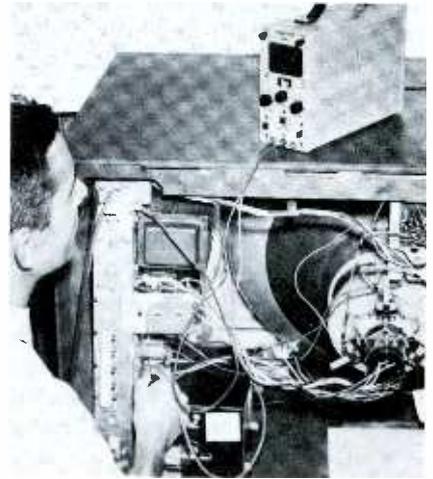


Fig. 2. New Waterman scope is so small that you can carry it in a tube caddy.

If you've been asking for a *really* portable oscilloscope, Waterman Products Co., Inc., of Philadelphia has an answer — the Mark I *Primer-Scope*. Shown perched upon a color TV cabinet in Fig. 2, this "baby" instrument occupies only 1/6 to 1/8 as much space as a conventional service scope; yet it has all the necessary waveform-reproducing features of an "adult" unit.

Specifications are:

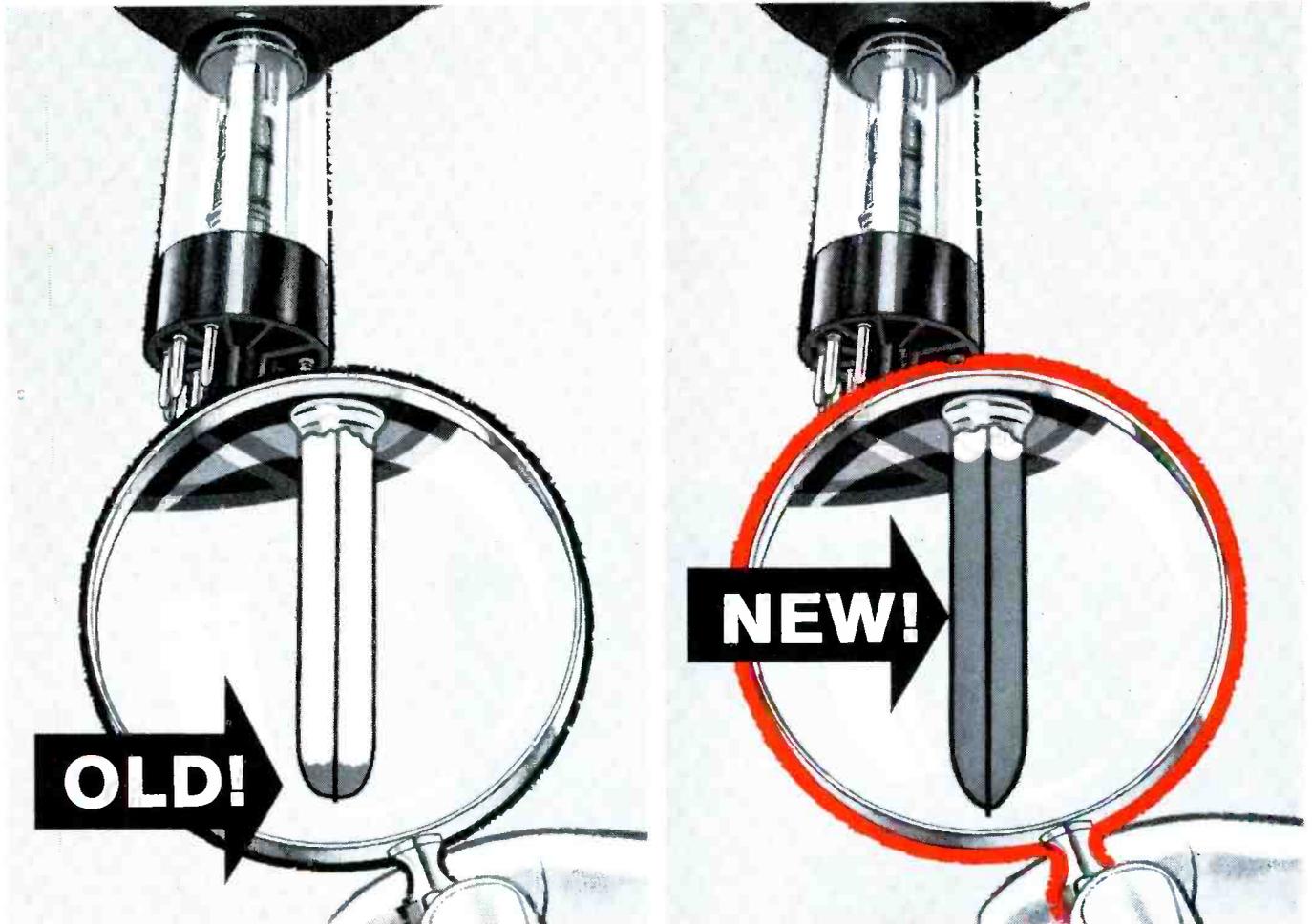
1. *Power Requirements* — 105/125 volts, 60 cps; power consumption 40 watts; instrument isolated from AC line and fused.
2. *Vertical System* — input impedance .5 megohm shunted by 100 mmf; AC-DC switch provided; AC fre-



Fig. 3. Face of the Mark I has calibrated 3" screen and simplified controls.

New Sylvania Technique eliminates erratic pin soldering

Picture tube callbacks due to "open-pin connections" dramatically reduced

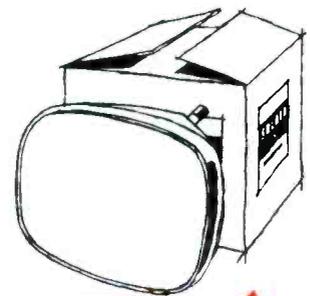


The "old" conventional pin soldering method relied upon contact between pin and wire only at their tips.

New Sylvania pin soldering technique extends solder far up into the pins—provides maximum contact with the wire—assures low electrical resistance and high mechanical strength.

What does the new Sylvania pin soldering technique mean to you? It means the solution of a long-standing, industry-wide pin soldering problem. Callbacks will be reduced—crimping and resoldering will be a thing of the past.

Thousands of service technicians have proven for themselves—in millions of service calls—that Sylvania SILVER SCREEN 85 TV PICTURE TUBES are the surest way to build a better business. You should, too. Electronic Tubes Division, Sylvania Electric Products Inc., 1740 Broadway, New York 19, N. Y.



SYLVANIA

SUBSIDIARY OF

GENERAL TELEPHONE & ELECTRONICS



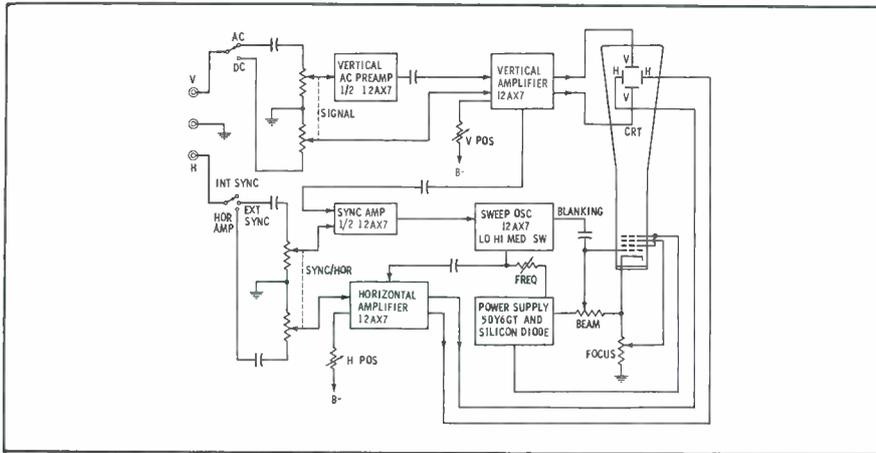


Fig. 4. Functional block diagram of the Waterman Primer-Scope Mark I.

quency response 20 cps to 75 kc, sensitivity 6 mv rms per scale division ($\frac{1}{4}$ "); DC frequency response 0 to 75 kc, sensitivity 250 mv P-P per scale division; pulse rise time 2.5 usec; maximum input 400 volts (AC + DC); input and ground leads supplied.

3. Horizontal System — input impedance .5 megohm shunted by 100 mmf; frequency response 20 cps to 75 kc; sensitivity 150 mv rms per scale division ($\frac{1}{4}$ "); maximum input 400 volts (AC + DC).
4. Sweep System — frequency continuously variable in three overlapping ranges from 20 cps to 20 kc; fixed sweep width; internal retrace blanking provided.
5. Synchronization System — panel switch provides internal or external sync; internal requires signal capable of producing peak-to-peak vertical deflection of one scale division, while external requires 150 mv rms (both of positive-going polarity); maximum external-sync input 400 volts (AC + DC).
6. Cathode-Ray Tube — flat-face 3" Waterman "Rayonic" VC129P1 with internal magnetic shield; $2\frac{3}{8}$ " x $1\frac{3}{4}$ " rectangular mask and scaled graticule.
7. Size and Weight — $7\frac{1}{4}$ " x $3\frac{1}{2}$ " x $11\frac{1}{4}$ ", 5 $\frac{3}{4}$ lbs.

A close up of the front panel is presented in Fig. 3. All operating controls have been simplified and clearly marked. The vertical input circuit does not include the usual step attenuator; gain is governed by a single control labeled SIGNAL. The knob in the center of the panel, marked SYNC/HOR, has a dual function. Normally, it controls the amount of sync signal applied to the internal sweep oscillator. During external sweep operation, with the input selector in the HOR AMP position, it governs the amount of driving signal (width).

Internal sweep frequencies are selected by a three-position slide switch (LO-HI-MED), and the control labeled FREQ. The two-position slide switch located in the lower left corner of the panel sets up the instrument for either AC or DC measurements, while the three-position switch in the center selects the mode of sweep and sync desired. Remaining adjustments include both vertical and horizontal positioning controls, focus, and brightness. At the bottom of the panel, the jack on the left is for vertical inputs, the center one is for ground connections, and the one on the right is for external-sync and horizontal inputs.

In the block diagram of Fig. 4, the number of stages, tube types, circuits capacitively coupled, and electrical locations of all panel controls are shown for the Mark I. An unusual thing I noticed about this scope is the fact that the operator has no control over horizontal gain when the sweep is internally generated. However, I found it easy to compensate for this omission by adjusting the FREQ control to change the number of cycles displayed on each sweep. I could always find some setting

TIPS

for the ELECTRONIC TECHNICIAN

Now! The TV-Radio-Audio Replacement of the Future!

THE MARK VII SILICON RECTIFIER

replaces all existing types.

750 mil minimum
50 amp surge

*type no. 5A4-95

ACTUAL SIZE

NOW! FROM SPACE AGE TECHNOLOGY. An important development brings you a single rectifier that replaces all other rectifier types. This development is as significant as the introduction 4 years ago of silicon rectifiers, which have come to be almost universally used in TV-Radio-Audio circuits.

NOW! HIGHER RATING—SMALLER SIZE. The IR "Mark VII" is rated at 750 mil minimum and has a surge capacity of 50 amps. Looks like and is no larger than a half watt resistor. Insulated, completely safe; can't short to chassis.

NOW! CARRY ONLY 1 RECTIFIER. For every replacement, the Mark VII fits anywhere selenium or silicon rectifiers were originally used. Long lasting, easy to solder due to pure silver leads, fully guaranteed. Sets a new break-through in reliability, and in price.

**SPECIAL INTRODUCTORY
"MONEY BACK GUARANTEE!"**

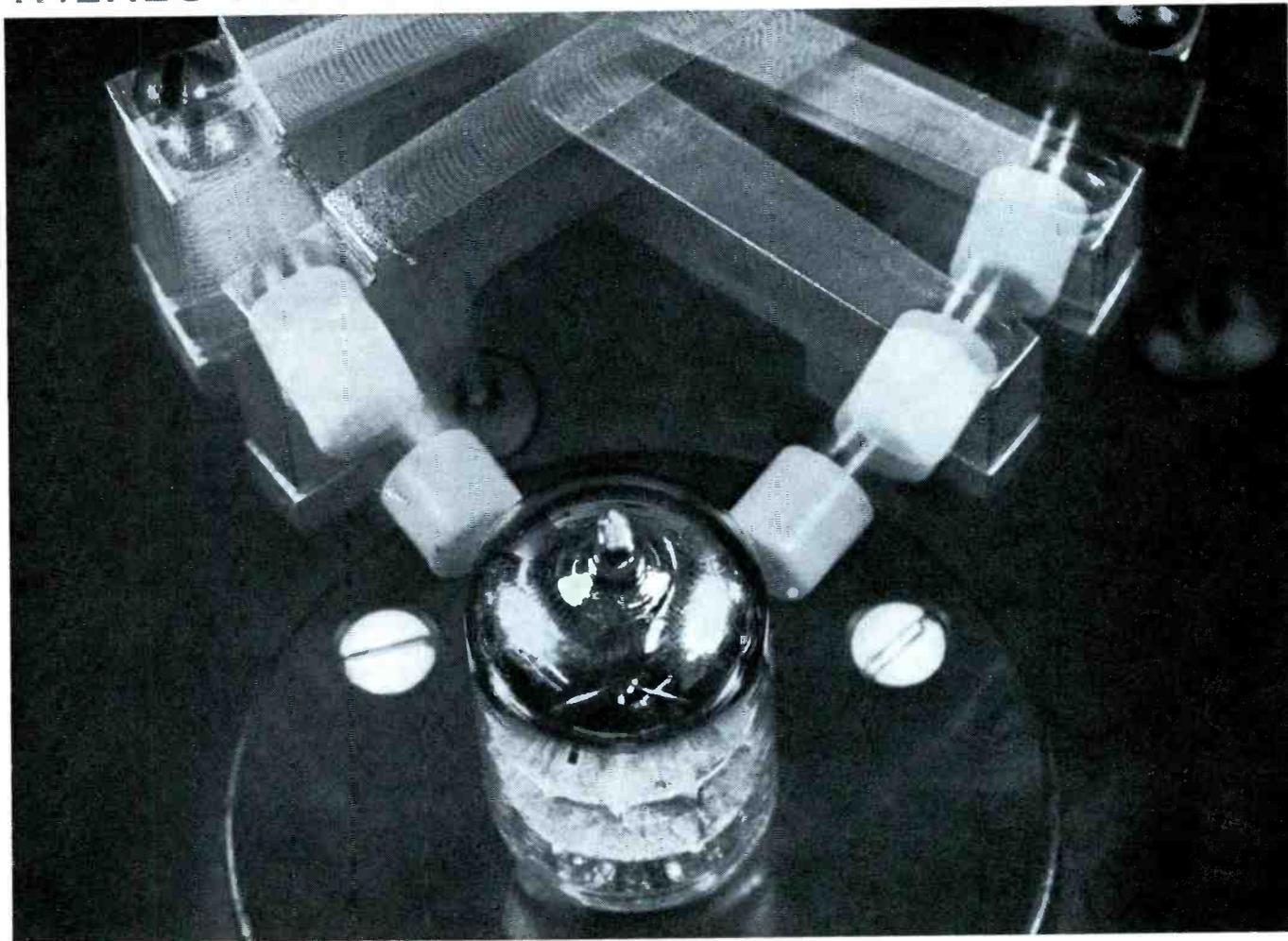
2 FREE
RECTIFIERS
with purchase
of 5 Pack
ONLY **\$5.60**

Buy 5 Mark VII Rectifiers—get 2 free! Use the 2, and if they do not meet all the specifications that we state, return the 5 and receive the full purchase price.

INTERNATIONAL RECTIFIER

233-KANSAS STREET - EL SEGUNDO, CALIFORNIA

THERE'S NEW POWER IN WESTINGHOUSE TUBES



FOR EVERY TUBE- SEVERE "HAMMER" TEST PROVES WESTINGHOUSE QUALITY

Now, under a stringent program of quality-control every Westinghouse electronic tube is put through an exclusive shock test. Tubes are given repeated, uniform blows by each of two hammers—to detect shorts and any other defects which may occur during handling procedures in the plant. This final check guarantees all tubes are perfect before packing . . . assures you of more satisfied customers, repeat business, higher profits! Rigid quality-control is just one important feature that gives your distributor NEW POWER in Westinghouse tubes. Others include:

- HIGHER PROFIT MARGINS—realistic and constant—result of outstanding product quality and competitive product cost ratios.
- THE ULTIMATE IN FINANCING PLANS—offers distributors a flexible line of credit
- MARKETING AND FINANCIAL COUNSEL—to help distributors solve financial, advertising, and promotion problems
- FAST TIE-LINE SERVICE—distributor orders are processed within one hour of receipt
- INDUSTRY INNOVATIONS—new packaging and merchandising builds more business.

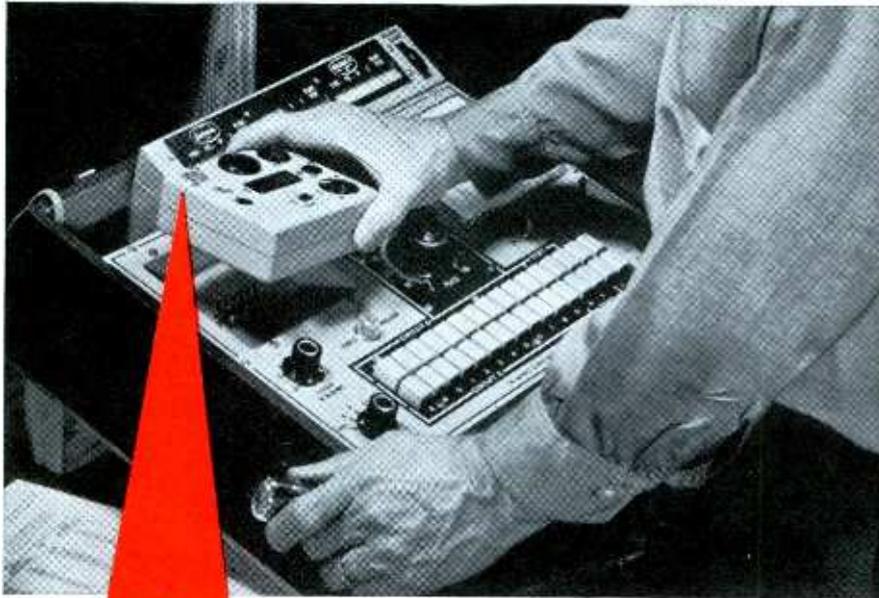
There's new POWER in Westinghouse tubes. See your Westinghouse distributor today and discover how the NEW POWER in Westinghouse tubes can work for you. Westinghouse Electric Corporation, Elmira, New York. *You can be sure . . . if it's Westinghouse.*

Westinghouse



Now You Can Check All The New Tubes, Too!

**Nuvistors—5 and 7 pin • Compactrons • Novars • New 10 pin
New 12 pin—large and small—plus all older radio and TV tubes**



JACKSON 648S DYNAMIC® TUBE TESTER

\$154.95 net

**Exclusive compact, double-face reversible socket assembly—7 different sockets on one side for popular and newest tubes—7 different sockets for regular tubes on the other side. No adapters . . . you simply lift out and reverse socket assembly to accommodate tube being checked.*

This new Jackson 648S Dynamic Tube Tester lets you check all the newest tube types and all other popular tubes with profit-making speed and accuracy.

These features make it best for busy servicemen

- Push-button sequence switching for fastest set-up time
- Semi-conductor rectifier for instant warm-up
- 23 Separate Heater voltages from .75 to line voltage
- Variable Sensitivity Shorts test to 2 megohms
- Angled view zig-zag roll chart
- Automatic line voltage indicator
- Guaranteed Jackson accuracy and quality

See the new 648S at your distributors . . . or write for Bulletin 107.

*If you own a Jackson 648R or 658 Tube Tester you can modify it with a Socket Kit available from your distributor.

New tube test data appears every month in PF Reporter and Photo-Fact Folder



ELECTRICAL INSTRUMENT COMPANY

124 McDonough St., Dayton, Ohio

In Canada: Tri-Tel Associates Ltd., Willowdale, Ontario

at which one or two cycles were clearly presented.

Since it can easily be carried on outside calls, this miniature scope opens up new possibilities for more extensive "on-the-spot" servicing. Many of today's TV sets incorporate printed circuitry with all components exposed on the tube side of the chassis, and this type of receiver can be "scoped" in the cabinet as easily as on the bench. On any set, regardless of chassis design, numerous check points are accessible with just the cabinet back removed. For example, you can check for ripple on AGC and B+ supply lines at tuner connections; check at the picture-tube socket for the composite video signal, hum modulation, and vertical blanking pulses; make horizontal-oscillator waveform adjustments on some sets; test for audio signals across a speaker or at terminals of the volume control or TV-phono switch; check sync and sawtooth waveforms at the socket of an AFC dual diode; look for B+ ripple at a fuse connection, or for boost ripple at the accelerating anode of the CRT; and sample the video signal at the second detector (in sets having the crystal mounted on top of the chassis). Furthermore, by pulling tubes or using a socket adapter, you can view every meaningful waveform in a receiver.

Although its frequency response is limited, I found that the Mark I could reproduce all monochrome TV waveforms, and that it was also useful in signal-tracing many sections of a color receiver. Among the waveforms it can reproduce are the R-Y, B-Y, and G-Y signals applied to the tricolor CRT; grid and plate signals of burst amplifiers; and waveforms associated with sync phase detectors. Of course, since the higher-frequency components of these signals are attenuated somewhat, accurate amplitude measurements are not always possible; however, the results are useful for determining the presence or absence of the signals.

Considering that the instrument is easily portable and well suited for audio work, it offers many opportunities for developing more efficient field-troubleshooting methods for electronic organs, public-address systems, and complex intercom installations.

Tester Updater

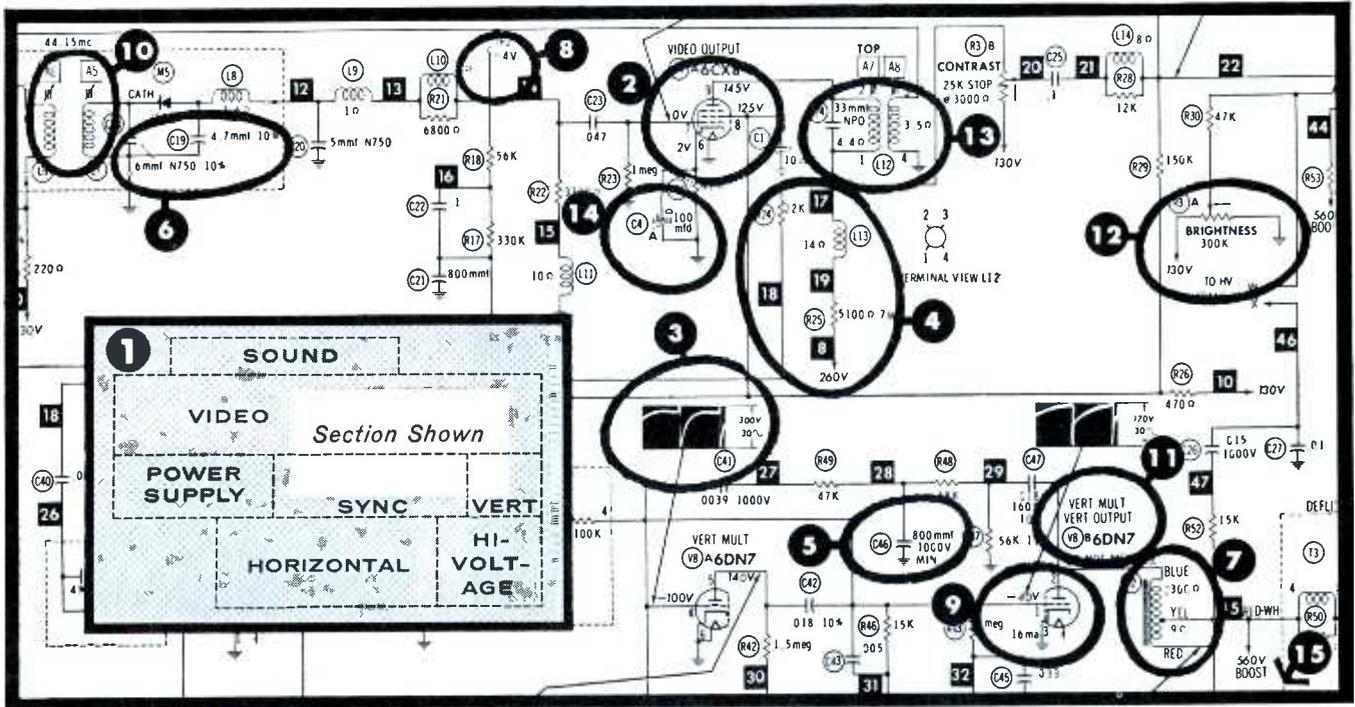
Jackson Electrical Instrument Co. of Dayton, Ohio has recently designed a plug-in Socket Modification Kit that fits all Model 658 and 648R tube testers, equipping them to check *Compactron*, *novar*, *nuvistor*, and 10-pin miniature tubes in addition to all conventional types.

A reversible plug-in unit with 14 different tube sockets (seven on each side) replaces the nine-socket fixed panel originally mounted in the Jackson testers. (The new panel is already incorporated in two Jackson testers introduced this year, Models 648S and 658A.) One side includes all the newly-introduced sockets, plus octal and 7-pin miniature types. The 9-pin tubes can be plugged into the 10-pin socket, since the tenth pin is

exclusive in PHOTOFACT the world's finest electronic service data

the famous Howard W. Sams **STANDARD NOTATION SCHEMATIC!**

as easy to read as a road map...makes circuit tracing and parts identification simple, quick, accurate...saves you hours each day for more profitable servicing...



THIS AMAZING FEATURE-PACKED SCHEMATIC GIVES YOU ALL THE RIGHT ANSWERS AT A GLANCE!

- 1 Uniform schematic layout. Each receiver circuit can be located quickly, since layout is always the same, regardless of receiver make.
- 2 Voltages are shown at all tube pins and test points for speed and convenience—no time-wasting separate reference charts to fumble through.
- 3 Shows actual photos of waveforms at key check points for quick comparison with those obtained on your own scope.
- 4 "CircuiTrace" numbers on schematic are keyed to actual photos of printed boards, for easy location of specific circuit points.
- 5 Component item numbers are keyed to chassis photos for parts location, and to parts lists to enable you to quickly determine proper replacement.
- 6 Special capacitor and resistor ratings are shown on the schematic; valuable where tolerances are a factor in replacement parts consideration.
- 7 Coil and transformer color codes or terminal identifications are given to speed tracing of connections.
- 8 Test points are shown for speedy reference in measuring and servicing.
- 9 Special currents (B+ supply, horizontal output cathode, vertical output cathode, etc.) are given, to isolate improperly operating circuits or components.
- 10 Alignment points are identified on the schematic and photos, and are keyed in with the alignment procedures for rapid, error-free adjustments.
- 11 Tube functions are shown on schematic and Tube Placement Charts to help you quickly isolate troubles.
- 12 Complete identification of controls and switches quickly shows their functions without needless circuit tracing. Arrows indicate direction of rotation to help you understand circuit operation.
- 13 Coil resistances over 1-ohm are shown—a great help in determining shorted turns, opens, etc.—avoids misleading continuity tests.
- 14 Polarity and section identification of electrolytic capacitors are easily determined from the schematic—saves valuable time in identifying component sections.
- 15 Fuse ratings are shown on schematics and Tube Placement Charts for quick replacement; handy for in-home service work.

The Standard Notation Schematic is just one of dozens of great features in PHOTOFACT for fastest, easiest, more profitable servicing. See your Sams Distributor for full details on an Easy Buy Library or Standing Order Purchase!

COMING IN PHOTOFACT!
FREE BONUS 20-LESSON Second-Class Radiotelephone License Course!
 Will help you pass the exam for an FCC License...so you can upgrade your career in electronics and become an expert in communications! Begins in January 1962 (Photofact Set No. 561) as a bonus with your subscription to PHOTOFACT. Be sure your distributor has your subscription!



FREE!
VALUABLE PHOTOFACT INDEX!
 Your guide to over 50,000 TV, Radio, Electronic listings—covering virtually every model produced since 1946. Helps you locate the proper PHOTOFACT Folder you need to solve any service problem in any model. Send coupon today for your FREE copy of the latest PHOTOFACT Index!

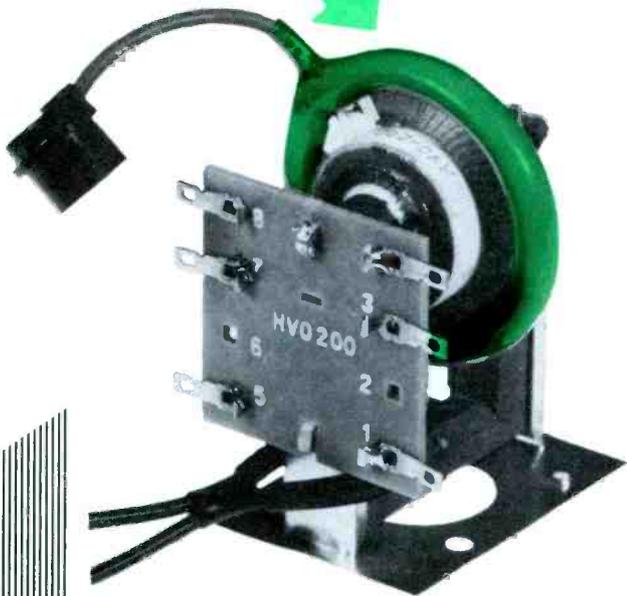
HOWARD W. SAMS & CO., INC.
 Howard W. Sams & Co., Inc., Dept. 7-L1
 1724 E. 38th St., Indianapolis 6, Ind.
 Send FREE Photofact Cumulative Index
 Send full information on: Easy Buy Plan Standing Order Subscription "Peet" Program
 Shop Name _____
 Attn.: _____
 Address _____
 City _____ Zone _____ State _____

The MERIT GREEN ANTI-CORONA TIRE

is a distinctive feature of the famous Merit line of Flyback Transformers.

It typifies a product engineered and manufactured to rigid specifications, and subjected to a rugged 100% testing procedure.

Over 200 basic models applicable to thousands of replacement uses - 87% exact replacements.



BE GENUINE

GO MERIT!



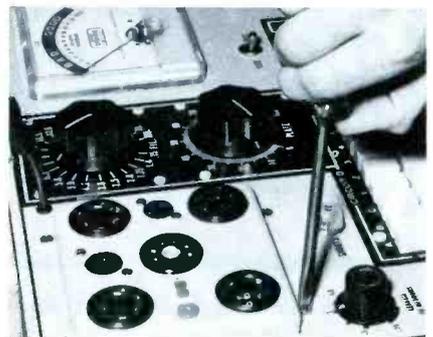
COIL & TRANSFORMER CORPORATION

MERIT PLAZA - HOLLYWOOD, FLORIDA

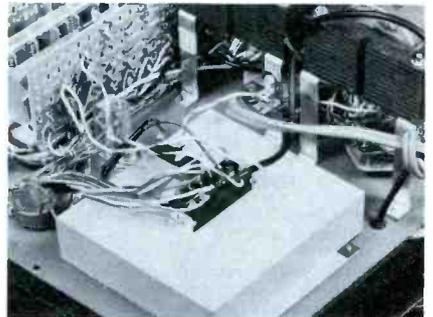
in the center. On the other side are the older 4-, 5-, 6-, and 7-prong sockets, plus two subminiature types. A two-position slide switch labeled NOR./S (for NORMAL-SPECIAL), permits testing certain unusual tubes in a conventional manner.

Connections between the socket unit and the tester are completed through a 12-prong male plug mounted in a "well" (also furnished in the kit). This part is designed to occupy the space vacated by the original panel section.

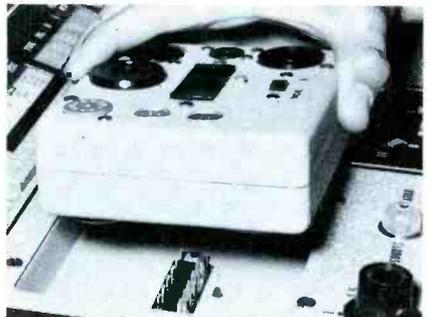
When I installed one of these kits on a Jackson 648R in our lab, I began by removing the entire instrument from its case. Then I took out the original socket unit by unfastening four screws (Fig. 5A), and clipped off all connecting wires close to the socket assembly. Attaching the new receptacle to the panel cutout, I wired the connecting plug (Fig. 5B) according to the instructions packaged in the kit. The wiring job was simplified by the fact that all leads requiring splice connections are identically color-coded. Reinstalling the tester chassis in the case completed the job; by plugging the new socket assembly into the receptacle one way or the other, I could test any tube type now on the market. ▲



(A) Remove old panel.



(B) Mount receptacle and wire.

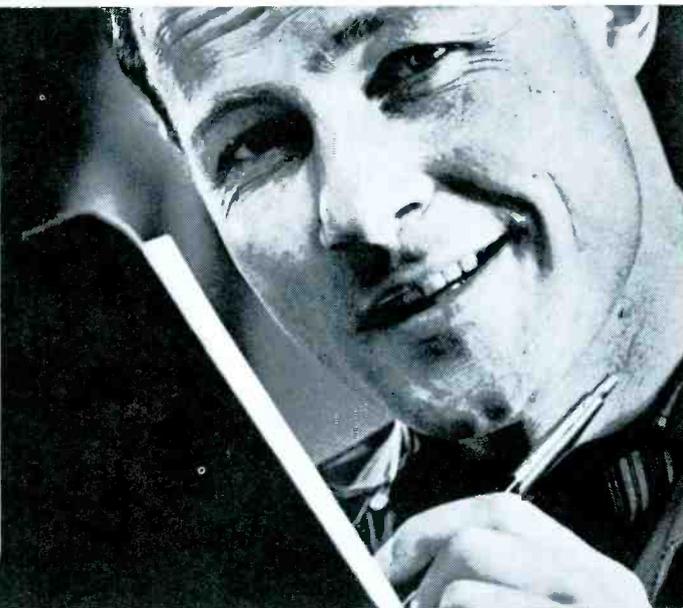


(C) Insert socket unit (either side).

Fig. 5. Steps in installing Socket Modification Kit on Jackson 648R tester.



NEW RCA VICTOR COLOR TV!



PROVED IN SERVICE! PROFITABLE TO SERVICE!

New RCA Victor Color TV incorporates more than seven years of refinements based on field and service experience. Experience that tells you why RCA's new High Fidelity picture tube has been accepted as the industry standard. It's the same experience which has proved the greater dependability and serviceability of RCA's "road-mapped" printed circuits.

A proved chassis, with easy-to-find, accessible test points, proved-in-use replacement parts, and proved-in-practice service

literature make RCA Victor Color TV *easy and profitable* to service.

Join the growing corps of servicemen who have found new interest and opportunity in Color TV. Ask your RCA Victor Distributor to help you.

SEE WALT DISNEY'S "WONDERFUL WORLD OF COLOR," EVERY SUNDAY, NBC-TV NETWORK



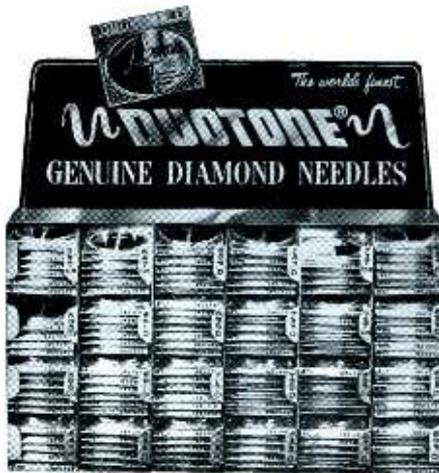
The Most Trusted Name in Television

Tmk(s)®



**WHAT
EVERY
NEEDLE
DEALER
SHOULD
HAVE...**

**DUOTONE'S NEW
DIAMOND NEEDLE
DISPENSER!**



Because...your needle sales will skyrocket. This attractive display contains the most wanted stereo and monaural diamond needles. The dispenser, by being constantly in front of your customers, will stimulate point-of-purchase needle sales...and it will save you Inventory Time. The dispenser is FREE! You just pay for the 32 Duotone Diamond needles it contains. They're newly and handsomely packaged for customer eye appeal.

SEE YOUR DUOTONE DISTRIBUTOR TODAY!
DUOTONE
COMPANY, INC.
KEYPORT, N. J.

Color Test Equipment

(Continued from page 31)

bars, but a gradual shading from one hue into the next.

The *keyed rainbow* or *sidelock* generator produces an output at a frequency 15,750 cps above or below the reference-oscillator frequency of the receiver. This gives the effect of a continuously varying phase difference between the generator and oscillator signals. In addition, both signals momentarily coincide in phase 15,750 times each second, thus enabling the receiver to lock into color sync at a definite point corresponding to "burst phase" in a normal transmitted color signal.

The generator output is keyed alternately on and off to form a series of well defined vertical bars representing 30° chroma-phase intervals. Of the 12 signal pulses generated during each horizontal sweep cycle, only 10 actually show up as bars on the screen. The 11th, at 0°, is utilized as a color burst; the 12th, at 330°, is lost during horizontal retrace time. The vector diagram (Fig. 1) and the drawing (Fig. 2A) indicate the various hues represented by the other phase angles, in the order they appear on the screen. Note that only one of the bars (green) happens to coincide with a pure primary color. Also, since the rainbow-generator output is not amplitude-modulated, the colors are not fully saturated.

The more elaborate NTSC-type bar generator develops a 3.58-mc chroma signal which is accurately amplitude- and phase-modulated to reproduce all three primary colors, and their complementary hues, at 100% saturation. Luminance information is also added to the signal so that all colors will be equally bright. An NTSC signal waveform and bar-sequence drawing are shown in Fig. 2B for comparison with the keyed rainbow signal in Fig. 2A.

Any bar generator should provide a choice of RF or video outputs, so that the signal can be injected at various points to isolate troubles. These instruments commonly provide their own internal synchronization — a feature which simplifies the test hook-up. However, some units are equipped to accept external sync, which is use-

ful in obtaining a more stable pattern under certain circumstances.

To decide which of the three types of color-bar generators would best suit your needs, first consider the probable extent of your color-TV servicing activities. If you're interested mainly in an easily-portable, low-cost unit to assist you in troubleshooting color defects (especially on home calls), a continuous-type rainbow generator will be satisfactory. It will help you to localize defects involving partial or complete loss of color, and will also show whether or not a receiver can be held in color sync. However, since these units typically provide no specific reference phase (burst signal), they are not adequate as a signal source for making chroma-sync and demodulator-phasing adjustments.

On the other hand, a keyed rainbow generator is excellent for this purpose, because it does offer a substitute burst signal in addition to

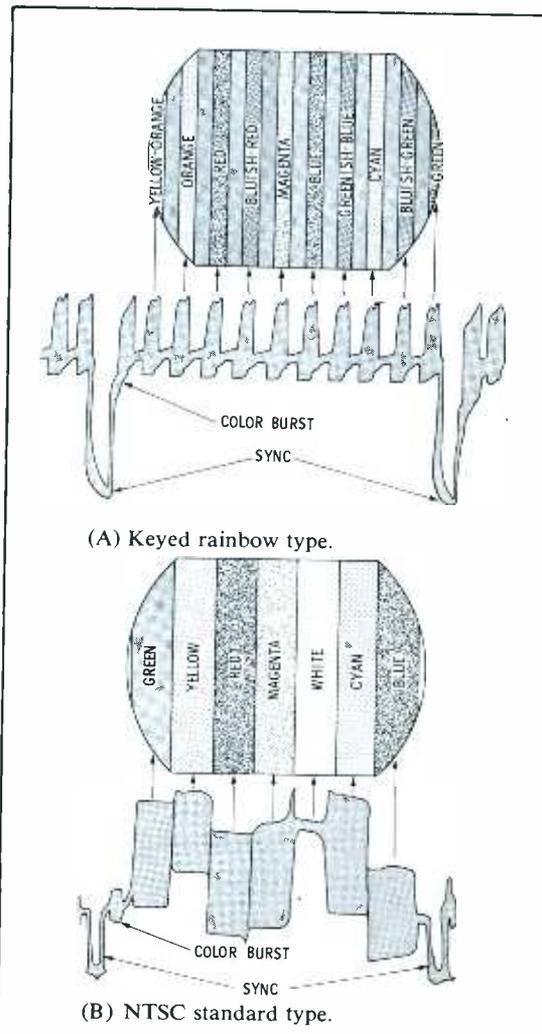


Fig. 2. Color-bar generator outputs.



GMW TRON FUSE

Diameter: .270 inch
Length of Body: 1/4 inch



HWA FUSEHOLDER

Diameter: .500 inch
Length with Knob and Terminals: 15/16 inch

ACTUAL SIZES SHOWN

Another BUSS sub-miniature fuse and holder combination

EXTREME RELIABILITY UNDER HIGH SHOCK AND SEVERE ENVIRONMENTAL CONDITIONS.

Rigid construction of fuse and holder assures extraordinary reliability under high shock and vibration conditions. Fully insulated ceramic body isolates fusible element from effect of dust, corrosion, moisture and vapors.

DESIGNED FOR SPACE-TIGHT APPLICATIONS

Panel Mounted. Holder can be mounted on panel by hand. No special tool required to run down holding nut.

Prong type contacts on fuse make it easy to install or replace.

A knob for the holder may be used to make holder water proof from front of panel.

HOLDER CAN BE MOUNTED IN PRINTED CIRCUITS

Terminals of holder can be inserted into holes and soldered on printed circuit board without additional forming.

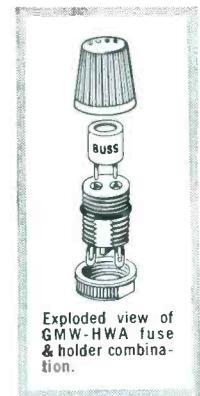
If desired, GMW fuse may be used without holder and mounted directly into printed circuit boards.

AVAILABLE RATINGS FOR GMW FUSES.

Fuses are made in sizes from 1/10 to 5 amperes for use on circuits of 125 volts or less where fault current does not exceed 50 amperes.

Transparent window in end of fuse body permits visual inspection of fusible element.

Before crystallizing your design using sub-miniature fuses be sure to get full data on the Buss GMW fuse and HWA holder combination.



Exploded view of GMW-HWA fuse & holder combination.

IN THE BUSS LINE, you'll find the type and size fuse to fit your every need . . . plus a companion line of clips, blocks and holders.



BUSSMANN MFG. DIVISION, McGraw-Edison Co., UNIVERSITY AT JEFFERSON, ST. LOUIS 7, MO.



an output of varying phase. Since the keyed rainbow output includes a nearly complete range of hues, it also enables the user to recognize when some colors are missing from the picture or weakly reproduced. However, it is not as versatile as the NTSC generator in troubleshooting this type of problem, since the saturation and brightness levels of the signal vary at random from hue to hue. Notwithstanding this slight limitation, a keyed rainbow generator can provide the average color-TV serviceman with adequate signals for practically all trouble-

shooting and alignment needs. On top of this, it is moderately priced, and also portable enough to be conveniently taken on home calls.

An NTSC unit, the ultimate in color-bar generators, is a lab-type instrument suitable for analyzing the worst "tough-dog" problems ever encountered in color-TV servicing. As this description might lead you to expect, it is also the largest and most expensive type of bar generator. However, it is worth the extra investment when used at the bench in a shop that does a great deal of color work.

Pattern Generators

Color convergence adjustments demand the use of a generator that produces special white patterns on a dark background. Since the latest methods of convergence call for the use of both line and dot patterns, many generators offer a choice of horizontal-line, vertical-line, cross-hatch, or dot displays. Other units produce only dots or lines.

The edges of the dots or lines should change abruptly from white to black, since a sharp transition helps to reveal any color fringing caused by misconvergence. Also, the smaller the dot size, the more readily you can notice convergence errors. However, the dots should not be so small that they are difficult to see clearly. Typical generators produce square or round dots 1/8" to 3/16" across; some models of "dot-only" generators have provisions for varying the dot size.

A pattern generator, like a color-bar generator, should provide both RF and video-frequency outputs; furthermore, it should be possible to synchronize the scanning frequencies of the generator and receiver closely enough to insure a steady, jitter-free pattern.

In addition to a pattern generator's primary function of assisting in color convergence adjustments, it can be used even on black-and-white sets for signal-tracing, linearity adjustments, and approximate video frequency-response checks. (Since the dot or line signals are similar to square waves, low-frequency distortion shows up as smearing, and high-frequency distortion appears as edge-blurring or ringing.)



Model 1571 Shown with Accessory 45 rpm Spindle in Base Plate Spindle Well

V-M Deluxe 'Stere-O-Matic'® 4-Speed Automatic Record Changer with Stereo Cartridge and Diamond Needle

The Sales Pace Setter For ALL Custom and Replacement Hi-Fi and Stereo Installations! Sell customers a combination of true transcription-turntable fidelity and automatic record changer convenience . . . all in *ONE* unit with this functional V-M 'Stere-O-Matic'®! The eleven-inch turntable, scientifically balanced, assures minimum rumble and wow! V-M Automatic Manual-Play function saves possible needle damage by returning the extra-long, dynamically balanced tone arm to the rest post *AUTOMATICALLY* after single record play! V-M Model 1571 . . . \$50.00* List Available with 4-pole motor and plug-in tone arm head for magnetic cartridges as Model 1572 . . . \$50.00* List

*Slightly Higher West.

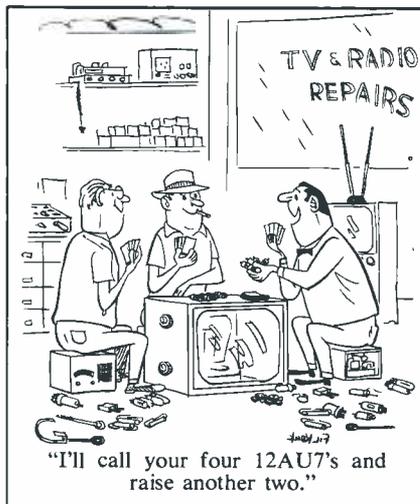


Attractive, functional Base or pre-cut mounting board available for mounting all V-M record changers in any kind of Hi-Fi Installation. Model 1438 . . . \$5.95 List.

GET THE SELLING FACTS ON THIS COMPATIBLE V-M DELUXE 'STERE-O-MATIC'® — YOU'LL PROFIT!



V-M CORPORATION • BENTON HARBOR, MICHIGAN • KNOWN FOR THE FINEST IN RECORD CHANGERS, PHONOGRAPHS AND TAPE RECORDERS



with...



...you can service

COLOR TV

simply...swiftly...profitably!

Color TV is Here ... Prepare now ... But, before you invest in color test equipment, get *all* the facts. Plan to attend a Hickok Color Clinic and write for our free booklet, "Why NTSC?".

These manufacturers have announced that they will be marketing color television sets this fall.

DUMONT ADMIRAL



ZENITH

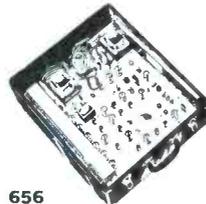
Emerson

Magnavox

Olympic.

PHILCO.

Remember, Hickok *Color Approved* Test Equipment is built to NTSC standards, recognized and approved by leading TV manufacturers.



656
NTSC Standard Color Bar Generator



660
White Dot-Bar Generator



675A
Wide Band Oscilloscope



691
Heterodyne Marker-Adder



615
Sweep and Marker Generator



CR33
Color Tube Tester

The

Hickok

Electrical Instrument Co.

10566 Dupont Avenue

Cleveland 8, Ohio

CAUTION

a \$1.00 investment
that can save you
hundreds of dollars in
legal entanglements

HOW TO AVOID LAWSUITS IN TV-RADIO- APPLIANCE SALES & SERVICE

by Leo Parker (Attorney at Law)

• When can a serviceman collect for repairs? • When is a service guarantee enforceable? • When can a serviceman demand cash payment? • When does a lien protect a serviceman? • How can a knowledge of contract law earn profits? • How valid are written contracts? • What are the insurance laws? These are just a few of the vital questions that are answered straight from the shoulder in down-to-earth English in this book written by an experienced lawyer and a contributor to many magazines. This particular book covers actual lawsuits involving other servicemen and dealers and important laws and decisions affecting their livelihoods. The content reflects the laws and rulings everywhere in the United States. It covers many situations that you may face if you sell equipment, enter a home to service it or receive equipment for servicing in your shop. *Here's how it will benefit you:*

1. helps you avoid legal entanglement...
2. learn the difference between hearsay and actual law. 3. learn what you can do and cannot do according to modern law. At \$1.00, this book is the best investment anyone who sells and services TV, radio, and appliances can make. You can't afford to be without it! #283, **\$1.00**

The Most Timely, Exciting Area of Audio
FM STEREO MULTIPLEXING
by Norman H. Crowhurst

This book is of great value to every service technician. It tells you how it works. It shows you and explains the typical receiver circuits in the equipment available on the market. The information on conversion of Monaural FM tuners into stereo units is complete. It includes antenna installation, matching different adapters to different tuners; matching adapter or tuner to a stereo system. Several chapters are devoted to servicing, alignment, performance check and general troubleshooting procedures. This practical book will help you cash in on FM stereo this fall. #282, **\$1.50**

Order these Rider books today at your electronic parts distributor.
Write for free 1961 catalog.

JOHN F. RIDER PUBLISHER, INC.
116 West 14th Street, New York 11, N. Y.
A division of Hayden Publishing Co., Inc.

Some pattern generators also offer a color-bar output, thus combining the functions of two essential color-TV test instruments in one unit. The advantages for in-home servicing are obvious. However, if you plan to use the equipment for both home and shop jobs, you may find that separate color-bar and pattern generators will provide more desirable features than you can obtain in a combination instrument. Or it may work out better for you to keep a fairly elaborate bar generator at the bench and use a combined dot-crosshatch and continuous-rainbow generator for setting up and troubleshooting color receivers in the home.

CRT Testers

Since a tricolor picture tube costs well over \$100 to replace, color-TV owners appreciate prompt and accurate information about the condition of this component. Therefore, an instrument that can check the performance of a three-gun CRT is a definite asset to the serviceman. A conventional type of CRT tester is satisfactory, provided that it includes a color-tube socket and also a three-position switch for selecting the particular gun to be tested. (These features may be either built-in or supplied as part of an accessory adapter.)

The tester should be able to indicate interelement shorts and tube emission. Optional features include a measurement to determine grid-cutoff characteristics, a relative life-expectancy test, and provisions for rejuvenation.

Voltmeters

Trouble in the color circuits can often be localized to specific components by checking voltage and resistance values at tube pins, using the same technique as in radio or monochrome TV servicing. However, some voltage indications may change only slightly when a trouble is present. For example, it's doubtful if mere DC-voltage checks will enable you to determine if color information is reaching a demodulator stage.

A VTVM, because of its high input impedance, should be employed for all grid-circuit measurements and for color-killer or chroma-sync troubleshooting. With an accessory RF probe added, this instrument can also indicate the amplitude of the color signals at various test

points such as the secondary of the quadrature transformer. Still another function of the VTVM is as an indicator in chroma-sync alignment.

If you normally carry a 20,000-ohms-per-volt VOM on home calls, you will find it useful for making a fair number of key voltage and resistance checks on a color TV chassis still in the cabinet. When equipped with a high-voltage probe, a VOM is also convenient for measuring CRT focus and high-voltage anode potentials that normally range from 3 to 25 kv.

Voltmeters are not included in the test-equipment availability chart published with this article, because the units you now have will undoubtedly fill the bill very nicely for color-TV servicing.

Oscilloscopes

A wide-band scope is desirable for servicing color circuits. The expression *wide-band* refers primarily to the frequency response of the vertical deflection system. If the amplifiers in this section give equal gain to all frequencies up to approximately 4 mc, the scope can produce both low- and high-frequency components of the composite chroma signal at proper amplitudes. In a narrow-band scope, the 3.58-mc color-burst and chroma information can usually pass through the vertical amplifier with sufficient gain to make its presence known; however, since it appears at a greatly reduced amplitude, the scope cannot indicate its peak-to-peak voltage with any degree of accuracy.

The vertical amplifiers of a color-TV scope need not have unusually high gain, since extremely low-level signals are not normally encountered in the color circuits. However, the scope should be capable of relatively high internal sweep frequencies (100 to 500 kc maximum), or should have provisions for expanding the horizontal sweep, so that reasonably well-defined 3.58-mc reference-oscillator and burst signals can be inspected.

Just as in scopes used for black-and-white TV servicing, a built-in system for calibrating waveform amplitudes is an asset. Both low-capacitance and demodulator probes also come in handy. These units should be properly matched to the scope and the attenuation factors accurately evaluated.

new

A **must** for any serviceman now servicing or planning to service Color TV receivers ■ Make a one man service call out of a costly two man cabinet pulling job ■ Eliminate possibility of damage to the customer's set when transporting to and from his home ■ Eliminate the need to reconverge the customer's set when the chassis is returned ■ Professional Appearance—Finish matches that of RCA Test Equipment ■ Partial Assembly—Safety glass and kine mask assembled at factory ■ Components Kit furnished with Test Jig includes all necessary components, hardware and Instructions for installation of an RCA Tri-Color Kinescope ■ Convergence control panel supplied provides dynamic as well as static convergence for the CTC-10 and CTC-11 chassis ■ Instructions included with test jig provides data for utilization with CTC-4, 5, 7 and 9 chassis and lists extension cables required ■

**act now for
the color season**

see your RCA distributor for details

RCA parts & accessories/camden, n. j.

RCA COLOR TEST JIG

#11A1015



RCA The Most Trusted Name in Color Television
RADIO CORPORATION OF AMERICA

You'll find an oscilloscope useful in signal-tracing chroma bandpass and demodulator circuits, checking signals at the output of the burst amplifier, sampling the output of the reference oscillator, and analyzing signals on the chroma phase-detector diodes. The scope also finds many applications in convergence-circuit troubleshooting, alignment, and checking the operation of other color test instruments.

Sweep Generators

An output in the video-frequency range is the most important special requirement for sweep-signal gen-

erators used in color-TV servicing, since the mean frequency of the generator output must be approximately 3.58 mc during chroma bandpass alignment. Many conventional TV sweep generators now afford this relatively low band of frequencies, with sweep width adjustable by either a switch or a control. Some units have a built-in marker generator, while others have provisions for adding markers from an external source. Some optional features that add to the convenience of using the generator are retrace blanking, a sweep-reversal switch,

and provisions for crystal calibration.

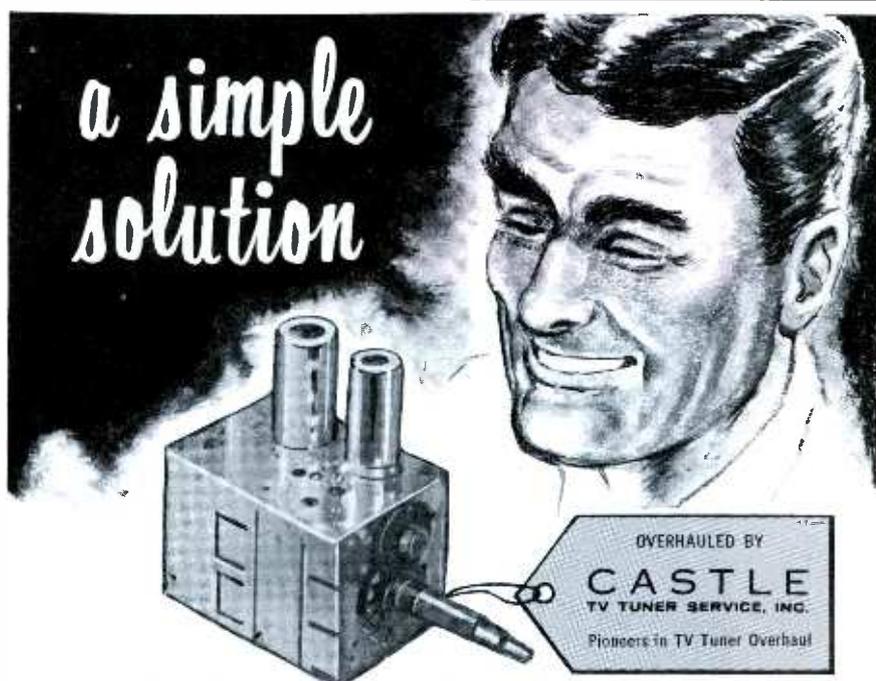
Marker Generators

Marker generators used for color servicing must also have an output in the video-frequency range. Since accuracy and stability are imperative in a generator of this type, the instrument should have facilities for crystal calibration, and its power supply should be well regulated. Among the desirable, though not essential, features found in many generators are provisions for internal or external modulation, and a switch to select either pip or dip marker indications.

An *over-all* chroma-response check of the video-IF and bandpass amplifiers in a color set requires two additional pieces of equipment—a second marker generator (or other very accurate CW signal generator) and an RF modulator unit. The generator provides a 45.75-mc output that serves as a carrier for the video-frequency sweep signal, so that the latter can be fed through the video-IF section of the receiver. Amplitude modulation of the carrier by the video-sweep signal takes place in the modulator; then the output of this device is injected at the mixer, just as in conventional video-IF alignment. The video-frequency marker used during this procedure is coupled into the bandpass amplifier.

Conclusion

Obviously, it takes a fair-sized investment to equip a shop with the proper test equipment for color TV servicing. To offset this expense, however, you can justifiably advertise yourself as being "equipped for professional color service"—thus opening the way to a healthy increase in revenue. ▲



THAT SOLVES ALL YOUR TV TUNER PROBLEMS

Ask yourself

... do you have the time to fool around drilling, sawing, filing ... trying to make a "Universal" replacement tuner fit in place of the original?

... do you have all the expensive instruments and equipment to complete the alignment so essential after each tuner repair or replacement?

... can you spare the time repairing and adjusting your own TV tuners and can you charge enough to justify the time spent?

A Castle Overhaul eliminates every one of these problems.

Castle replaces all defective parts, (tubes and major parts are extra at net prices) and then aligns your tuner to the exact, original specifications.

Simply send us your defective tuner complete; include tubes, shield cover and any damaged parts with model number and complaint.

Send for **FREE Mailing Kit** and complete details.

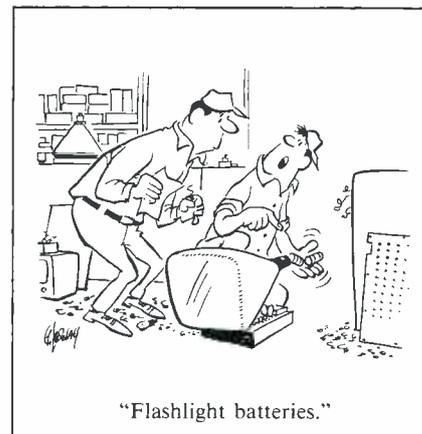
ONE PRICE
9⁹⁵
ALL MAKES

VHF TUNERS
UHF TUNERS
UV COMBINATIONS*

*UV combination tuner must be of one piece construction. Separate UHF and VHF tuners with cord or gear drives must be dismantled and the defective unit sent in.
90 Day Warranty

CASTLE Pioneers in TV Tuner Overhauling
TV TUNER SERVICE, INC.

5710 N. Western Ave., Chicago 45, Illinois • 653 Palisade Ave., Cliffside Park, New Jersey
In Canada: 136 Main St., Toronto 13, Ontario

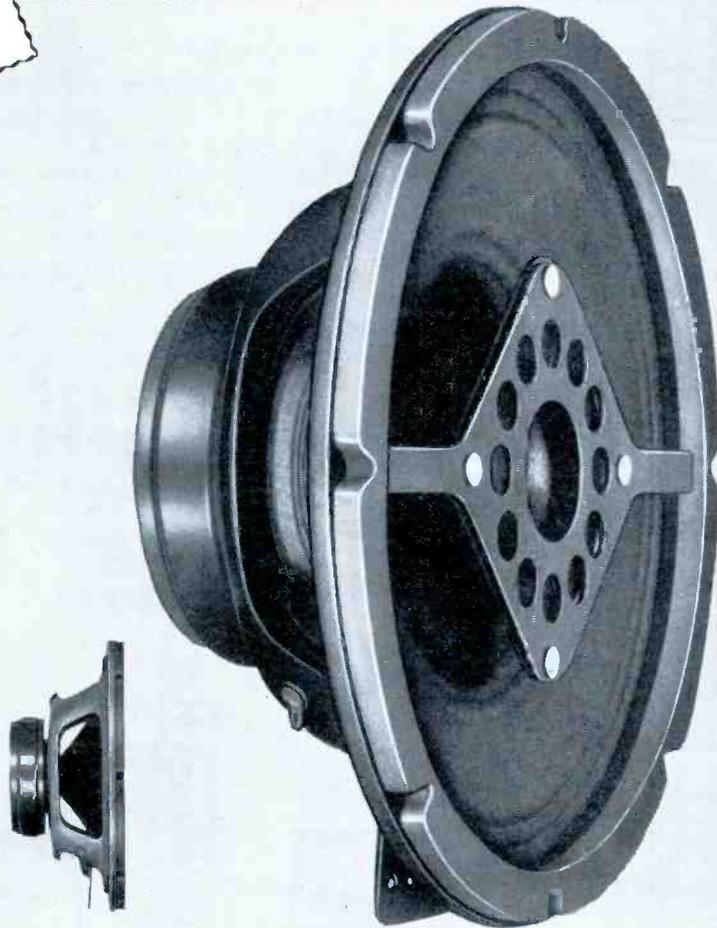


K-950

NEW

... 8" 2-way coaxial distributed sound loudspeaker... MORE

THAN 50% LOWER INSTALLED COST!



Available with factory installed 70.7 or 25 volt transformers. KWIKON* instant connectors and tap adjustments are a cost saving feature.

It's simple arithmetic to show that with the full 110 degree coverage angle of the K-950 (compared with 90° or less for conventional types) you can use *half as many speakers, transformers, ceiling baffles . . .* have *less than half* the installation cost, because KWIKON* instant connectors and factory preattached transformers further cut on-the-job time importantly. And amplifier cost goes down, too, due to reduction in the number of speakers plus higher efficiency.

When the K-950 is used with conventional "90 degree" spacing, reproduction quality is substantially improved, and loudness and articulation variations with position are drastically reduced compared with the performance of simple cone speakers.†

So whether you're designing for lowest installed cost or highest quality distributed sound, investigate the advantages of the outstanding K-950. Write for Specification Sheet CSP-102 for complete technical details.

†Results of an impartial test by a world famous firm of acoustical consultants.

NO OTHER DISTRIBUTED SOUND SPEAKER HAS ALL THESE FEATURES

1. Genuine coaxial 2-way system with electrically and acoustically independent tweeter.
2. High fidelity wide range response.
3. High efficiency.
4. Widest high frequency dispersion.
5. Lowest variation of articulation with position.
6. Super-shallow depth . . . will mount in the wall.
7. SYNTOX-6* ceramic magnet (10 oz.).
8. Available with factory mounted 70.7 or 25-volt transformers.
9. Handy 10-pack is economical, easy to handle.
10. KWIKON instant connection and transformer tap adjustments.

*T.M.



jensen MANUFACTURING COMPANY

Division of THE MUTER COMPANY

6601 S. Laramie Avenue, Chicago 38, Illinois

In Mexico: Universal De Mexico, S.A., Mexico, D.F.

A Profitable New Field!

INDUSTRIAL ELECTRONIC SERVICING

with
OHMITE[®]
QUALITY
Components

Industrial electronic servicing is profitable new business for you. Especially when you stock and replace with dependable Ohmite components . . . the line your industrial customers know and prefer. Service such industrial equipment as mobile radio, aircraft and marine radar and radio, electronic controls for factory processes and automation, industrial P.A. and intercom systems, and—medical and dental electronics.

AXIAL-LEAD RESISTORS

Vitreous-enameled, power-type units designed to withstand high temperatures. In 3, 5, and 10-watt sizes.

BROWN DEVIL[®] RESISTORS

Vitreous-enameled. In 5, 10, and 20-watt sizes.

LITTLE DEVIL[®] COMPOSITION RESISTORS

Meet all MIL-R-11A requirements. Available in 1/10, 1/4, 1/2, 1, and 2-watt sizes in all standard EIA values.

MOLDED COMPOSITION POTENTIOMETERS TYPE AB

Resistance material is solid-molded, noise-free. Rated at 2 watts.

Write for Stock Catalog

OHMITE[®]
DEPENDABLE
RESISTANCE
UNITS

OHMITE MANUFACTURING COMPANY
3644 Howard Street, Skokie, Illinois

SERVICE DEALER ADVERTISING PROGRAM

Several of these ads reflect a holiday theme that will soon be right in season. Don't delay; before the Christmas rush overtakes you, plan now for the ads you're going to use the rest of this year. For a change of pace from holiday greetings and special Christmas-season promotions, try the "TV Neurosis" cartoons included in this month's selections.

Check with your printer to see if you should order newspaper mats (\$1.75 per set of 5), reproduction proofs (\$1 per set), or both (\$2.50). Then, fill in the handy coupon on page 100 to order either this month's selection or the entire program of 60 ads. (With the latter, you receive a comb-bound book of proofs.) To be sure of getting your ads in time for your promotion, mail the request as early as possible.

ES-18 1 7/8" x 3 7/8"

The viewer whose TV set conks out during his favorite TV show is perturbed, to say the least. But he'll recognize himself in this ad, cheer up, and probably call you.

TV NEUROSIS:
"perturbed"

TV Failure always occurs during his favorite TV show. When this happens to you call ME 0-0000

YOUR NAME
ADDRESS

ES-29 1 7/8" x 4 1/8"

Just in time for Christmas, this special get-acquainted offer provides a free toy for each customer's offspring — and some new names for your customer file.

TV REPAIR
"Get Acquainted"
SPECIAL!
FREE TOYS

This week only, a complete set will be given with every TV service call. For plus TV service, always call

YOUR NAME
ADDRESS

ES-41 1 7/8" x 4 3/8"

This cartoon calls attention to one of the consumer's pet peeves (past-due delivery), and points out that you avoid this pitfall in public relations.

TV NEUROSIS:
"antagonism"

PROPERTY of TV, you take for granted services always can usually be avoided. For PROMPT, dependable TV REPAIR always call ME 0-0000

YOUR NAME
ADDRESS

FOR A HAPPIER NEW YEAR

Have your TV repair work done by

YOUR NAME
ADDRESS

MERRIEST CHRISTMAS

from your friends at (Your Name)

YOUR NAME
ADDRESS

ES-51 3 3/4" x 2 3/4"

It's time to plan your Christmas-season advertising campaign. Here's a Merry Christmas wish that is quickly recognized as yours, since it follows the same pattern as your regular ads.

ES-33 3 3/4" x 3"

About the time your regular and prospective customers are thinking of New Year's resolutions, this gala greeting comes along to suggest they resolve to have their TV work done by you in '62.

THE NEW DYNAMIC RAPID TROUBLE SHOOTER

METREX GENIE

POCKET-SIZED — TRANSISTORIZED
SIGNAL GENERATOR
Tunable 50 cy. to 3.3 mc.

7 INSTRUMENTS IN ONE!

FUNCTIONS AS • RF • IF • AUDIO
VIDEO • PULSE • BAR GENERATOR
& VOLTAGE CALIBRATOR



Services — RADIO, TV, HI-FI,
RECORDERS, PHONES AND INTERCOMS

The GENIE has a tunable range of 50 cycles to 3.3 mc. Output variable from zero to 9 volts peak to peak. The uniquely designed circuitry makes possible unusually stable operation and extremely low battery drain. The rugged diecast housing insures extreme durability and perfect shielding. 2 3/4" x 3 1/2" x 2" size is ideal for shop, lab, and field use.

1495
less
Batt.

WRITE TODAY FOR
FREE TROUBLE
SHOOTING
GUIDE

METREX 519 HENDRIX ST., BKLYN 7, N. Y.

GE ELECTRONICS

ONE G-E 21FLP4 PICTURE TUBE REPLACES 13 TYPES

FILLS 25% OF YOUR REPLACEMENT NEEDS

The General Electric 21FLP4 just released. Here's the only picture tube you need for one out of every four replacements. It replaces 13 tube types. Thirteen replacement tubes you don't have to order—pick up—pay for—or carry in stock to meet your customers' requirements. It's almost like getting a 13-tube inventory in one picture tube! Quick availability for more of your replacement needs.

The General Electric 21FLP4 is a low-voltage electrostatic focus tube which does not require an ion trap magnet. Saves time and work on service calls and in the shop. The General Electric high-resolution electron gun and deep-cushion phosphor screen help provide the long-lasting, brighter picture your customers want.

The General Electric 21FLP4 replaces these 13 tube types:

21ALP4	21BAP4	21CBP4B
21ALP4B	21BNP4	21CMP4
21ATP4	21BTP4	21CVP4
21ATP4A	21CBP4	21CWP4
	21CBP4A	



Get full details on this 21-inch 90-degree "universal" replacement picture tube from your General Electric tube distributor. General Electric Company, Distributor Sales, Electronic Components Division, Room 8238B, Owensboro, Kentucky.

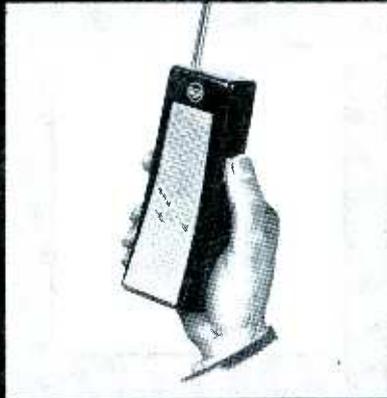
Progress Is Our Most Important Product

GENERAL  ELECTRIC

**A FEW
WILL DO**

Talk Two-Way

- on your job
- in your car
- in your office



PERSONAL-COM 300 Hand-Held 2-Way Radio

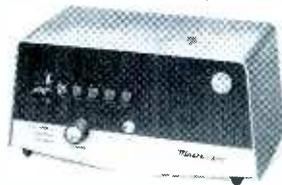
Rugged, dependable, fully transistorized 27-megacycle portable 2-way radio, designed specifically for business and industrial uses. Small and light, weighs less than one pound. Has 11-volt mercury battery for 50 hours' operation. Factory-installed plug-in module available to increase transmit power.

MARK VII "Top-of-the-Line" Citizens' Band 2-Way Radio



Short-range communications facilities for business service and personal needs. Ideally suited for use on materials handling vehicles, or for 2-way conversation between fixed points. Also serves as excellent base station for hand-held radio. 6 or 12 V DC or 115 V AC operation.

LOW-COST INTERCOM



A complete line of quality Intercoms—wired, or wireless—designed for office, factory or home use, at lowest prices. Suitable for many applications, from simple wireless 2-way talk-listen systems to flexible, multi-unit systems with a variety of talk-listen-monitor options.



Additional sales outlets are now being opened. Full particulars on request. Write to RCA, Telecommunication Center, Dept. B-429, Meadow Lands, Pa.

The Most Trusted Name in Electronics
RADIO CORPORATION OF AMERICA

RADIO CORPORATION OF AMERICA

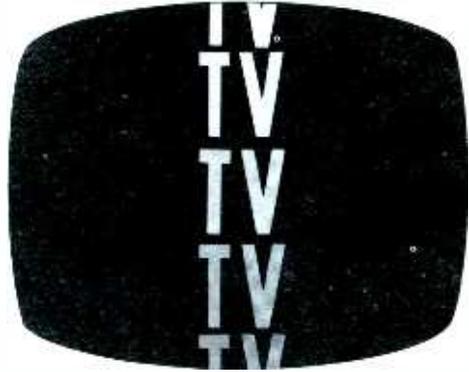
Special Products Department, Dept. B-429, Meadow Lands, Pa.

Please send me complete information on the following:

- RCA PERSONAL-COM 300 RCA Mark VII RCA Intercom

NAME _____
 TITLE _____
 FIRM OR ORG. _____
 ADDRESS _____
 CITY _____ ZONE _____ STATE _____

CASE HISTORIES OF



COLOR TROUBLES

These experiences will give you a better understanding of color TV troubles and their solutions.

Talk to anyone who is doing much color TV service, and you'll soon learn that the overwhelming percentage of trouble is in the black-and-white circuits. However, color-section defects claim more than their share of troubleshooting time, simply because service technicians are less familiar with the symptoms and circuits involved. To give you an idea of the special problems found in color sets, we've rounded up a few typical service experiences.

Ghosts in Technicolor

One case we've heard of, although not specifically a color problem, resulted in a service call because the receiver was a color set. The symptom, as understood from the customer's three-paragraph description, was a tunable ghost—one that comes and goes at various settings of the fine-tuning control. Had the receiver been a black-and-white set, there wouldn't have been a call—the customer would have been satisfied with the picture until a more severe trouble developed. However, with a full-color ghost showing up during regular monochrome programs, and the set producing a miserable color picture, it didn't take long for the customer to decide he needed service.

After the home-call man arrived on the scene and viewed the symptom himself, he quickly reasoned that the tunable ghost was due to an RF or IF defect. He therefore substituted the tubes in the tuner and IF section. This failed to solve the problem, so he carefully replaced the original tubes in their appropriate sockets, made an explanation that bench service was required,

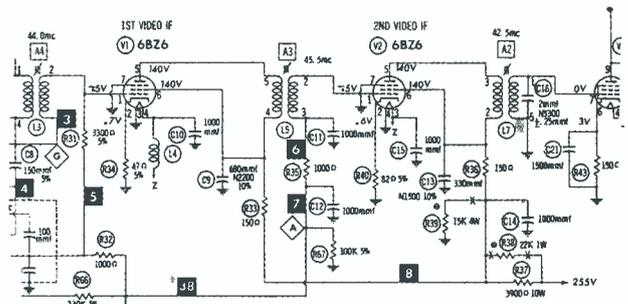


Fig. 1. Tunable ghost was traced to shorted capacitor.

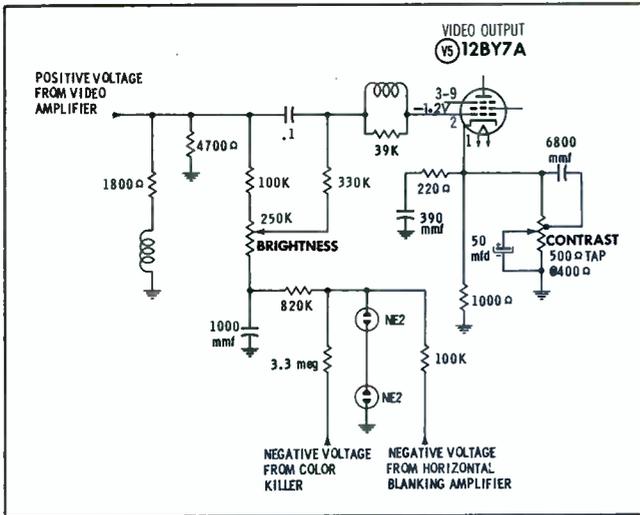


Fig. 2. Neon lamp failed in brightness-control circuit.

and carted the set into the shop.

The first few bench tests revealed regeneration in one of the IF circuits. On close visual inspection of the chassis, a 150-ohm, 1/2-watt resistor showed signs of overheating. When the set was fired up, a quick check of the voltages in the IF strip revealed low plate and screen voltages on the input IF tube (Fig. 1). A resistance measurement at pin 5 of V1 indicated a short circuit. Since R33 showed evidence of overheating, a shorted screen-bypass capacitor C9 was suspected. Sure enough, when the grounded lead of C9 was clipped, the short disappeared. Both C9 and R33 were replaced, and the set was again fired up. Success! There was no sign of a ghost, regardless of the setting of the fine tuning.

All or Nothing

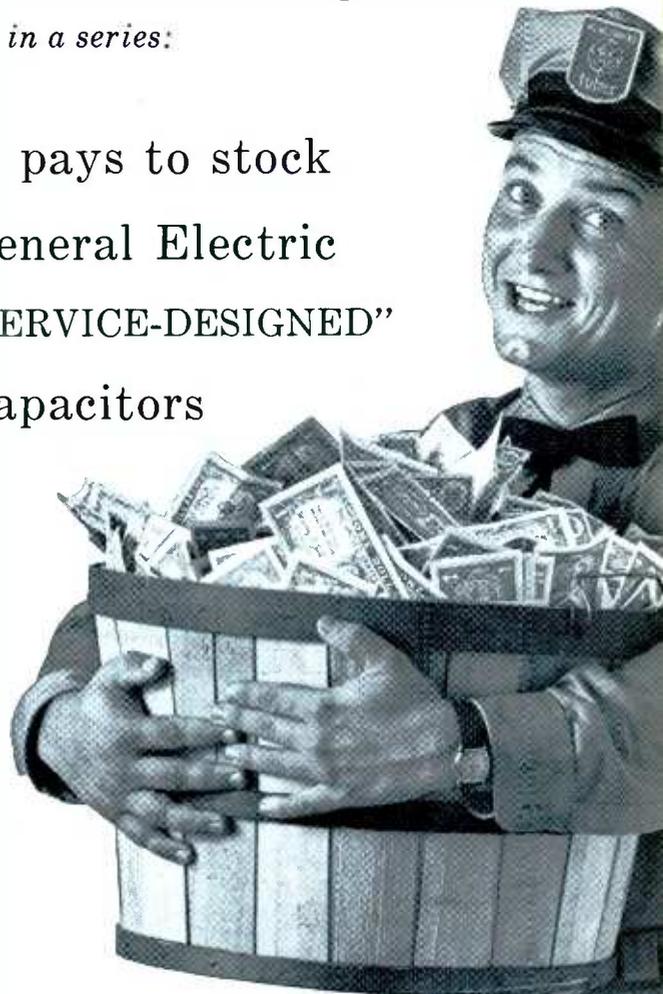
Another trouble unique to color sets showed up in a newer RCA Chassis CTC10. This set produced a picture only when the brightness control was advanced to maximum. There was always light on the screen no matter where the control was set; however, video information wouldn't appear except at the maximum setting.

What could have been a rather knotty problem was again solved by close visual inspection—after the chassis was fired up on the bench. Two NE2 neon lamps form the ground-return path for the negative bias circuit feeding one side of the brightness control (see Fig. 2). In this chassis, the lamps failed to light. This fault was immediately noted by the serviceman, who is already an "old pro" in color work.

By putting two and two together, the serviceman reasoned that excessive bias was cutting off video output tube V5 except when the brightness control was set to the most positive position. This meant there was either excessive negative voltage at one end of the control, or insufficient positive voltage fed to the other end from the video amplifier stage. Since the NE2's failed to light, excessive negative voltage and a defective lamp seemed to be the most likely answer. A quick check with a VTVM confirmed this suspicion. Bridging a new NE2 across each lamp disclosed one defective unit. (The technician had to bridge both of them because he tried the good one first!) After the bad NE2 was replaced, normal operation was restored, and another color trouble bit the dust.

1st in a series.

It pays to stock
General Electric
"SERVICE-DESIGNED"
Capacitors



INCREASE YOUR PROFITS

Save the premium you pay for slow-moving "exact" replacements in ordinary capacitor lines. General Electric "Service-Designed" capacitors are engineered for both mechanical and electrical interchangeability and are clearly marked for range of capacitance and voltage requirements. No slow movers. No more guessing or substituting for exact replacements. Make all your electrolytic capacitor replacements from smaller inventory and turn it into profits faster.

The complete "Service-Designed" line contains tubulars, twist-prong and miniature electrolytic and paper Mylar* types. Get the full profit picture from your General Electric capacitor distributor. General Electric Company, Distributor Sales, Electronic Components Division, Room 8247B, Owensboro, Ky.

*T.M. duPont Company

Progress Is Our Most Important Product

GENERAL  ELECTRIC

Saw Red

Troubles that produce a solid-color background for any picture are fairly common in color TV work. Although the screen may be tinted with any of the three primary colors, our favorite example of this type of trouble literally caused the customer to see red.

In such circumstances, it doesn't take too much brain power to figure that the problem must be caused by improper gray-scale adjustment (color temperature), a defect in the CRT circuit, or trouble in the R-Y amplifier stage (Fig. 3). Simply adjusting the red screen and background controls in this case proved it wasn't a misadjustment problem. Also, substituting V22 eliminated the possibility that a heater-cathode short or gassy R-Y amplifier might be causing the trouble.

When the VTVM was put to work measuring the voltages at the R-Y amplifier, a healthy positive voltage was found on the control grid. The best bet was that coupling capacitor C131 was shorted. Also, it was probable that increased current had caused R171 to decrease in value. Clipping one lead of C131 reduced the grid voltage to nearly normal—proving it was shorted. Therefore, R171 was checked and, as suspected, it had dropped to a low value.

Replacing the two defective components restored normal operation. However, this didn't conclude the troubleshooting. Experience has shown that two 1600-ohm, 10-watt resistors in the power supply feeding the 280-volt source are often damaged by this sort of trouble. Therefore, they were checked and found to be changed in value. Both resistors were replaced to complete the job.

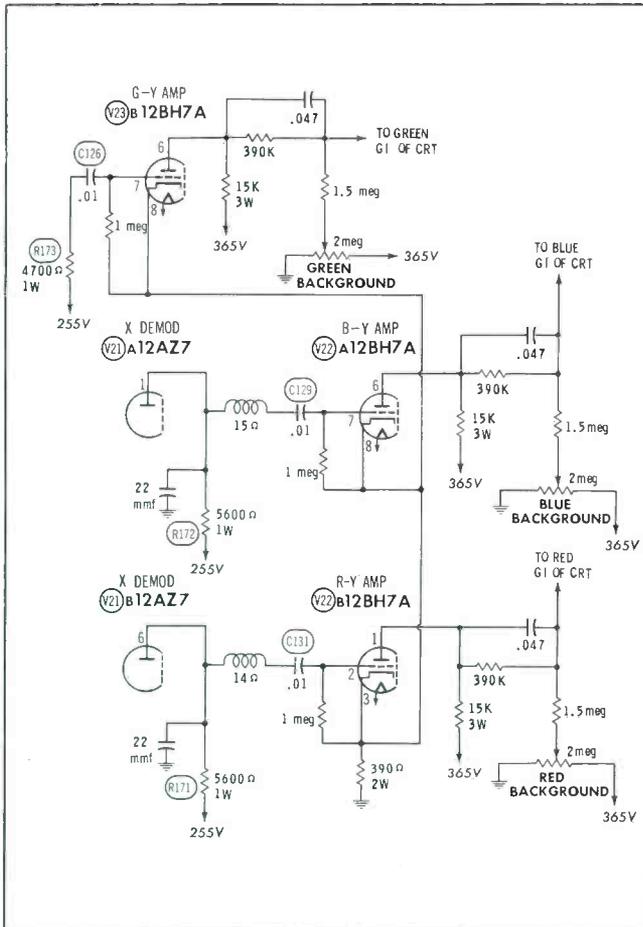


Fig. 3. Red screen was produced by short at R-Y amplifier.

NEW TUBE TYPES ARE REVOLUTIONIZING YOUR BUSINESS

We promised you the answer and here it is...

NEW TUBE TESTER MODERNIZING PANEL

Now, you can test all of these new tubes in the Sencore Mighty Mite or any other tube tester except the "cardomatic" type. Don't throw away your tube tester just because you can't check the RCA Nuviators, the GE Compactrons, the Sylvania 10 pin tubes or the all new RCA Novars.

These new tubes, which are the industry's answer to the transistor, are causing a revolution in electronics today. Thousands are being installed in electronic equipment every day from coast to coast. You will be called on to test them tomorrow. Be prepared with the TM116 Tube Tester Modernizing Panel.

For use with any manually operated tube tester.

Tests are made by plugging the TM116 into an octal socket on your tester and setting controls from the chart provided with the unit. All tests are the same as your tester now makes. Some other adaptor units merely reduce all tests to an emission check. Sencore uses additional internal circuitry to provide complete mutual conductance or high grid leakage checks if

your tester now makes them.

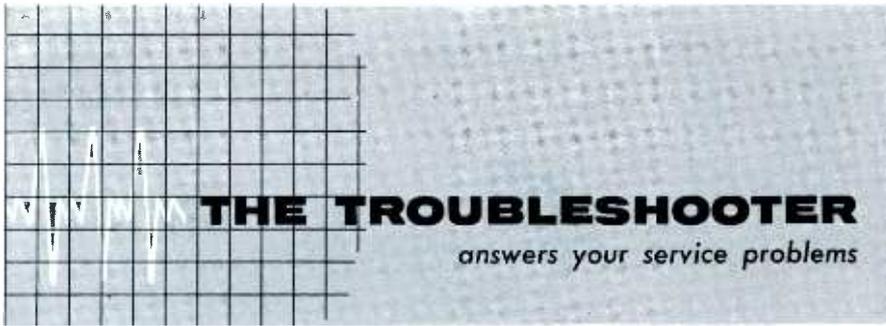
You can own the TM116 for less money than it costs to keep substitutes in your shop or lab. Model TM116 Dealer Net Only.....

\$2495

Ask your Authorized Sencore Distributor for the New TM116. He has them in stock.

SENCORE

ADDISON, ILLINOIS



Color Hash

An RCA CTC4 chassis is giving me a rough time. During color programs, color hash appears as soon as the color control is advanced slightly from the minimum setting. However, there is no hash in black-and-white pictures.

GABRIEL SAND

Jacksonville, Fla.

Take a more critical look at that symptom. Color hash (also referred to as "confetti") is nothing more than colored snow. Therefore, you undoubtedly have a snow problem and should check the antenna, RF, IF, and AGC circuits. Close observation of a black-and-white picture will probably reveal the snow; however it's certain to be more noticeable during a color transmission.

Incidentally, it's almost a sure bet that the killer threshold control is misadjusted, making it necessary to set the color control to minimum during monochrome reception to prevent color contamination. Notice that the bias voltage developed to cut off the bandpass amplifier during black-and-white reception is produced by the conduction of both the color killer and blanking amplifier. This circuit is rather unusual, and operates as follows:

During black-and-white programs, V20A is cut off by a negative voltage developed across R168 at the chroma phase detector. This voltage is produced by the conduction of the lower section (pins 1 and 7) of V21 when a positive pulse is applied to pin 7. The applied signal is a combination of an amplified keying pulse from the killer and a portion of the signal developed in the cathode circuit of the blanking amplifier. The amplitude of the latter depends on the setting of the color control, and that of

the former is determined by the setting of the killer threshold control.

When a color signal is received, the burst signal is fed to pin 7 of V21 from the burst amplifier. A negative voltage is then developed across the series combination of R168 and R169, and is fed to the grid of the killer. Here it combines with the positive voltage from the threshold control, and conduction of the killer is reduced or blocked—depending on the control setting. This, then, permits the color control to regulate the bias on the bandpass amplifier by varying the amplitude of the signal fed to pin 7 of V21.

Intermittent Blur

I'm having trouble solving an intermittent focus problem in an RCA CTC10 chassis. The last time it happened, R188 at the red screen grid (pin 11) of the CRT overheated, and I was able to determine that the focusing voltage was quite low. However, the trouble cleared up before I could find the cause.

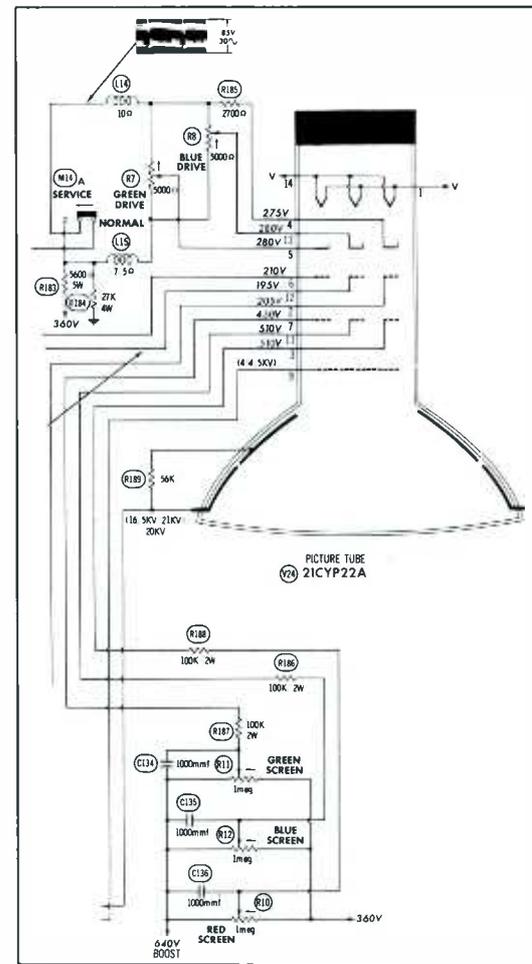
K. S. JACKSON

Ann Arbor, Mich.

Chances are you have an intermittent short between the red screen grid and focusing anode of the CRT. The next time the trouble appears, pull the picture-tube socket and check voltages again; you'll probably find they will return to normal with the socket removed. If so, the CRT is definitely shorting.

Hot Stuff

I'm having trouble in a Sylvania color TV (Chassis 1-534-1) with arcing from the CRT to the convergence yoke and to the tuner. Also, there is some arcing in one of the 3A2 tubes. I've changed



the high-voltage regulator, but it didn't help.

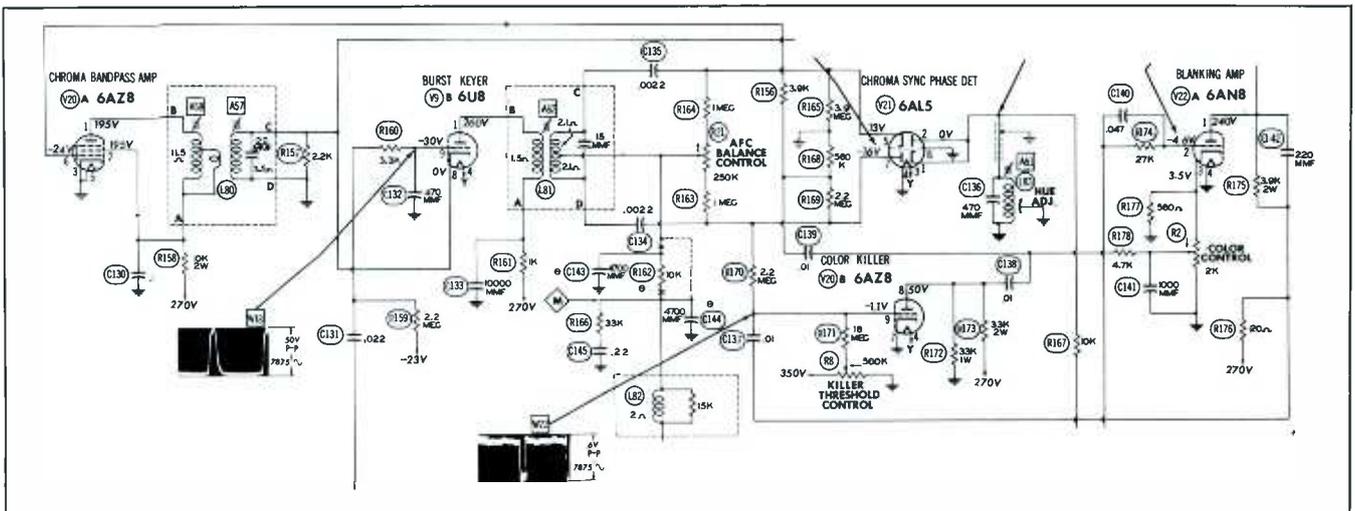
JOHN E. PAVLICK

Monroeville, Pa.

When you changed the high-voltage regulator you eliminated the most likely suspect.

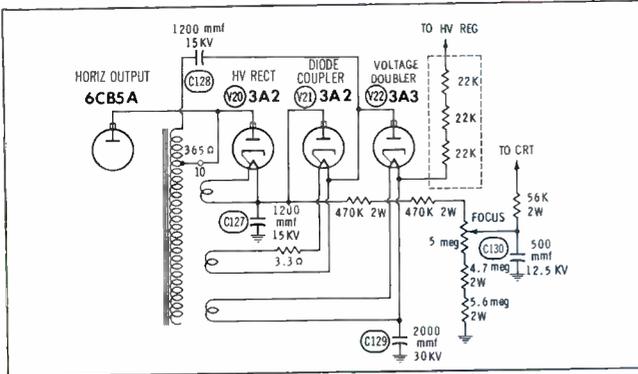
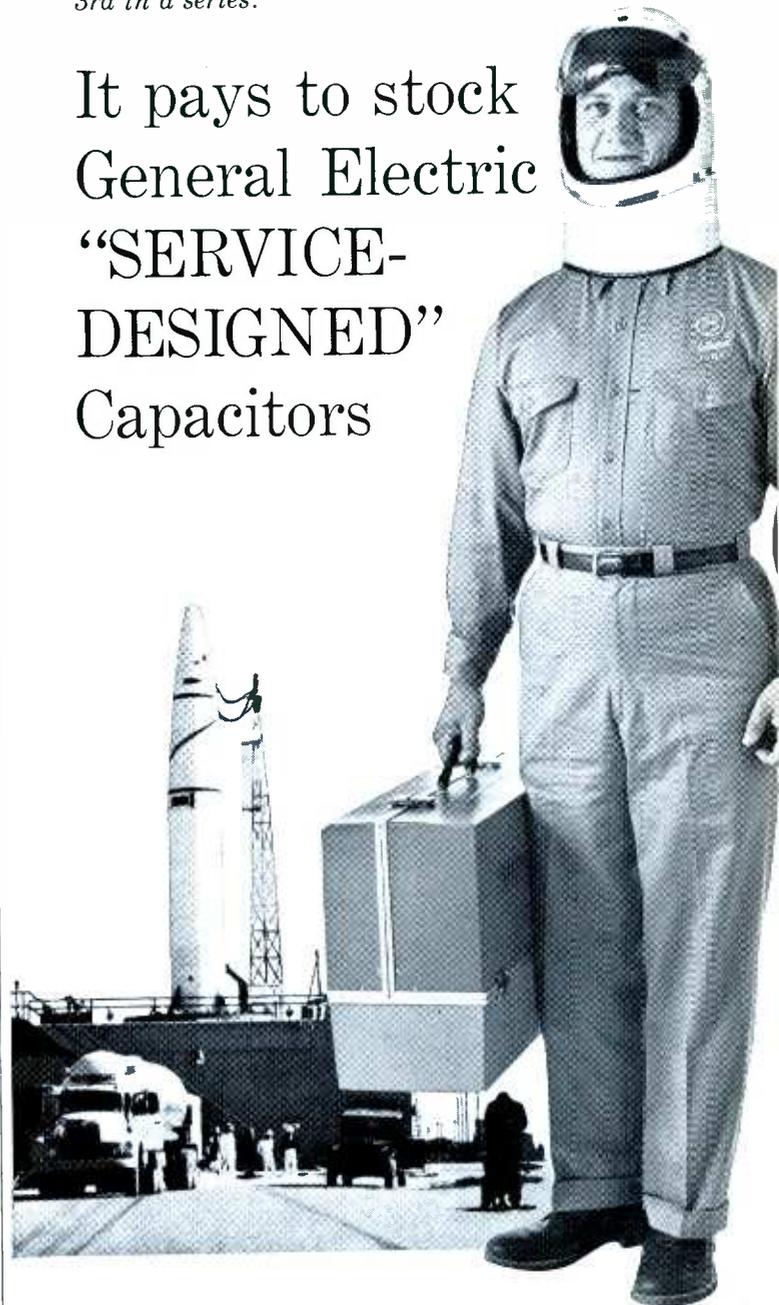
A lot of stray RF must be floating around inside the set. Check to make sure the convergence yoke and CRT shield are well grounded. Perhaps a ground strap was left disconnected during a previous service call.

As far as the 3A2 is concerned, be sure the plate leads are dressed away from the glass envelope, and check high-voltage filter capacitors C127, C129, and C130.



3rd in a series:

It pays to stock General Electric "SERVICE- DESIGNED" Capacitors



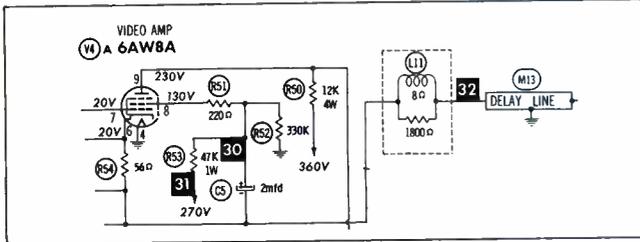
Regular Offender

An RCA CTC10 chassis has a rather weak picture with very touchy vertical hold. The trouble is present on both black-and-white and color programs. All voltages appear to be normal. Any suggestions?

J. G. REESE

Philadelphia, Pa.

The 2-mfd bypass capacitor C5 in the screen circuit of the video amplifier is probably your culprit. This component is a regular offender. When it opens, the unbypassed screen grid causes a loss of video and also sync compression. We know of some servicemen who replace this component every time a chassis lands on the bench, to guard against a possible callback.



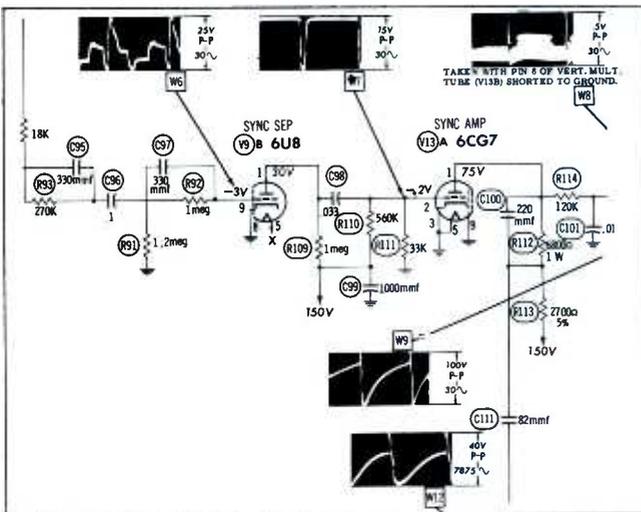
Contrary Horizontal

I'm having trouble pinning down a horizontal hold problem in an RCA CTC5B chassis. The set works fine during color programs, but it loses horizontal hold when a black-and-white show comes on. When the picture is out of sync, the horizontal hold control has no effect.

J. W.

Laurelton, N.J.

This sounds like sync trouble. Apparently the burst signal is adding just enough pulse amplitude during color programming to synchronize the oscillator. Use your scope to trace through the sync circuits until you locate the defective stage. You're most likely to find trouble in the sync separator, since the burst signal could be increasing the bias in this stage and providing better separation. If this is the case, you'll find video information at the output of the separator during black-and-white programs. This of course, could drive the horizontal oscillator far off frequency.



BENEFIT FROM G-E LEADERSHIP in capacitor design and manufacture—General Electric's 70-year record as a leading manufacturer of advanced-design capacitors stands behind this line of replacement capacitors. G-E Alumalytic® Capacitors are being used as original components in many leading radio and TV sets. As the nation's largest supplier of aluminum and tantalum capacitors for military use, General Electric has furnished capacitors for every major U. S. missile. The same design and manufacturing skill that led to General Electric's development of foil-type Tantalytic® capacitors, the type most widely used for critical military applications, has created this line of "Service-Designed" capacitors. Get them from your authorized G-E capacitor distributor. General Electric Company, Distributor Sales, Electronic Components Division, Room 8239A, Owensboro, Kentucky.

Progress Is Our Most Important Product

GENERAL ELECTRIC

How do you select a soldering iron?

...by wattage or delivered heat?

The wattage of an uncontrolled iron is no indication of delivered heat. Tip temperature varies under load from too hot to too cool. Sound connections require proper soldering temperature within a controlled range. With a high wattage iron that sags into the proper range, you pay an unnecessary premium and risk damage from too high heat.

A Weller Magnastat iron is temperature controlled at the tip. Efficient soldering temperature is maintained continuously by a thermo-magnetic sensing device. The iron never overheats . . . saves current when idling . . . and holds within $\pm 3\%$ variance of the specified temperature. Interchangeable tips provide either 750, 700 or 600°F. temperatures.

...by the pound or for operator efficiency?

With only half the weight, a Weller Magnastat iron does the work of an uncontrolled iron of much higher wattage. A 55 watt Magnastat iron weighs only 3 ounces. Operator efficiency is also aided by a delicate balance and constantly cool handle.

Weller[®]

MAGNASTAT

temperature controlled soldering irons

MODEL TC-552. 55 watts, for heat-sensitive soldering	\$9⁰⁰ <small>list</small>
MODEL TC-602. 75 watts, for medium soldering	\$10⁰⁰ <small>list</small>
MODEL TC-1202. 120 watts, for heavy soldering	\$11⁵⁰ <small>list</small>

Prices shown are for Magnastat Iron with tip and 2-wire cord. 3-wire cords available. Over 50 tip styles available in 3 temperature ranges.

SEND FOR NEW BULLETIN ON MAGNASTAT IRONS

WELLER ELECTRIC CORP. 601 Stone's Crossing Rd.
Easton, Pa.

Bandpass & Demodulator

(Continued from page 26)

vided by this arrangement may be used either to permit feeding a signal directly to the bandpass amplifier from the video detector, or to develop the relatively high input-signal amplitude required by some types of chroma demodulators.

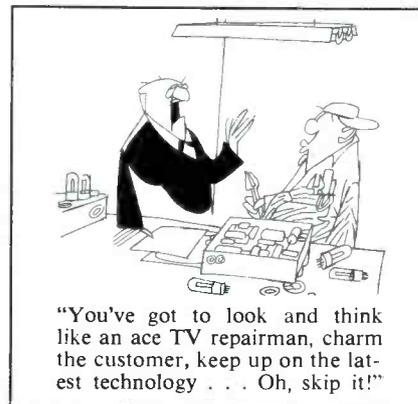
Fig. 2 illustrates a two-stage circuit containing many of the same features found in Fig. 1. However, notice that the burst signal is taken from the secondary of the interstage transformer. This means that the horizontal blanking pulses and color-killer bias must be applied only to the second bandpass stage, because the first stage must be left conducting so that the burst signal can reach the input of the color killer.

In the grid circuit of the first bandpass amplifier, the connection marked FROM KILLER DET is a source of automatic chroma control (ACC) bias. The negative voltage at this point, produced in proportion to the strength of the burst signal, assists the AGC system of the receiver in maintaining a steady input-signal level at the chroma demodulators.

Another type of two-stage bandpass amplifier, introduced this year in the new Zenith color sets, is described in "What's New in Color TV?" elsewhere in this issue.

Frequency Response

A correct response curve in the bandpass - amplifier section is extremely important to good color reproduction. When the bandwidth is too great, or the frequency limits of the response curve are incorrect, the luminance (Y) signal enters the bandpass amplifier and causes cross talk. This results in ragged or fluctuating edges on objects in the picture which are much brighter or darker



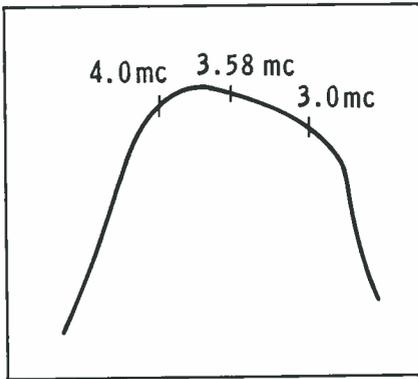


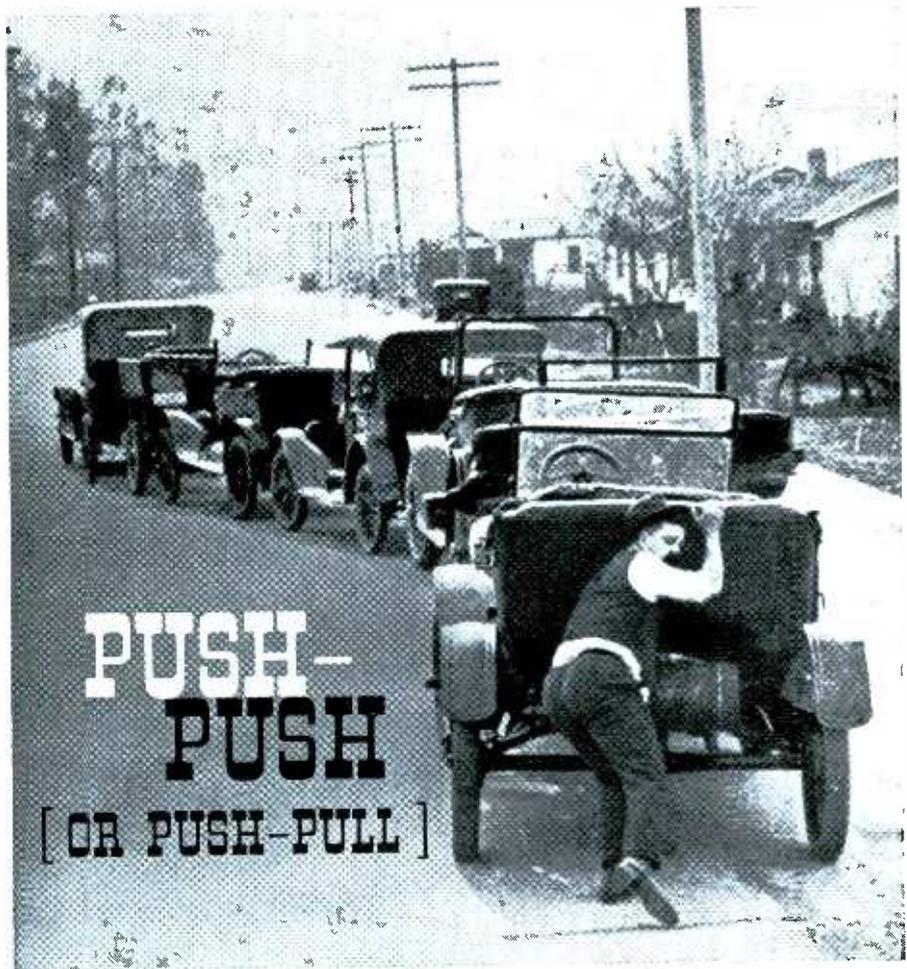
Fig. 3. In many sets, response curve of bandpass amplifier has slight tilt. On the other hand, too narrow a bandwidth produces an effect similar to the results of narrow response in black-and-white video amplifiers. Color details are less clearly defined because the chroma sideband frequencies farthest from the carrier (representing the finest picture details) are choked out. The stage gain may also be reduced, thus weakening the chroma signal and causing poor color contrast. If there is severe misalignment, the chroma signal may be badly distorted; typical results are a smeared, muddy-looking picture or incorrect hues.

In addition to the exacting bandwidth requirements of the bandpass response curve, its slope is also fairly critical. The bandpass amplifiers of most receivers are tuned for slight peaking toward the high-frequency end of the curve, somewhat as shown in Fig. 3, rather than for a flat-topped response. This is the reverse of the video-IF curve, which gradually falls off at frequencies 3 to 4 mc away from the picture carrier. Therefore, the overall frequency response of the signal path from the mixer-oscillator stage to the chroma demodulator is substantially flat between approximately 3 and 4 mc.

A video-frequency sweep generator and certain other special facilities are necessary for checking chroma - bandpass response. (See "Test Equipment for Color TV" in this issue.) However, shops that are serious about color TV work find it advantageous to have this equipment and use it frequently in maintaining top-notch color-picture quality.

Common Circuit Troubles

Next to tube failures, capacitor defects are the greatest source of difficulty in bandpass amplifiers.



controls from Centralab®

... won't make car-pushing easier but they will make your job much simpler.

This is because CENTRALAB has the most complete line of push-push and push-pull controls on the market. They are available in four different types—Adashaft, Universal Shaft, Fastatch for dual concentrics and Twin types for stereo. These push-push and push-pull controls are now used in over 78% of the television, radio and hi-fi sets coming out of the factories. In addition, you can make your customers happier by installing these convenient-to-use controls when replacing the standard volume controls.

You will find the CENTRALAB replacement you need at your distributor. Contact him now for your copy of the latest CENTRALAB catalog listing hundreds of other CENTRALAB replacement components... or write us directly for your free copy.



ACTUAL SIZE

Centralab®

THE ELECTRONICS DIVISION OF GLOBE-UNION INC.
942L EAST KEEFE AVENUE • MILWAUKEE 7, WISCONSIN
CENTRALAB CANADA LIMITED—AJAX, ONTARIO

ELECTRONIC SWITCHES • VARIABLE RESISTORS • CERAMIC CAPACITORS
PACKAGED ELECTRONIC CIRCUITS • ENGINEERED CERAMICS

Leaky capacitors may shift bias voltages in either a positive or negative direction, depending on the circuit arrangement and the location of the defective capacitor. Thus, accurate circuit analysis and careful voltage checks are particularly important in localizing bandpass-circuit capacitor troubles.

Too much negative bias voltage on the bandpass amplifier produces symptoms similar to those of a weak tube. The stage gain is reduced, and color contrast (saturation) becomes poor. Color sync is also likely to become unstable if the burst signal

passes through the affected stage. A very negative voltage may cut the bandpass amplifier stage completely off, resulting in no color. The opposite trouble — bias voltage not negative enough — may cause a bandpass stage to become overloaded and produce smeared or false colors in the picture. Bias troubles usually originate in the color killer or ACC (automatic chroma control) circuits, but a defective cathode-bypass capacitor could result in the same trouble.

Marginal or defective filter capacitors in the B+ supply sometimes in-

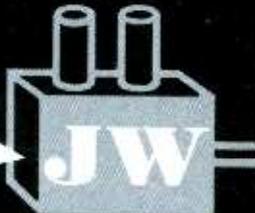
terfere with good color reproduction by placing colored hum bars in the picture. However, the ripple voltage to the bandpass amplifier must usually become quite large before any indication of breakdown actually shows up. Another trouble which may originate in the B+ system is low plate or screen voltage on a bandpass amplifier, which reduces stage gain and results in compression or clipping of the chroma signal. The symptom is usually very weak color, or in some cases, a complete loss of color.

A defective horizontal blanking amplifier, or a damaged blanking-pulse winding on the horizontal output transformer, is not an uncommon occurrence. Either of these troubles permits a burst signal to pass through the bandpass amplifier to the color demodulators, possibly producing the yellowish interference mentioned earlier.

Saturation controls are often troublesome. A dirty or noisy control can cause everything from drifting color reception to jumpy or intermittent color.

Sound traps in the bandpass amplifier are another trouble spot in older color sets. In many cases, they drift off frequency, distorting the bandpass-amplifier response curve and letting sound interference appear in the picture. A shorted parallel trap produces symptoms very similar to an off-frequency trap, but is often difficult to pinpoint. A shorted series trap circuit means an inoperative amplifier.

Various makes and models of color receivers tend to develop their own characteristic circuit troubles. For example, service technicians in the field constantly report two specific breakdowns in the RCA Chassis CTC4 which caused weak color or complete loss of color. One is a high-resistance short between the primary and secondary windings of the bandpass transformer, resulting in lower plate and screen voltage on the bandpass amplifier. The other common trouble is an increase in the resistance of a 560-ohm, 1-watt plate-decoupling resistor in the demodulator-driver circuit. The change is apparently caused by an intermittent short in a 10,000-mmf bypass capacitor, which results in excessive current through the resistor.

Trust your
24 HR SERVICE
VHF or UHF-All Makes
TV TUNER REPAIR and ALIGNMENT to 

Personal Service

EACH TUNER COMPLETELY SERVICED BY ONE EXPERIENCED TECHNICIAN

VHF TUNERS	\$950	Prices are for service and unmutated units. Missing, broken and damaged parts, defective tubes charged extra at LOW net prices. We ship C.O.D.
UHF TUNERS		
UHF CONVERTERS ..		
UHF-VHF COMBINATIONS		

OUR GUARANTEED SERVICE INCLUDES:

1. All tuners mechanically and electronically inspected.
2. All necessary parts replaced.
3. Contact surfaces correctly cleaned and lubricated.
4. First test run for intermittents and drift indication.
5. Fine tuning range checked on all channels.
6. Local osc aligned to correct frequency all channels—XTAL controlled.
7. RF alignment—all channels—XTAL controlled.
8. AGC check, all channels—cut off of RF amp checked.
9. Overall response all channels, shield covers in position.
10. Quality control FINAL CHECK ALL UNITS, UHF-VHF.

IMPORTANT: Ship complete. Include all broken parts. State model and complaint. Package well to avoid transit damage.



NOW - Transistor Repair Service

American or Foreign made Transistor Radios, Tape Recorders, etc., promptly repaired by experienced technicians. Radios \$4.50; Tape Recorders \$6.50; AM-FM Radios \$6.50. Write for prices on other transistor equipment.

\$4.50
RADIOS

JW ELECTRONICS Phone: EDison 2-0665
P.O. BOX 51 • BLOOMINGTON, INDIANA

Helpful SAMS BOOKS on
COLOR or BLACK & WHITE TV
available from your local
SAMS DISTRIBUTOR



Color TV Training Manual



A comprehensive manual prepared to train the technician in servicing Color TV receivers. Describes the science of color, the requirements and make-up of the composite color signal, color circuits, servicing procedures and many other subjects. Includes color blocks outlining the use of color test equipment. Over 300 illustrations with 40 pages in full color. 260 pages, 8 1/2" x 11".

No. TVC-1 Only..... \$6.95

Fundamentals of Color Television



A complete and up-to-date explanation of color TV written in a simple style to give the reader a clear understanding of the subject. Explains principles of color TV; describes the color signal; transmission; receiving; covers all aspects essential to a full grasp of the subject. Invaluable for the technician preparing himself for

color TV. 224 pages, 5 1/2" x 8 1/2". No. BA-1 Only..... \$2.00

TV Servicing Guide



A quick reference guide showing how to apply proper troubleshooting procedures based on analysis of symptoms, illustrated by picture tube photos and listing possible causes for each symptom. Also includes troubleshooting and servicing hints for locating and eliminating various

troubles. 132 pages, 8 1/2" x 11". No. SG5-1 Only..... \$2.00

101 Key Troubleshooting Waveforms



Bob Middleton provides the most helpful aids to TV troubleshooting you've ever used! Each volume pictures 101 abnormal waveforms for typical TV circuits, and ties them directly to specific component defects. Also includes picture and circuit symptoms, tests, and evaluations of results. Supplementary notes add rich background. Each volume

128 pages, 5 1/2" x 8 1/2". No. WFM-1 Only..... \$2.00

101 Key Troubleshooting Waveforms for Horizontal-Sweep Circuits. Covers the three most popular horizontal AFC-oscillator configurations. No. WFM-2 Only..... \$2.00

101 Key Troubleshooting Waveforms for Vertical-Sweep Circuits. Covers the four most popular vertical-sweep circuits. No. WFM-3 Only..... \$2.00

101 Key Troubleshooting Waveforms for Sync Circuits. Covers the five most popular sync circuits. No. WFM-4 Only..... \$2.00

Eliminating Man-Made Interference



Jack Darr's book covers the entire field of man-made interference—what it is, how it's transmitted, how it originates, tracking it to a source, how to eliminate it in TV, auto, aircraft and marine radios, audio amplifiers, 2-way mobile-radio systems, electromechanical equipment, etc. Includes case

histories of unusual noise and interference problems, plus many photos of TV picture interference. 173 illustrations, 160 pages, 5 1/2" x 8 1/2". No. MMD-1 Only..... \$2.95

FREE SAMS BOOKLIST AVAILABLE—ask your Distributor or write us direct

HOWARD W. SAMS & CO., INC.
1720 E. 38th St., Indianapolis 6, Ind.
In Canada: A. C. Simmonds & Sons, Ltd., Toronto 7

peaks of the 3.58-mc reference signal fed to its cathode. At this "sampling" time, the strength of tube conduction is determined by the instantaneous amplitude of the chroma signal on the grid. If the phase of the reference signal is accurately adjusted, this process results in a pure R-Y or B-Y signal at the plate. (A 3.58-mc signal component is also present, but this is filtered out by coils L28 and L29 in conjunction with bypass capacitors C127 and C130.) The signal is amplified as well as demodulated; however, the plate signals are still not strong enough to be fed directly to the control grids of the CRT. Therefore, R-Y and B-Y amplifiers (not shown in schematic) follow the demodulators. A G-Y signal is developed across the common cathode resistor of these stages and used to drive another amplifier that feeds the green CRT grid.

A different type of R-Y and B-Y circuit, introduced by Zenith this year, is more fully described in "What's New in Color TV?" elsewhere in this issue. Using sheet-beam tubes, it produces high-amplitude outputs of both positive and negative polarities. The circuit contains no additional color-difference amplifiers—just a resistive matrix to adjust the relative signal amplitudes and obtain G-Y.

Common Circuit Troubles

A defective filter coil or oscillator-plate transformer is a particularly troublesome service problem in chroma demodulators. An open or shorted primary winding in the transformer removes the reference signal from the demodulators, while a defect in the secondary circuit usually shows up as a phasing error which results in incorrect reproduction of hues. An open coil in the output of a chroma demodulator kills one of the color-difference signals. In addition, it sometimes upsets the DC voltage distribution in the chroma circuits, producing color tinting in the raster. A shorted coil allows the subcarrier signal to reach the picture tube; this generally results in overloading and produces a smeared picture. Shorted turns also produce the same effect. A careful ohmmeter check will sometimes uncover this trouble, but it is far better to substitute for suspected components.

New BEARNS Perfect Pin Crimper

Picture-Tube Repair Tool

Eliminates that hard soldering job

only \$1.25 each

PT-1 3/32" PIN

Fix loose pin connections in seconds. Pays for itself in time saved on first job. 3" long.

Patented

Intermittent operation of picture tubes due to defective solder connections easily corrected. Provides solid electrical connections, can also be used as channel-selector wrench and screwdriver. Pin keeps its original form. A 3-in-1 tool.

3 MODELS ELIMINATE SOLDERING

Makes Solid Electrical Connections

Pin-Plug Crimper

Slip wire in "pin plug," insert in tool, and squeeze job is done.

AU-2 1/8" PIN

C-rings 1c ea.

Use end of tool to push on C-ring for ground connection.

Ant. plugs, hi-fi, multiple plugs, public address, radio and TV tubes, radar, speakers, and loop connections. Many, many more uses.

Model LC-3 for 5/32" pin diameter

At your parts distributor or write us

BERNS Mfg. Co.
9853 Chalmers,
Detroit 13, Mich.

Swing-O-Lite

SWING ARM LAMPS FOR EVERY PURPOSE

THE INSPECTOR

magnifying lamp for precision work

- Used with printed circuits, blue prints, schematics, microminiatures, quality control inspection, etc.
- Shadow free 22 watt fluorescent light
- 5" precision polished magnifying glass.
- 45" arm reach adjusts to any position
- Choice of colors and mounts
- Gooseneck and other arms available. Also available with extra-large 7" lens and 32 watt lamp

Model M1 \$36.00 List Less Bulb

THE CRAFTSMAN

for direct bright light where you need it!

Model IMC \$13.95 List Less bulb

- All-directional swivel arm
- Full 24" arm reach
- Exclusive "Cool Aid" Shade
- Choice of base installations

Model IGC 15" Gooseneck \$9.25

DEALER & DISTRIBUTOR INQUIRIES INVITED

REPS WANTED—CHOOSE TERRITORIES OPEN

Write for literature on complete line of lamps for professional and industrial uses.

Swing-O-Lite INCORPORATED
13 MOONACHIE ROAD HACKENSACK, N. J.

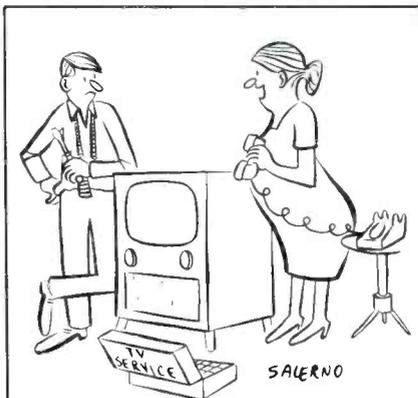
Hum in chroma demodulators, usually attributable to heater-cathode leakage, is a very common occurrence. This fault produces horizontal hum bars in the picture. Different colors are generated in different types of demodulators, as follows:

COLOR	AXIS
Orange and Cyan:	I
Green and Magenta:	Q
Red and Blue-green:	R-Y
Blue and Yellow-green:	B-Y
Green and Blue-red:	G-Y

It should be pointed out that hum in the demodulator will mix with the test signal from a color-bar generator and produce incorrect colors; that is, the hues will change from the top to the bottom of the picture-tube display.

Supposed demodulator faults often originate in other circuits — particularly the 3.58-mc oscillator. Since the output signal of the oscillator is used in the demodulation process, failure of this circuit for any reason results in an inoperative chroma demodulator and a loss of color. Lesser defects in the oscillator also affect the demodulators and produce intermittent or weak color. Incorrect hues are also sometimes produced by a weak subcarrier-injection signal.

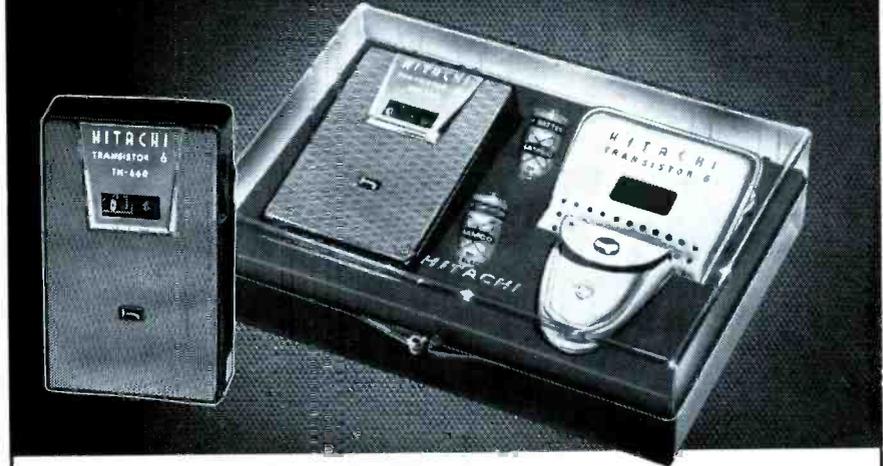
An absence of output from the demodulator can also be caused by partial or complete loss of the chroma signal from the bandpass amplifier. Therefore, in isolating the cause of apparent demodulator failure, be sure to check both chroma and reference waveforms entering the stage—paying special attention to their amplitudes. ▲



"It's my husband, he says be sure to check the horizontal syncopation, see that the audio harmonics are adjusted, and he wants you to file the tuner."

To help you show and sell for CHRISTMAS HITACHI

TH-660 6-transistor Pocket Portable Radio in the handsome new Personal Gift Presentation Case



Helps you show and sell — another Hitachi extra you can offer customers at no extra cost. Beautifully fashioned case of durable, transparent plastic. Gives customers an unobstructed view of the radio complete with accessories . . . An eye-stopping display on counter or in window. The new "SHOWCASE" Gift Presentation Case is a gift itself! Ideal for at-home or travel uses.

Unique, too, is the radio's startling power, sensitivity, and distance-getting reach-out reception. Yet it almost gets *lost* in your shirt pocket. Exclusive "Quick-Action" Battery Release for split-second changing, no need to remove back. High-impact cabinet in Red, Black or Ivory, with smart gold-tone grille.

This is the small one that out-reaches, out-performs, out-gifts all other pocket portable 6's

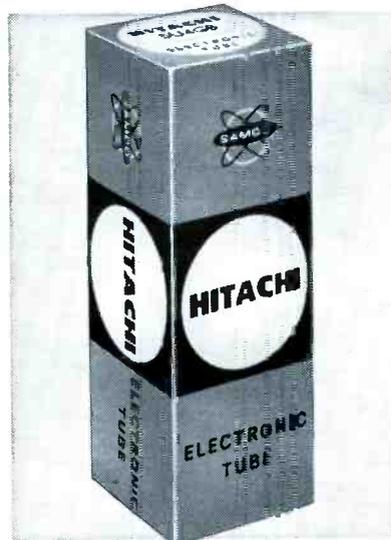
Complete with 2 luxurious glove-leather carrying cases . . . 2 standard penlite batteries . . . personal earphone.

RETAIL PRICE **\$24⁹⁵** COMPLETE

Other fine Hitachi 6, 7, and 8-transistor radio portables in AM and SW/AM combinations . . . from \$24.95 to \$79.95.

SELL • SERVICE • SATISFY with CERTIFIED-QUALITY

HITACHI RECEIVING TUBES



Choice as original equipment by manufacturers in the U.S. & abroad.

MORE PROFIT PER CALL—more satisfaction for all—these fine receiving tubes can't be beat for performance and reliability. Strict quality control to fully meet *top American standards* goes into the careful manufacture of each Hitachi tube. Yet important cost savings guarantee you extra profits. Most popular types available. And distribution is on a localized, prompt delivery basis.

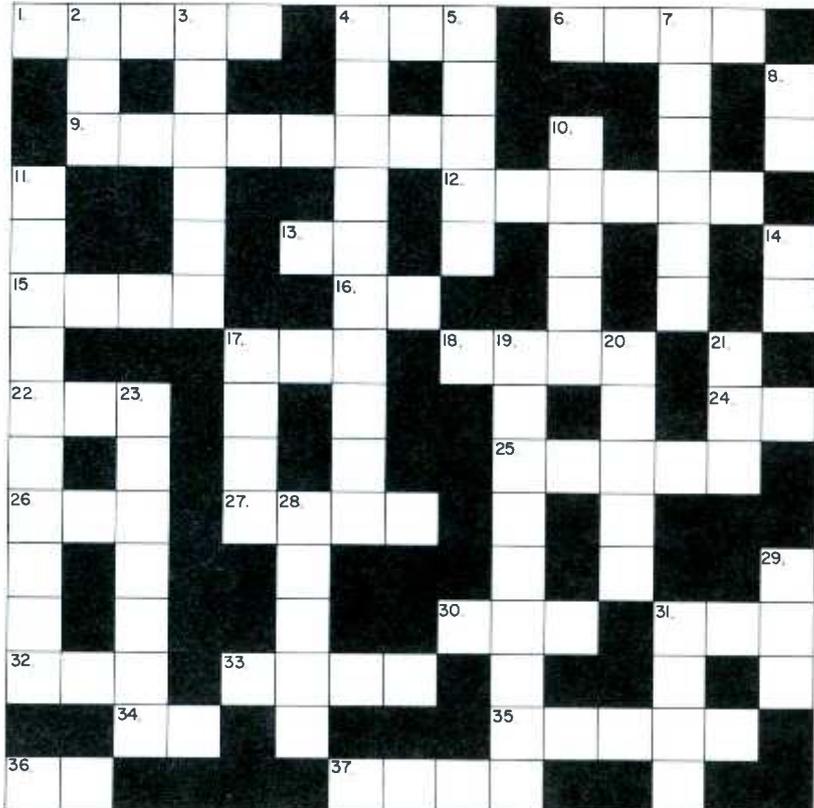
See your HITACHI Distributor, or write for Catalog No. CT-400A.

Distributed throughout the U.S. by

THE SAMPSON COMPANY (Est. 1921) ELECTRONICS DIVISION
2244 SOUTH WESTERN AVENUE, CHICAGO 8, ILLINOIS

COLOR TV

CROSSWORD



Are you familiar with the many words and terms used in color TV? Test your color TV vocabulary by working this challenging crossword. Watch out—Many of the clues are tricky just to throw you off the track! After you have filled in all the empty blocks, check your solution against the diagram on page 95.

ACROSS:

1. Another name for a matrixing amplifier.
4. The color burst is a sample of the 3.58-mc _____ carrier.
6. The purpose of the burst signal is to _____ the reference oscillator on the correct frequency and phase.
9. Term applied when all three rasters of the color CRT are superimposed on each other.
12. This word, in conjunction with item 31 down, describes a device mounted inside a tricolor picture tube.
13. Voltage output of the red camera tube at the transmitter (abbr.).
15. In late-model color sets, proper dynamic convergence on the right side of the screen is obtained by making _____ adjustments.
16. The type of modulation placed on the chroma subcarrier to determine saturation of colors (abbr.).
17. A color-TV signal-generator pattern used in adjusting convergence.
18. For accurate color reproduction, the over-all frequency response from the antenna to the chroma demodulator must be _____ from approximately 3 to 4 mc.
22. If there are no shades of green in the color picture, check to see if the G-Y amplifier tube is _____.
24. In color TV, "break-_____ " is an effect caused by rapid subject motion.

25. Watery color picture pattern resulting from interference beats.
26. Two of the _____ chromatic coefficients describe a color by its position in a chromaticity diagram.
27. _____ing in the color picture may result from a defective delay line.
30. The CW driver transformer in a color set resembles a typical video IF _____.
31. In the _____rix circuitry, the three primary color signals are recovered from the demodulated chroma signals.
32. Pastels are _____saturated colors.
33. Many stations transmit a color stripe as a _____ signal.
34. The resultant of -I and -Q is _____ - _____ (supply missing letters).
35. In a properly-converged tricolor CRT, the paths of the electron beams from the three guns _____ at the shadow mask.
36. The resultant of +I and +Q is _____ - _____ (supply missing letters).
37. The color represented by the B-Y color-difference signal.

- presses the relative freedom from dilution by white light.
5. The 3.58-mc color sync signal.
7. The section of a color receiver which is inactive during black-and-white reception.
8. The color difference signal produced by combining -I and +Q chrominance signals is _____ - _____ (supply missing letters).
10. Coefficient defining the relationship between the luminance of the color picture and the CRT drive voltage.
11. Generally speaking, the _____ of color information in the picture is not as good as that of the black-and-white information.
14. Voltage representing the brightness component of the color TV signal (abbr.).
17. In most color sets, the high-voltage regulator tube can be reached through the _____ of the high-voltage cage.
19. The part of the color TV signal which can also be utilized as a black-and-white video signal.
20. Group of three primary color phosphor dots.
21. The identification or "name" of a color.
23. Hangover of luminous spots on TV screen.
28. The color TV term _____ leaving denotes the transmission of both color and monochrome signals within the same range of video frequencies.
29. Color television (abbr.).
31. See clue 12 across.

DOWN:

2. One of the primary TV colors spelled backwards.
3. Spurious colors at borders of different-colored areas in the color picture.
4. The characteristic of a color that ex-

What's New in Color

(Continued from page 35)

former L2 contains relatively equal proportions of all chroma-signal components within the range from 3 to 4 mc. This signal is tapped off at the desired level by the color control.

Two signals from the blanking amplifier are coupled to the grid and cathode of the bandpass amplifier to cut it off during horizontal-sync time, thus preventing the 3.58-mc burst signal from reaching the demodulator circuits.

Some '62 receivers use a two-stage variation of the above circuit, as described in "Chroma Bandpass and Demodulator Circuits" elsewhere in this issue. It is important to recognize this variation when you are troubleshooting color problems, since an extra stage of amplification means another possible trouble spot.



The "Big Picture"

...informative shop talk from
Sylvania Field Service Headquarters



A fast, easy way to build a good service reputation

TV service focus customers are tough customers . . . especially on "tough dog" service bills. There's no such animal in the new Sylvania TV . . . it's designed for fast and easy service, the kind that keeps customers happy and your reputation high.

The new GT-555 chassis is the cleanest yet . . . horizontal and modular for fast and easy access to all components. The exclusive Flexi-core transformer that powers it is 100% interleaved and welded (rather than bolted) to reduce magnetic interference and eliminate lamination buzz. It's smaller and lighter, too . . . and provides easier-testing parallel circuits.

Pulling and remounting whole assemblies takes just seconds. All major components have easy-to-pull plugs, and new bracket mounting eliminates those tough-to-get-at screws.

Fast and easy service is built into the new chassis board, too. Its easy-to-follow road map color-codes circuits 5 ways . . . even designates parts and tube pin numbers. No wiring errors or cracking problems, either . . . automatic production assures "lab model" uniformity, and tough copper-bonding withstands flexing, vibration and shock.

The GT-555 has many more quality features you'll appreciate. It's a cold chassis . . . completely insulated from ground and AC line. The cage door on the Mylar-insulated high voltage transformer is hinged (with safety lock) for easy access. All capacitors are plastic encapsulated.

It's a honey, with a fast-growing reputation for fine performance and reliability—the kind of reputation that's easy to recommend.

SERVICE TIP OF THE MONTH

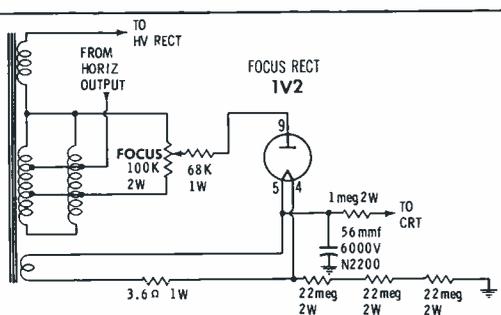
Check stubborn cases of sync buzz in TV audio as follows: (1) align all tuned sound circuits according to manufacturer's service literature; (2) check lead dress on video leads, which may be close to sound section and injecting buzz; (3) ground the volume control case (through capacitor on series filament "hot chassis" sets).

Sylvania Home Electronics Corp., Batavia, New York

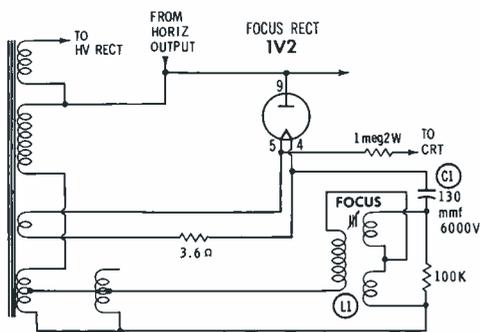
SYLVANIA

SUBSIDIARY OF

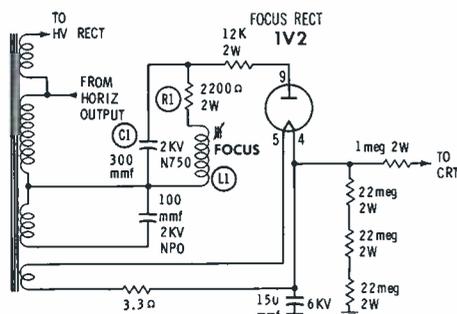
GENERAL TELEPHONE & ELECTRONICS



(A) Potentiometer control.



(B) Opposing-pulse control.



(C) Phased sine-wave control.

Fig. 5. Typical focus circuits.

PLANET



Type "PCT" . . . constructed in strong red cardboard tubes, wax impregnated, one end closed, printed circuit board terminals.
 Type "PCTL" . . . has insulated lead out top providing for low voltage section.
 For 65 °C operation . . . recommended for table and clock radios . . . individually packaged . . . guaranteed for one year.

Write today for complete information.

PLANET SALES CORPORATION
 225 Belleville Avenue Bloomfield, New Jersey

DON'T REPLACE CRYSTALLIZED RUBBER PHONOGRAPH DRIVE WHEELS UNNECESSARILY



brush on **NEW FONO-MAGIC**
 eliminate slipping...dragging

EASY... SAVES EXCESSIVE DRIVE WHEEL INVENTORY COSTS TOO!



- 1** Remove slipping, dragging phono-graph turntable.
- 2** Brush FONO-MAGIC on metal friction drive surfaces. (FONO-MAGIC dries in 2 minutes.)
- 3** Replace turntable, stall-ing changer will immediately cycle properly.



*FONO-MAGIC is a NEW compound of special rubber and carbide particles. When FONOMAGIC is brushed on metal drive surfaces, it forms a coat of live, pliable non-slipping rubber .000065 inches thick. Carbide particles imbedded in the rubber coating will scratch slipping rubber idler wheels, exposing live rubber and prolonging the life of the idler wheel. Just one bottle of FONOMAGIC is equivalent to the replacement of 100 drive wheels. *Trade Mark

only
\$/95

DEALERS NET.

The third style of bandpass amplifier circuit also incorporates two stages of amplification. However, it uses a different method of interstage coupling, and the input signal is obtained from the video detector rather than from the video amplifier. This system, used by Zenith, is shown in Fig. 4. Like the other two-stage circuit, it includes the added feature of *Automatic Color Control* (ACC). This is similar in action to AGC, acting on the control grid of the first bandpass amplifier to regulate amplification of the chroma signal.

A 3.58-mc signal from the burst amplifier is fed to the ACC-killer phase detector, where it is compared to a reference-oscillator signal taken from the in-phase secondary of the quadrature transformer. Since the reference oscillator maintains a constant output, the conduction of the ACC-killer phase detector is regulated by the strength of the burst signal. Obviously, since the amplitude of the burst signal varies as reception fluctuates, ACC phase-detector conduction will vary and automatically adjust the bias on the bandpass amplifier to maintain a constant color-signal level.

Incidentally, coil L1 in Fig. 4 serves the conventional chroma-sync phase detector as well as the ACC-killer phase detector. This design feature is one of several minor variations in chroma-sync circuitry found among the '62 sets. For a more detailed explanation of how these circuits function, see "Understanding Chroma Sync" in this issue.

Picture Tubes

An increase in light output has been obtained in the new 21FBP22 and 21FJP22 picture tubes through the use of more efficient sulfide phosphors. These CRT's, found in most of the '62 sets, are also available for direct replacement of different types used in older color receivers.

Changing over to a sulfide-type tube presents one slight problem: The new blue, green, and red phosphors are more nearly equal in efficiency than those formerly used. Whereas the red phosphor always used to be considerably less efficient than the other two, it is now possible for it to be even more efficient than the blue phosphor.

The light-output balance among the three phosphors is not the same

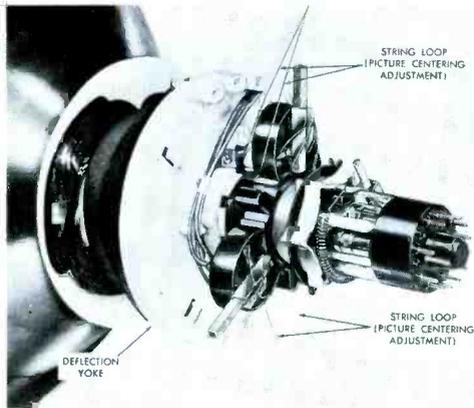


Fig. 6. Centering rings in one new set are manipulated by means of strings.

for every individual tube; thus, most new sets provide a means of compensating for differences in efficiency by rearranging the cathode circuits of the three CRT guns. Two cathodes are returned to the center arms of the CRT-drive controls, while the third cathode is connected directly to the video amplifier circuit. This direct connection is usually made to the red gun, since the red phosphor is generally the least efficient. However, with the circuit wired in this way, it is sometimes impossible to set the drive controls for a white raster. In such cases, the cathode circuits must be reconnected.

When a sulfide tube is installed, it is impossible to determine in advance which phosphor will be the least efficient; a trial setup procedure must be performed to obtain this information. An over-all magenta tint in the raster means that the direct connection should be transferred to the green gun; an over-all yellowish background means that the blue gun should be direct-connected.

Focus Circuits

The methods used to obtain variable focus voltages in the new color sets also reduce to only three basic configurations, as shown in Fig. 5. In A, the voltage applied to the plate of the focus rectifier is varied by a potentiometer connected across a portion of the secondary winding on the flyback.

In the most widely used circuit (shown in B), I₁ develops a rather low-amplitude pulse of positive polarity which is coupled to the filament of the rectifier through C₁. As the focus coil is adjusted to produce a higher pulse amplitude, the potential between plate and filament is

Get ALL Basic Color-TV Test Patterns From This ONE Low-Cost Generator



RCA WR-64A

COLOR-BAR / DOT / CROSSHATCH GENERATOR

Here is the low-cost, lightweight, high-quality instrument that gives you all essential Color-TV test patterns: Color-bar signals for checking, adjusting and troubleshooting Color-TV circuits; dot and crosshatch pattern signals for adjusting convergence in color receivers and for adjusting linearity and overscan in either color or black-and-white receivers. Designed for in-the-home or shop servicing.

ONLY \$189.50*

*User Price (Optional)

SIMPLICITY: Only three operating controls! Provides RF output... connects directly to antenna terminal of receiver. No external sync leads needed.

STABILITY: Crystal controlled signals assure accuracy and dependability. Patterns are rock-steady, free from "jitter" and "crawl".

PORTABILITY: Weighs only 13 pounds. The ideal test instrument for proper in-the-home color-TV adjustment and servicing.

FLEXIBILITY: Extra wide range on chroma control... "standby" position on function switch... fixed number of dots and bars... "on-off" control on sound-carrier.

GENERATES:



Color-Bar Pattern... Ten bars of color including R-Y, B-Y, G-Y, I and Q signals spaced at 30° phase intervals for checking phase and matrixing, and for automatic-frequency and phase alignment.



Crosshatch Pattern... A crosshatch of thin sharp lines for adjusting vertical and horizontal linearity, raster size, and overscan. **Dot Pattern** (not illustrated) permits accurate color convergence.

GET ALL THE FACTS ON THE NEW RCA WR-64A

RCA Electron Tube Division
Commercial Engineering Dept. PF
Harrison, N. J.

Please send me your folder (1Q1017) on the new RCA WR-64A Color-Bar/Dot/Crosshatch Generator.

Name _____ Title _____

Company _____

Address _____

City _____ Zone _____ State _____

-----Or see it at your Authorized RCA Test Equipment Distributor-----



The Most Trusted Name in Electronics
RADIO CORPORATION OF AMERICA

reduced, the tube conducts less, and the focus voltage is reduced. If a higher focus voltage is required, the amplitude of the feedback pulse can be lowered in order to increase tube conduction.

In Fig. 8C, on the other hand, the amplitude of the pulse applied to the plate is varied. Components L1, C1, and R1 form a ringing circuit that produces a sine wave measuring 2000 volts peak-to-peak. Adjusting L1 varies the phase of the sine wave in relation to the pulse. In this manner, the algebraic sum of the two signals can be modified

to increase or decrease plate voltage, in turn adjusting the output.

Picture Centering

For the first time in the history of color TV, centering rings similar to those used in monochrome receivers have been put to use. The rings are mounted inside the yoke assembly and can be adjusted by means of a pair of string loops (Fig. 6).

The above arrangement is found only in Zenith sets. All other color receivers employ electrical centering circuits which control the direct current flowing through the vertical and

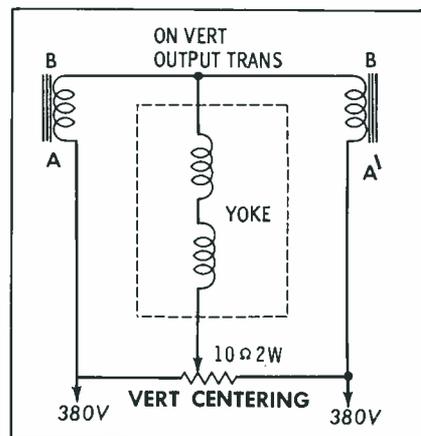
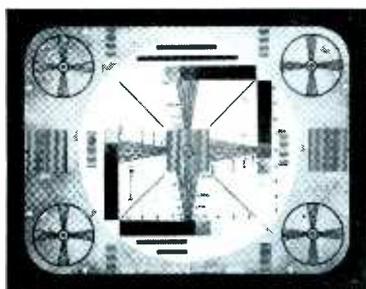


Fig. 7. Basic arrangement of vertical centering circuit now widely used. The control arrangement forms a balanced bridge, as shown in Fig. 7 (a simplified schematic of a typical vertical-centering circuit). Windings AB and A'B are sections of the tapped, bifilar-wound secondary of the vertical output transformer; identical yoke-drive signals appear across both sections. When the potentiometer between points A and A' is set to the middle of its range, no DC (positioning) current flows in the yoke. At any other setting, the bridge is unbalanced; thus, the yoke is fed a positioning current which moves the raster up or down. Horizontal centering is accomplished in a similar manner. (Caution: Never center the raster on a color receiver unless you are prepared to perform the entire convergence procedure.)

Summary

Increased variety in chassis design, a natural result of keener competition among color-TV manufacturers, is already evident in the '62 sets. However, developments are following a conservative path of gradual evolution, and this is encouraging news to servicemen who are striving to gain experience in color TV. ▲



TV TIPS FROM TRIAD

NO. 14 IN A SERIES

Bill, the Senior PTM, was being stubborn. Which was different.

Al, the Parts Salesman, was being persistent. Which was normal.

"What do you care what the price is, as long as it works? The higher the price the more profit you make?"

"I make, or you make?" asked Bill.

"The greater the profit the less the labor you have to charge for, to make the same money, and the happier the customer," said Al, ignoring the thrust.

"Like indoor antennas, \$11.95 list. I sold quite a few when they were \$2.95 list and forty off. Do you know who sells them now? The discount house and the price: 90¢!"

"Well," said Al, changing ground rapidly. "You do need a flyback and I have two brands to choose from. Which will it be?"

"Let's look them over," said Bill, "and I'll decide on the basis of workmanship, appearance, and most complete information. If the price is better, I won't object!"

* * *

MORAL: Triad's new catalog TV-62 will show that prices have changed very little, but coverage, quality, and associated information are at a new high. If you are not on the permanent mailing list you may secure a copy by asking your Triad Distributor or sending a request to **Renewal Division, Triad Transformer Corporation, 4055 Redwood Ave., Venice, Calif.**

Isolating Chroma

(Continued from page 29)

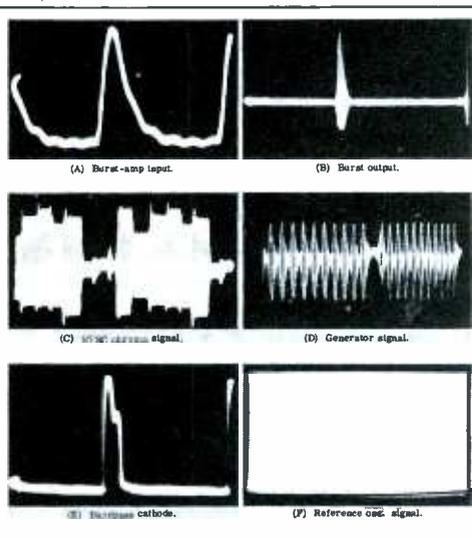


Fig. 2. Normal waveforms found at the key test points in the chroma section.

overlook it.

The "teardrop" pattern in Fig. 2B is the burst signal which is passed along to the phase detector from the burst amplifier.

Fig. 2C shows the waveform which should be present at the grids of the chroma bandpass amplifier and demodulator stages when a standard NTSC color-bar signal is fed to the receiver. (A similar signal is shown on PHOTOFAC schematics.) On the other hand, the type of chroma signal in Fig. 2D is produced by a keyed rainbow generator. Therefore, you'll find this waveform along the chroma path instead of the one in Fig. 2C if you are using this type of generator.

Fig. 2E is a horizontal blanking pulse such as you'll often find at the bandpass amplifier. Many circuits employ a positive pulse of this sort at the cathode to cut the tube off during burst-signal time. There-

fore, you'll normally find the burst signal (center pulse) lacking in Fig. 2D beyond the bandpass amplifier.

Fig. 2F is the signal produced by the reference oscillator. You should find this waveform not only at the oscillator, but also at both demodulators and the sync phase detector. While there is a phase difference in the three signals, this characteristic cannot be discerned from an analysis of scope waveforms.

If you have trouble identifying the waveforms in Fig. 2, practice on them until you know what to ex-

pect at various points in the chroma circuits. Learning these basic troubleshooting patterns will not only eliminate the need for constantly referring to pictures in service data, but will also increase your understanding of what's going on in the circuits and will thus speed your servicing.

Where to Check

Once you know the paths of various signals in the chroma section, and learn what the signals look like,

save 56¢

GC ELECTRONICS 3 PACK Special

SAVE 56¢ ON THIS SPECIAL OFFER

try Super Contact Cleaner

new carry-out carton

new Super Contact Cleaner stops circuit chatter

From GC Electronics laboratories comes a new service product that eliminates noise from all electrical sliding contacts and stops corrosion, too! And now you save 56¢ when you buy the carry-out carton containing the New Super Contact Cleaner and the popular and accepted Sprakleen and Super Freeze Mist. See your GC Distributor today.

write for FREE GC chemical and hardware catalog.



GC ELECTRONICS CO.

a division of Textron Electronics, Inc.

400 S. WYMAN ST., ROCKFORD, ILLINOIS

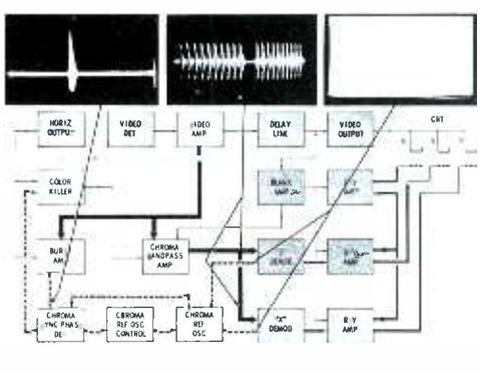


Fig. 3. Key waveforms and test points for troubleshooting a loss of color.

isolating a specific chroma trouble becomes a simple matter of deduction. Remember that we said chroma trouble falls into four categories? Let's see how a troubleshooting procedure is developed for each symptom.

Loss of Color

Complete loss of color can be caused by many things. However, when preliminary tests have shown the trouble is in the chroma section, it can be centered in any of the stages shown as unshaded blocks in Fig. 3. This illustration also shows

the normal waveforms you'd expect to find at the key check points.

The best place to start checking is at either demodulator stage. Since there is a complete loss of color, it is obvious that either the chroma input signal (center waveform) or the reference-oscillator signal (right waveform) is missing. If both signals were present at either demodulator, some sort of color would appear.

Suppose your check shows that the reference-oscillator signals are present, but the chroma signal is absent. Under such circumstances,

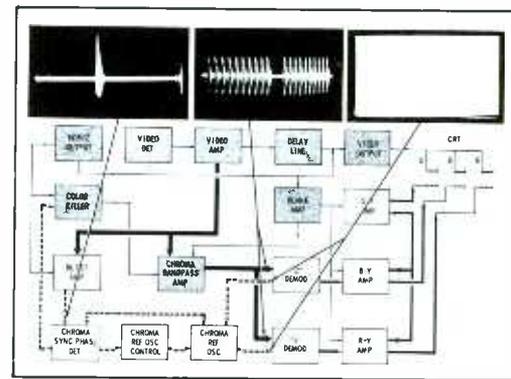


Fig. 4. Key waveforms and test points for localizing cause of wrong colors.

you'll want to go back along the chroma path (heavy line) to see where the signal is being interrupted. So, the logical place to check will be the bandpass amplifier. The center waveform should appear at both the grid and the plate. If the signal is absent at the plate, but does appear on the grid, check the plate, screen, and grid voltages. You'll undoubtedly find either a severe drop in plate and screen voltages, or excessive bias at the control grid. In the latter case, the trouble is probably being caused by a malfunction in the color killer.

When a color signal is being received, the color killer tube is normally cut off by a negative voltage on its grid. This voltage is developed in the chroma sync phase detector whenever a burst signal (left waveform) is present. Therefore, if the killer is not cut off, you'll want to trace through the phase detector and burst amplifier stages to find out why not.

If your preliminary scope checks show that loss of color is caused by an inoperative reference oscillator, you can troubleshoot this section just as you would a conventional horizontal oscillator and AFC stage.

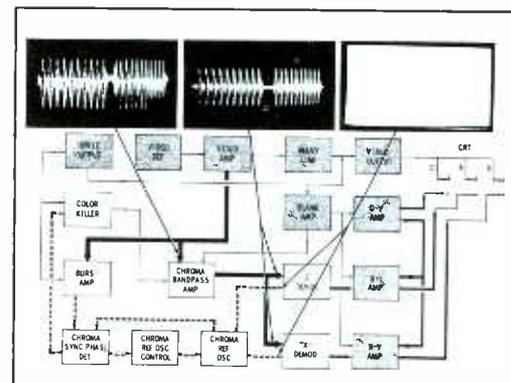


Fig. 5. Key waveforms and test points for analyzing problem of weak colors.



TWO-WAY RADIO

communications equipment

VHF-FM FOR:

- MOBILE
- AIRCRAFT
- MARINE
- MOTORCYCLE
- PORTABLE
- BASE

VHF-AM FOR:

- AIRPORT VEHICLES
- GROUND STATIONS
- POINT-TO-POINT

VHF

- ANTENNAS
- REMOTE CONTROLS
- ACCESSORIES

NEW! "680 BASECOM"

FOR VHF-FM TWO WAY
MOBILE RADIO

the new 680 series offers
**HIGH PERFORMANCE at
MODERATE COST with
LOW MAINTENANCE!**



"680 FLEETCOM"

COMBINATION

- MOBILE CONTROL HEAD
- SPEAKER
- TRANSISTOR POWER SUPPLY

ATTENTION DEALERS!
Write for available territories.

- ### "680" FEATURES AND OPTIONS:

 - ★ **PROVEN PERFORMANCE**... all the outstanding features of the popular "580" series, plus the following.
 - ★ **HIGH POWER**... 100 watts output 25 to 50 mc, 75 watts 144 to 174 mc, both base and mobile.
 - ★ **TONE SQUELCH**... two way tone squelch compatible with other systems to EIA standards.
 - ★ Meets all FCC and OCDM requirements.
 - ★ **SIMULTANEOUS RECEPTION**... dual front end receiver for monitoring two frequencies anywhere in the band.
 - ★ **TRANSMITTER FILAMENT SWITCH**... reduces battery drain when on "stand-by".
 - ★ **MONITORS REMOTE CONTROL**... base station monitors remote transmissions. Intercom provided. All functions available at remote position.



DESIGNERS AND MANUFACTURERS OF

COMMUNICATIONS COMPANY, Inc.

FOUNDED 1933 CORAL GABLES, MIAMI 34, FLORIDA

POWER TRANSISTOR

POPULAR POWER TRANSISTOR FOR USE AS A REPLACEMENT IN MOST DELCO AUTO RADIOS

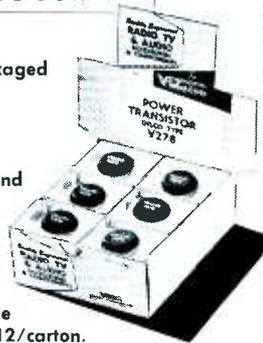


REPLACES 2N277, 2N278, 2N441, 2N442, DS-501.

Individually packaged in a plastic see-thru box.

Cross reference and installation data included.

Available in a compact attractive counter display, 12/carton.



Vidair ELECTRONICS MFG. CORP.
365 BABYLON TPKE. — ROOSEVELT, N. Y.

the business-like approach

to SERVICE CHARGES and RECORD KEEPING



For customer's prices on every replacement part, plus flat rate and hourly service charge data, regional and national. Dave Rice's OFFICIAL PRICING DIGEST, listing over 63,000 items. \$2.50.

AVAILABLE FROM YOUR DISTRIBUTOR

If you want to operate on a professional level, Dave Rice's OFFICIAL ORDER BOOKS give you triplicate forms for order, invoice, and office records... spaces for tubes, parts, serial numbers, labor and tax charges, signatures, etc. 75¢ per book, \$6.50 for dust-proof box of 10.



Dave Rice's

ELECTRONIC PUBLISHING COMPANY, INC.
133 N. JEFFERSON ST. • CHICAGO 6, ILL.

be placed on signal amplitudes rather than waveshapes or mere presence of the signals. Of course, the amplitude of the chroma signal can be regulated by a control often referred to as the color saturation control. In normally-operating receivers, this control should provide a signal of the required amplitude when set at its midpoint. If the control must be advanced beyond its normal setting, the signal feeding the chroma bandpass amplifier, and the voltages of this circuit, should be checked in order to localize the trouble. Don't forget, the bias on the bandpass amplifier can be altered by a malfunction in the color-killer circuit. Therefore, it may be necessary to troubleshoot the stages associated with the killer.

Color-Sync Troubles

As shown in Fig. 6, color-sync problems are associated with only a few of the chroma circuits. Troubleshooting these sections becomes a familiar process if you relate it to the experience you've gained from servicing horizontal oscillator and AFC circuits. Making rapid checks of the waveforms shown in Fig. 6 will normally direct your attention to the defective stage. For example, if your check for the burst signal at the phase detector (center waveform) shows the presence of chroma information, you can be reasonably sure the trouble is being caused by improper bias on the burst amplifier, and you can direct your attention to that stage. If, on the other hand, the amplitude of the reference-oscillator signal happens to be considerably different from the value shown in the service data, you can concentrate on the oscillator and control circuits.

Summary

For faster and more accurate troubleshooting in the chroma stages:

1. Determine that the trouble is definitely in the chroma section, by injecting a color-bar generator signal at the grid of the video amplifier.
2. Learn the paths of the various signals through the chroma circuits, and follow the troubleshooting sequence outlined in Chart I.
3. Become thoroughly familiar

with the signals at key check points as they are produced by your color test equipment.

4. Relate the visual symptoms to specific sections of the chroma circuits. ▲

STATEMENT REQUIRED BY THE ACT OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, JULY 2, 1946 AND JUNE 11, 1960 (74 STAT. 208) SHOWING THE OWNERSHIP, MANAGEMENT, AND CIRCULATION OF PF REPORTER published monthly at Indianapolis, Indiana for October 1, 1961.

1. The names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher: Howard W. Sams & Co., Inc., 2201 E. 46th St., Indianapolis, Ind.; Editor: Verne M. Ray, 2201 E. 46th St., Indianapolis, Ind.; Managing editor: Joe A. Groves, 2201 E. 46th St., Indianapolis, Ind.; Business manager: Mal Parks, Jr., 2201 E. 46th St., Indianapolis, Ind.

2. The owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual member, must be given.)

Howard W. Sams & Co., Inc., 2201 E. 46th St., Indianapolis, Ind.; Carson & Co., c/o Morgan Guaranty Trust Co., New York, New York; Jean B. Eldred, Redwood Dr., Franklin, Kentucky; Genoy & Co., c/o Morgan Guaranty Trust Co., P. O. Box 491, Church St. Station, New York, New York; Griffin & Co., c/o Colorado National Bank, P. O. Box 5168, Denver 17, Colorado; Lehman Brothers, One William St., New York 4, New York; Lorient & Co., c/o Manufacturers Trust Co., Corporate Trust Dept., 55 Broad St., New York, New York; James A. Milling, 7905 Morningside Dr., Indianapolis, Indiana; Mufun & Co., c/o Bankers Trust Company, P. O. Box 1371, Church St. Station, New York 8, New York; Reing & Co., Box # 491, Church St. Station, New York 15, New York; Howard W. Sams, 414 Kessler Blvd. W. Dr., Indianapolis, Indiana.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.)

Armer F. Ahlstrand, 335 Wilty Ave., Rockford, Ill.; John D. Baur & Ruth E. Baur J/T, 3239 Sutherland Ave., Indianapolis, Ind.; Mary M. Benham, 215 N. Senate, Indianapolis, Ind.; McFarland Benham, 601 Lemcke Bldg., Indianapolis, Ind.; Bertha Binninger & Frieda Binninger J/T, 3510 Watson Rd., Indianapolis, Ind.; Frieda Binninger & Bertha Binninger J/T, 3510 Watson Rd., Indianapolis, Ind.; A. W. Brayton, Jr., 3943 N. Illinois St., Indianapolis, Ind.; Lucile Lee Brayton, 3943 N. Illinois St., Indianapolis, Ind.; R. M. Brotherson & Mary H. Brotherson J/T, 2819 Grand Ave., Joplin, Missouri; Wayne Burns, Jr., 7600 N. Meridian St., Indianapolis, Ind.; Marguerite M. Edmondson, 19 S. Rebecca Dr., Indianapolis, Ind.; Edward D. James, 122 East Michigan, Indianapolis, Ind.; Edward D. James, Architect, Inc., 122 E. Michigan St., Indianapolis, Ind.; Grace Knox, 505 W. Oak St., Zionsville, Ind.; John B. Kolling & Helma G. Kolling J/T, 515 W. South St., Crown Point, Ind.; Florence T. Lewis, 523 E. 51st St., Indianapolis, Ind.; Katherine B. Lewis & Robert J. Lewis J/T, 3640 Watson Road., Indianapolis, Ind.; Jack B. Moore, 1126 Broadfields Dr., Louisville 7, Kentucky; Melvin R. Moser, 864 McGill St., Orville, Ohio; Crawford H. Naugle & Ruth Naugle J/T, 6470 N. Rural St., Indianapolis, Ind.; Frieda Neil & Harold Neil J/T, 5247 32nd Terrace, North, St. Petersburg, Florida; Edward E. Petri, c/o Petri Jewelry Company, Guaranty Bldg., Indianapolis, Ind.; Helen N. Sams, 5910 Primrose, Indianapolis, Ind.; Howard W. Sams & Co., Inc., 2201 E. 46th St., Indianapolis, Ind.; Kenneth Swan, 4243 Broadway, Indianapolis, Ind.

4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

5. The average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the 12 months preceding the date shown above was: (This information is required by the act of June 11, 1960 to be included in all statements regardless of frequency of issue.) 73,729.

(Signed) MAL PARKS, JR., Bus. Mgr.

Sworn to and subscribed before me

this 28th day of September, 1961

(Seal) Marian F. Newman, Notary Public

A Bout With a Color Set

(Continued from page 33)

opened up between the oscillator plate and B+; if there had been a short serious enough to reduce the plate voltage to only 5 volts, I surely would have smelled smoke by now.

Looking again at Fig. 2, note that the only possible open component besides L30 is R156, a half-watt, 1000-ohm resistor that is very vulnerable to excess current damage which might result from a shorted tube or bypass capacitor. When I checked this little resistor, I found it just about wide open.

Remembering the several flashes of the neon short indicator when I had checked V19, I got out another 6U8A, checked it too, and substituted it for the old tube. Then I tested dual capacitor C104 and discovered leakage in both sections. After replacing this unit with two individual ceramic capacitors (.01 mfd each), I fired up the set and looked once more at the oscillator and control-tube outputs. There was a modulated waveform of 25 volts peak to peak at the plate of the control tube (Fig. 7), and the oscillator signal (Fig. 8) was a normal sine wave of adequate amplitude.

Color Adjustments

It was almost a sure bet that my repairs to this receiver had affected the chroma sync and demodulator alignment, so I made a point of re-adjusting the set before returning it to the owner. Since I had the set in the shop, with my scope handy, I carried out the complete sequence of adjustments. Since these are pretty well spelled out in the service data, there's no point in talking about them here. However, while we're on this subject, I'd like to tell you of a simpler *in-home* adjustment procedure for RCA's CTC7, -9, -10, and -11 series of sets, using only a color-bar generator and VTVM. Though not as precise as the "full-dress" adjustment method, the in-home system is entirely satisfactory for the peaking and phasing adjustments made necessary by tube replacement or other minor servicing.

In later models, you don't even have to remove the chassis from the cabinet. If you have any CTC7A's

NOW test all the latest tubes

THIS NEW DELUXE TUBE TESTER tests 9-pin NOVARS, 12-pin COMPACTRONS, new 10-pin tubes and NU-VISTORS plus all previous standard tube types. The Model 107A is the finest, fastest tester at a popular price—offers every important test you need! Dynamic Mutual Conductance Test on pre-wired chassis, Cathode Emission Test by free point selector system and the nationally accepted Grid Circuit Test patented by Seco—up to 11 simultaneous checks for leaks, shorts and grid emission. In handsome carrying case with handy chart for tube set-up data.



Meets specifications for Federal Stock Classification. Government Agencies use Part No. Tube Tester Type 107-FSN-6625-713-9075.

NEW SECO MODEL 107A \$149⁵⁰ NET

COMPACT, PORTABLE, LOW-COST TESTER. Ten sockets offer complete modern TV tube coverage plus all heater-type radio tubes and hybrid types. Includes sockets for all latest types—NU-VISTOR, 9-pin NOVAR, 10-pin tubes and 12-pin COMPACTRONS. Incorporates the patented Seco Grid Circuit Test plus reliable Cathode Emission Test . . . also checks filament continuity and provides open element test. One easy-to-read meter indicates results of all tests. With portable carrying case and flip chart for quick set-up data.



NEW SECO MODEL 88 \$69⁵⁰ NET



MODEL 100 DYNAMIC TRANSISTOR CHECKER—checks transistors "in" or "out" of circuit. Permits matching of similar transistor types. No set-up necessary. **\$19⁹⁵ NET**

MODEL GCT-9 GRID CIRCUIT TUBE TESTER—tests for grid emission, leakage, shorts and gas in one operation! Two new exclusive tests—cathode continuity check and interelement short test with short identified to pin number. **\$32⁹⁵ NET**



two-way radio test equipment



TWO-WAY RADIO TESTER
Reduces servicing and installation time of crystal-controlled units. Combination Crystal Checker, RF Signal and Field Strength Meter. Model 500. \$29.95 Net



TRANSMITTER TESTER
Designed especially for use with Citizens Band and other low transmitters up to 160 MC. Checks percentage of amplitude modulation as well as RF power output. Model 510. \$46.95 Net



ANTENNA TESTER
A commercial quality in-line antenna efficiency tester and in-line RF power meter. Antenna testing is made easier and faster on wide range of transmitters employing 50 ohm transmission lines. Model 520. \$42.95 Net



ATTENU-LOAD
A dual purpose unit in one compact package. 50 Ohm, 50 Watts Attenuator and Load Termination. Model 511A. \$21.50 Net

Send for your FREE copy of the Seco Full Line Folder. Complete details on all quality Seco Testing Equipment including:

- VACUUM TUBE VOLT METER
Model 208 \$74.50 Net
- BATTERY ELIMINATOR
Model PS-2 \$13.95 Net
- IN-CIRCUIT CURRENT CHECKER
Model HC-6 \$12.95 Net
- FLYBACK CIRCUIT AND INDUCTANCE ANALYZER
Model FB-4 \$38.95 Net

SECO ELECTRONICS, INC.
5031 Penn Ave. So., Minneapolis 19, Minn.
Please send information on MODELS . . .

Full Line 107A 88 500 510 520 511A
 Folder GCT-9 100 208 PS-2 HC-6 FB-4

Name _____
Address _____
City _____ State _____

in your care, a little foresight will also enable you to adjust these in the home without the need for disassembly. Just remember to bring along a few socket adapters for 9-pin miniature tubes; also, on some occasion when you have the set in the shop, install a test-point extension lead running above the chassis from the junction of phase-detector resistors R164 and R165 (see "Quicker Servicing" in this issue). Another special requirement for adjusting the CTC7A and -AA chassis is an alignment tool with a slim shaft, which will allow you to adjust

both the top and bottom slugs of the double-tuned oscillator-plate transformer from the top side.

The following step-by-step procedure applies specifically to the CTC7A: Insert an adapter in the socket of V21, and connect a VTVM to the plate terminal of the killer-detector section (pin 7). This output test point is used for all chroma-sync adjustments. Begin by peaking both slugs of oscillator-plate transformer L30 (designated A16 and A17 in Fig. 2) for a maximum negative DC reading on the meter. Next, ground the lead running from

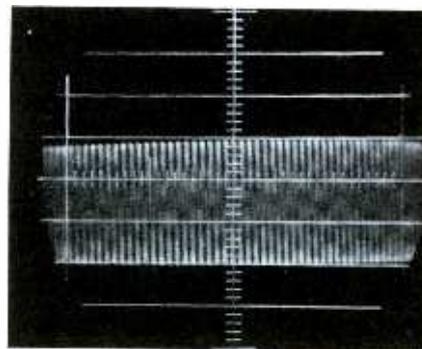


Fig. 5. Plate signal of 3.58-mc control tube looks good, but is incorrect.

between R164 and R165, in order to remove the DC correction-voltage input from the oscillator-control tube, and turn the control-tube plate adjustment A19 to stop the rapid movement of color bars on the face of the CRT. (This step is comparable to adjusting a horizontal-frequency slug with the horizontal AFC disabled.) As a final touch, install adapters in the sockets of V17 and V18; ground both pin 7 of V18A (the burst-amplifier grid) and pin 9 of V17A (the color-killer grid); and adjust the oscillator-transformer trimmer C111 for zero volts on the VTVM.

This completes the chroma-sync adjustments, and you can move on to the demodulator-phasing adjustments. Remove the tube adapters from the receiver, and disconnect the VTVM; you'll be using the picture tube itself as an indicator during the rest of the procedure. In each step, the object will be to disable two of the three guns in the tricolor CRT, and adjust the receiver so that the portion of the color-bar pattern contributed by the third gun appears to be correctly presented. Any gun can be disabled by temporarily connecting the control grid to ground through a 100K-ohm resistor. The different grids can be identified by the appropriately color-coded leads running from

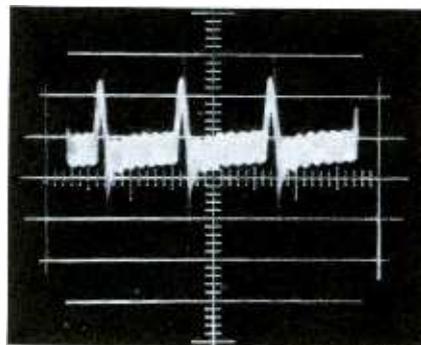
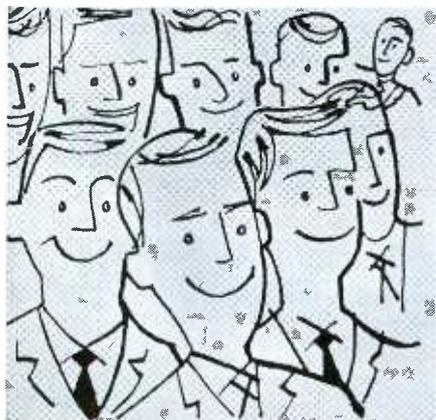


Fig. 6. Weak, deformed signal at the oscillator plate pointed to trouble.

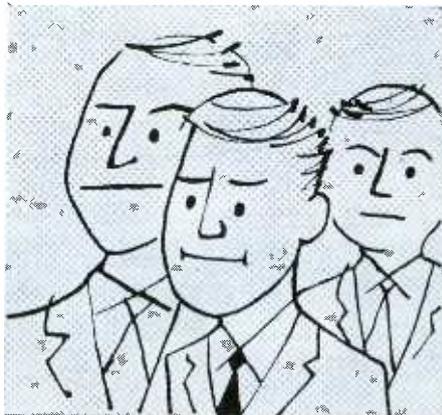
There are 2 Kinds of Radio-TV Servicemen-

Those who use
QUAM
replacement loudspeakers



We're proud to say that
this group is bigger*

Those who use
other brands of
replacement loudspeakers



- * According to the findings of Brand Name Surveys, Chicago, Illinois in March and April 1961, more servicemen prefer Quam speakers than all other replacement brands combined. Major reasons stated for the preference: Quality! Availability! Performance!

QUAM-NICHOLS COMPANY

234 East Marquette Road, Chicago 37, Illinois

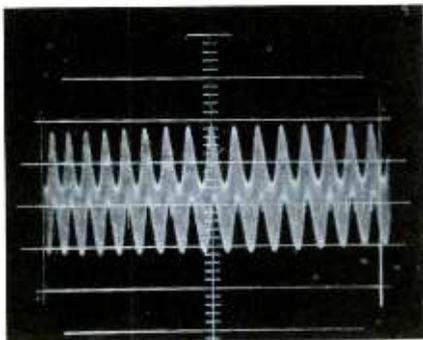


Fig. 7. Correct signal at plate of control tube after completion of repair.

the chroma section to the picture-tube socket.

Using a conventional keyed rainbow generator as a signal source, and with the tint control set at midrange, your results should turn out as follows:

With the blue and green CRT guns disabled, the third bar from the left should appear solid red, and nearly all of the other 10 bars should show some red color. However, the sixth bar (which is normally bluish) should be practically invisible. This shade of blue is produced by chroma-signal modulation 90° out of phase with the signal that produces red. (See the vector diagram in "Test Equipment for Color TV," elsewhere in this issue.) Therefore, the red gun normally contributes nothing toward producing the sixth bar. If this bar can be seen, try adjusting slug A18 in burst transformer L28, to blend the bar into the background as completely as possible.

The second step is to disable the red and green guns—leaving the blue gun active—and check for the absence of the third and ninth bars in the rainbow (normally red and bluish-green). If these bars are visible, try touching up the top adjustment A16 of the oscillator-plate transformer for more complete fade-out of both bars.

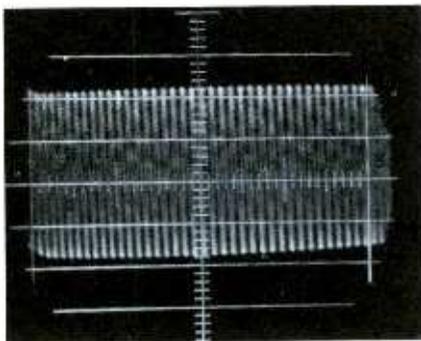


Fig. 8. Normal waveshape of output signal generated by 3.58-mc oscillator.

Also check the operation of the green gun with no output from the blue and red guns. If there is more than a trace of illumination in the first and seventh bars (normally yellow-orange and greenish-blue), it is advisable to recheck the previous adjustments for possible improvement. However, avoid unnecessarily readjusting A17, the lower slug of L30, since this usually requires further retouching of upper slug A16.

The last step in the procedure is a check of tint-control range. With

the blue and green guns again disabled, the sixth bar should become illuminated and the seventh bar should fade into the background as you turn the control to its clockwise extreme. Toward the full counterclockwise setting, the fifth bar should fade out. This action indicates that the control is able to introduce a 30° oscillator phase shift in either direction from the normal setting.

If these adjustments cannot be made as described, you may find that a previously unsuspected de-

new **3 IN 1** TRANSISTOR TESTER



**GC
MODEL
36-560**

**all three transistor
tests in one unit...**

TESTS: SHORTS-LEAKAGE-GAIN

only **19⁹⁵**



TEST PNP, NPN, POWER TRANSISTORS, DIODES AND RECTIFIERS with this High Styled but rugged, compact transistor tester. Only 5" x 5" x 1 3/4" in overall size and weighing only 1 3/4 pounds, this unit operates on two penlite batteries which under normal operating conditions last a lifetime. An ON-OFF switch eliminates possible meter or battery damage through accidental shorts. The body is finished in "Anti-Scratch" case with stylized chrome handle for easy carrying. The high visibility recessed panel is in a two-tone classic finish of pale gold and copper brown. Foreign equivalents listed in accompanying FREE MANUAL.

Write for our **FREE 400 page Catalog**

GC ELECTRONICS CO.

Division of Textron Electronics, Inc.

Western Plant: 3225 Exposition Place, Los Angeles 18, Calif.
Main Plant: 400 S. Wyman St., Rockford, Ill., U.S.A.

**MADE IN AMERICA
BY AMERICANS**



BEST performance FOR LESS

1... use the PS-2 to operate ALL TYPES of auto radios
(transistor, hybrid and tube)

2... use the PS-2 to operate personal portable radios
(transistor)

... also operates experimental transistor circuits, relays; use it for electroplating, laboratory work. Transistor protection with separately fused milliammeter. Longer life with EPL patented conduction cooling.

Outperforms all others in its price class

Also available in kit form through your Electronic Parts Distributor
Model KPS-2 \$44.95

VOLTAGE	CURRENT	RIPPLE
0-16 VDC	5 amps.	0.5%
0-20 VDC	75 ma.	0.15%

ELECTRO PRODUCTS LABORATORIES, 4501-T Ravenswood, Chicago 40
Canada: Atlas Radio, Ltd., Toronto
Proximity Switches • Magnetic Pickups • Tachometers • DC Power Supplies 1240

Service Dealer Program No. 11 in a Series



TV NEUROSI:
"perturbed"



TV Failure
call ME 0-0000
YOUR NAME
ADDRESS

TV REPAIR
"Get Acquainted"
SPECIAL!
FREE TOYS
This week only a quantity limited
will be given away every TV
service call. For more TV
service information call
YOUR NAME
ADDRESS

TV NEUROSI:
"antagonism"



delaying
if TV you late for
your fix order about a can
usually be installed for
FREE! Prompt, dependable
TV REPAIR
always call
ME 0-0000
YOUR NAME
ADDRESS

USE THIS COUPON TO ORDER ADS DESCRIBED ON PAGE 74

PF REPORTER
2201 E. 46th Street
Indianapolis 6, Indiana

Please send me

Ad mats @\$1.75 Glossy Proofs @\$1.00 Both for \$2.50

Enclosed is \$ _____ to cover cost.

Name _____

Address _____

City _____ Zone _____ State _____

fect is still present in the chroma sync, oscillator, demodulator, or matrix circuits.

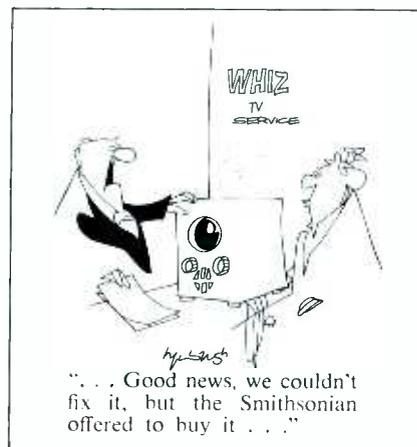
Adjustments for Newer Models

The in-home chroma-circuit adjustments have been revised and simplified for receivers introduced since the CTC7A. None of the latter sets have a killer detector; thus, the grid of the color killer is the proper VTVM test point for chroma-sync alignment. In addition, the CTC9 and all subsequent chassis have only a single-tuned 3.58-mc oscillator-plate transformer with no trimmer across it, eliminating two of the adjustments which were necessary in the earlier models. Thus, the adjustment boils down to the following three-point routine:

1. Peak the burst transformer and 3.58-mc transformer for a maximum DC reading at the color-killer grid, with a color-bar input injected into the chroma section.
2. Short the phase detector-control tube connection to ground (at the test point above the chassis), and adjust the control-tube plate coil to zero-beat the oscillator and color-bar signals.
3. Check for proper colors in the bars on the CRT, with the tint control set at midrange; if these are incorrect, retune the burst transformer until the correct color sequence appears.

Now, As I Was Saying

The complete chroma-adjustment procedure for the CTC7A on my bench wasn't quite as easy as the touch-up I have just described; however, it went off without a hitch. I reassembled the set, had it delivered, went out to the customer's home for a final check of purity and convergence, and left him with an excellently-performing color set. ▲



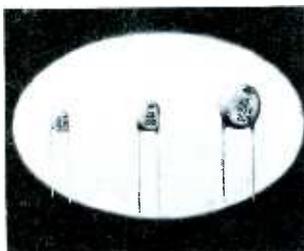
PRODUCT report

For further information on any of the following items, circle the associated number on the Catalog & Literature Card.

Bonded Color CRT (36H)

A new 21FJP22 color-TV picture tube, with a "glareproof" window bonded to the face, has been made available to the replacement market by **RCA Electronic Tube Div.** This type, which eliminates the need for a separate safety glass, is almost identical electrically to the recently-announced 21FBP22. Both tubes have new, high-efficiency sulfide phosphors that give a number of advantages, including a marked increase in both brightness and contrast.

Transistor-Circuit Capacitors (37H)



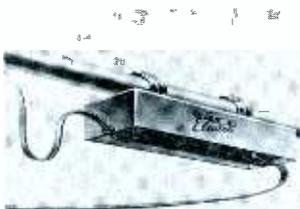
High-capacitance, low-voltage ceramic disc capacitors, **Centralab** Type CK, have many applications in transistor circuitry. Units with a working-voltage rating of 50V DC are manufactured in values from 5000 to 100,000 mmf. with a capacitance tolerance of $\pm 20\%$. All are $5/32$ " thick; diameters range from $3/8$ " to $5/8$ ", depending on capacitance value.

Sweep-Circuit Test Instrument (38H)



Numerous signal-injection and component-substitution tests can be performed with the **Sen-core** Model SS117 "TV Sweep-Circuit Analyzer." Checks of the horizontal oscillator, horizontal output, flyback, both pairs of yoke windings, and anode voltage can be made. In addition, a built-in meter has 300- and 1000-volt ranges on DC (for checking B+ and boost) and peak-to-peak AC (for checking sync and oscillator outputs), plus a 300-ma range for checking current through the sweep fuse. Dealer net price is \$82.50.

Antenna With Transistorized Amplifier (39H)



An antenna-mounted, transistorized amplifier gives the **TACO** "T-Bird Electra" a tenfold increase in gain over previous "T-Bird" models, while retaining the sharp directivity of the latter. The amplifier system obtains power from the 117-volt AC line, and includes a built-in TV/FM two-set coupler. Three models are available for different signal conditions.

CRT Base Adapters (40H)



The **Anchor** "110" Accessory Center" display holds an assortment of extension cables and adapters for 110° CRT's, packaged in reusable plastic boxes. One item, the RK-320 kit, contains a complete set of accessories for interconnecting various types of 110° tubes and sockets. In other boxes are single connectors designed for

specific purposes, such as adapting a standard 8-pin socket to accommodate the special base connections of a 23EP4 tube.

NEW! SARGENT ELECTRONIC CHEMICALS and FINISHES

Specially Formulated for Today's Service Needs

SARGENT RED INSULATOR

Stops corona discharge and arcing. Waterproofs exposed wires and circuits. Impervious to moisture and temperature variations. Dielectric strength exceeds 20,000 volts. Excellent for use in printed circuit repairs. Laboratory tested and approved.

Giant 16.4 Oz. Can \$1.29 Dealer Net

OTHER PRODUCTS IN THE SARGENT ELECTRONICS LINE

Tuner Cleaner, Gear and Parts Cleaner, Degreaser, Clear Acrylic Plastic, Penetrating Oil, Squeak Stopper, Enamels, Lacquers, Metals, Engine Enamels, Stop Rust, and other Specialties.

For Free Literature and Prices, Check Your Electronics Parts Distributor, or write . . .

ELECTRONICS DIVISION

THE SARGENT-GERKE CO.

Producer of Paints and Chemicals for Over 60 Years
P. O. Box 729 • INDIANAPOLIS 6, INDIANA



FM RADIO TUNER

JUST
PLUG IT IN!



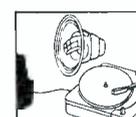
Adds FM Radio
To Television Set



Adds FM Radio
To Phonograph



Adds FM Radio
To Tape Recorder



Adds FM Radio
To Custom
Music System



MODEL T-300 FM RADIO TUNER

GRANCO
BY *Emerson Radio*

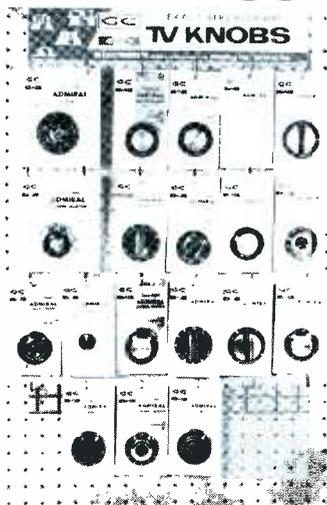
FM is getting bigger than ever — and this precision-engineered Granco Tuner is helping push the trend. Its amazingly low price delivers volume sales. This compact unit can be the heart and control center of every hi-fi system. Plugs in to amplifier and speaker, phonograph, television, custom music system or tape recorder. Super-selectivity assures brilliant FM reception even in fringe areas. Exclusive Granco coaxial tuner and associated circuitry reduce operation to just two knobs. In trim, smartly styled cabinet of Gunmetal Blue, $6\frac{1}{4}$ " wide, 4" deep, $4\frac{1}{2}$ " high. **ONLY \$19⁹⁵***

Get in on the big switch to Stereo FM. Granco's got it now. Write for details.

GRANCO America's Leading Specialist in Stereophonic FM
Division of **Emerson Radio** Inc. 680 FIFTH AVENUE, NEW YORK 19, N. Y.
Suggested list. Slightly higher in some areas.

\$26³¹ puts you in the TV KNOB BUSINESS

- Dealers Exact replacement TV Knob Deal
- Helps build extra profits
- Knobs same as original
- pre-packaged and clean
- free display merchandiser
- pre-priced for full profit



ADMIRAL DEAL NO.
49-573
DEALER NET
26.31

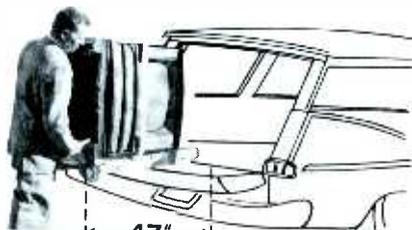
Here's immediate availability of the most popular exact replacement TV knobs, each individually skin-packed and priced. Shown are Admiral knobs, but exact replacement knobs are available for all seven leading TV manufacturers. Complete model number to GC number cross reference guide with each display order.

See your GC Electronics Distributor, or write.



GC ELECTRONICS COMPANY
a division of *Textron Electronics, Inc.*
400 S. WYMAN ST., ROCKFORD, ILLINOIS

SAVES
your back...
SAVES
your time...



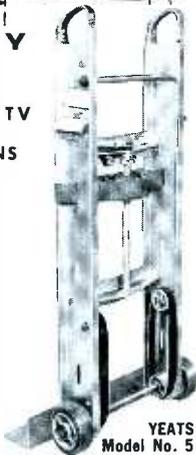
YEATS SHORTY DOLLY for RADIO and TV

just 47 inches high for STATION WAGONS and PANEL PICK-UPS



FOLDING PLATFORM
15 1/4" x 24 1/2" top.
Snaps on or off.
(Platform only)
\$11.95

Designed for TV, radio and appliance men who make deliveries by station wagon or panel truck... the short 47 inch length saves detaching the set for loading into the 'wagon' or pick up. Tough, yet featherlight aluminum alloy frame has padded felt front, fast (30 second) web strap ratchet fastener and two endless rubber belt step glides. New folding platform attachment, at left, saves your back handling large TV chassis or table models. Call your YEATS dealer or write direct today!



YEATS
Model No. 5
Height 47"
Weight 32 lbs.



FURNITURE PAD

"Everlast" COVER AND PADS

YEATS semi fitted covers are made of tough water repellent fabric with adjustable web straps and soft, scratchless white flannel liners. All shapes and sizes — Write



TV COVER



APPLIANCE DOLLY SALES COMPANY

2103 N. 12th STREET MILWAUKEE, WISCONSIN

Pocket Portable Radio (41H)

A six-transistor AM radio about as large as a pack of king-size cigarettes, the **Sampson Model S640 "Little Sampson 6,"** is packaged in a book-shaped gift box including a leather case, accessory earphone, and battery. Suggested retail price is \$19.95. A five-tube superhet table radio, Model ST61, has also been introduced.



Record-Cleaning Kit (42H)

For cleaning all types of phonograph records, **Duotone** supplies a kit including a bottle of antistatic detergent and a deep-pile wiping pad for sweeping dust and dirt out of record grooves. The kit, packed in a vinyl bag, also contains a needle-cleaning brush. Price is \$1.50. Another new feature in the company's product line is "bubble-packaging" for diamond needles. Units are displayed in individual clear plastic boxes with identifying tabs.



Socket Adapter (43H)

Fitting into the cord compartment of the **Seco Model 107** tube tester, the new No. 1171 adapter contains test sockets for "novar," 10-pin, and "Compactron" tubes. Case dimensions are 3 1/2" long x 2 3/8" wide x 3/4" high. The unit is supplied with a 12-wire, 22" cable, ready for installation, at a dealer net price of \$4.95.



UHF Antenna Line (44H)

Several models of **JFD** antennas are available for UHF reception. The following three types are designed to receive translator and airborne educational broadcasts on channels 70-83: 12-bay Model MPAT-1212 (shown stacked vertically), 6-bay Model MPAT-1206, and 4-bay Model MPAT-1204. Types for receiving conventional UHF station signals are the MPAT-410 corner reflector (for fringe areas) and MPAT-600 (for strong signals).



Dual Selenium Diodes (45H)

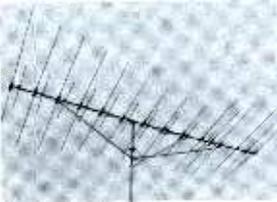
The three types of "Vac-U-Sel" dual selenium diodes supplied by **General Electric** are intended for use in horizontal AFC and other low-power circuits. The diodes are packaged on wall cards which are color-coded as follows: Type 6GC1 (common cathode), orange; 6GD1 (series-connected), black; and 6GX1 (common anode), gold. On the back of the card is a chart listing the original manufacturers' part numbers for units which the new component will replace. List price is \$1.40 each



Stereo FM Coils (46H)

A set of five inductors required in constructing stereo FM adapters is available from **J. W. Miller Co.** All units — a low-pass filter, two bandpass filter elements, a 19-kc locked-oscillator coil, and a 38-kc output transformer — are shielded, and measure 3/4" square x 1 7/32" high. Included with each coil is a circuit diagram and parts list for a complete adapter, plus useful facts about stereo FM.

High-Gain Antennas (47H)



The multiple driven elements of **Channel Master** "Crossfire" antennas gradually decrease in impedance from the front feed point to the rear of the array, giving an effect of "proportional energy absorption." The conductors of the feed line are transposed between each successive pair of elements to produce a wave-cancelling effect—thus increasing the front-to-back ratio. No reflector is used, but a "director group" is mounted at the front to increase gain. A short parasitic element in front of each dipole gives more efficient harmonic-mode operation on high VHF channels. Six models are available.

CB Transceiver Kits (48H)



Special features of **EICO** "770 Deluxe Series" Citizens band transceiver kits (not included in the standard kit series) are an adjustable squelch circuit, a "press-to-talk" relay, and crystal-controlled receiver operation on one of the four channel-switch positions. Model 770 (kit, \$69.95; wired, \$99.95) has a power transformer and silicon-rectifier voltage-doubler supply for 117V AC operation. Models 771 and 772 (kit, \$79.95; wired, \$109.95) also include vibrator-type supplies for 6V and 12V DC, respectively.

TV-Appliance Dolly (49H)



Equipped with an extra strap and ratchet assembly near the bottom of the frame, the **Yeats** Model 14 dolly is a deluxe version of the No. 7 type. Like the No. 7, the 14 has aluminum I-beam construction with curved cross members, conveniently placed side and top handles, roller-bearing wheels, permanently-lubricated step-guide belts, and heavy felt padding on the face. Weight is 40 lbs; price is \$79.50.

Nuvistor Test Adapter (50H)



The **Walsco** "Nuvistor Socket Adapter" (Cat. No. 1960), which permits testing of 6CW4 "nuvistor" tubes at the same test settings as the 6BQ6 or 6CU6, is designed for use with any emission-type tube tester. It is simply plugged into the octal socket of the tester. Dealer net price of this accessory is \$1.95.

Deflection Yokes (51H)

A number of exact-replacement yokes have been added to the **Merit** line. For 110° sets, Types MDF-112 and MDF-118 replace Packard-Bell part nos. 29645C and 29696; MDF-122 replaces Westinghouse and Airline part 490V007H01; and MDF-131 replaces Wells-Gardner and Airline part 9A2476. For 90° and 92° sweep, MDF-109 substitutes for Westinghouse part no. 490V004M01; MDF-121 is a replacement for Corona and Wells-Gardner part 9A2458B; and MDF-124 replaces Zenith no. 95-1768.

Tubes for Mobile Communications (52H)

New "A" versions of three popular tubes for mobile radio transmitters have been announced by **Sylvania**. They feature more stable power output at heater voltages about 15% below normal, thus affording better performance when radios are operated with the vehicle engine idling or turned off. The 6146A, 6883A, and 6159A (with 6.3-, 12.6, and 26.5-volt heaters, respectively) are all beam-power pentodes with identical basing arrangements. Maximum power output is 70 watts in class-C telegraphy under ICAS-specified conditions.

JUST WHAT YOU NEED FOR TESTING TRANSISTORS



**AC to DC
POWER
SUPPLY**

Plug this instrument into any 60 cps, 95/130 volt circuit and get a stabilized source of direct current, adjustable over a range from 0 to 45 volts DC, with current output 0/2.5 amperes. Filtered direct current output range 0/45 volts, 0/2.5 amperes is continuously adjustable and stabilized $\pm 1\%$ at any setting regardless of alternating current fluctuation. Voltage regulation is approximately 5% between full load and no load at full voltage setting.

This DC Power Supply instrument is ideal for use in transistor testing, circuit testing, to provide regulated voltage for light testing, eliminates the need of batteries by supplying exact DC voltage required.

Write for Bulletin 17-BL01 which gives full details and models available.

ACME ELECTRIC CORPORATION

9411 Water St.

SAA3499/1952

Cuba, N. Y.

Acme  **Electric**

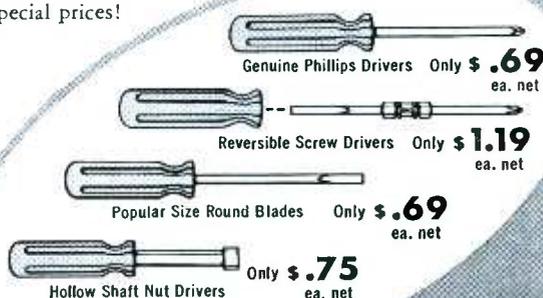


"Spotlight Specials"

**Look for them at
your distributor
and SAVE!**

**Need some
new drivers?
Doesn't everyone?**

Well, right now is the time to get them and genuine VACO drivers at that! These are the drivers with the world's most comfortable handles and with rugged blades of chrome vanadium steel. All unconditionally guaranteed. Now available at these special prices!



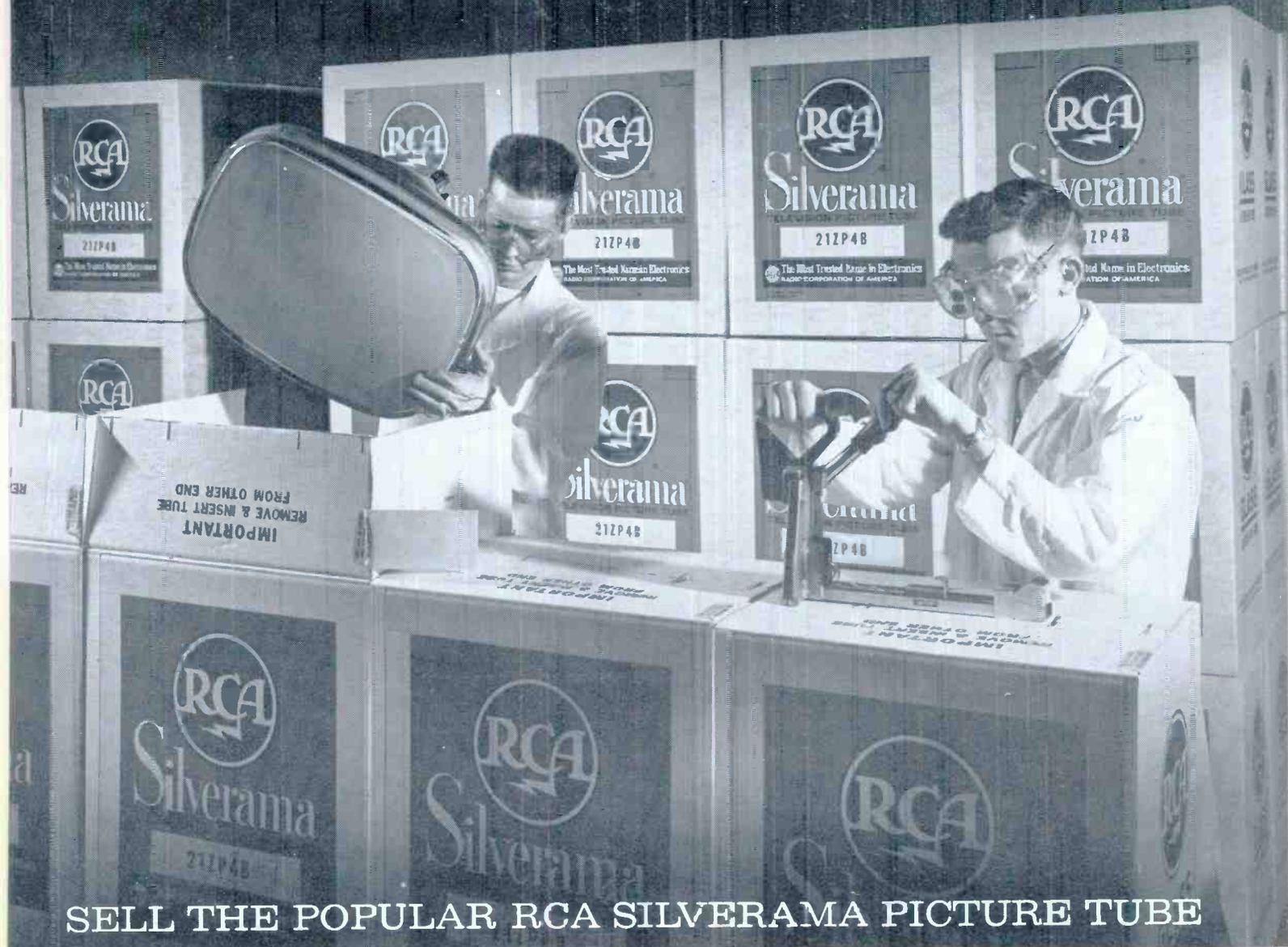
Genuine Phillips Drivers Only \$.69 ea. net

Reversible Screw Drivers Only \$ 1.19 ea. net

Popular Size Round Blades Only \$.69 ea. net

Hollow Shaft Nut Drivers Only \$.75 ea. net

VACO PRODUCTS COMPANY
317 East Ontario Street, Chicago 11, Ill.
In Canada: Vaco Lynn Products, Ltd. and Atlas Radio Corp.



SELL THE POPULAR RCA SILVERAMA PICTURE TUBE

To Increase Your Business and Build Customer Confidence

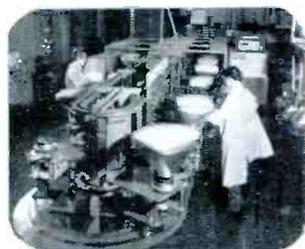
Before any RCA Silverama Picture Tube goes into its carton for shipment to your distributor, it has been through one of the most exhaustive series of quality tests in the picture-tube industry.

Every Silverama undergoes the same electrical tests as RCA's original equipment picture tubes. Even the Silverama envelope has been thoroughly cleaned, tested and inspected before re-use. Only then is the famous RCA high-quality phosphor screen added.

Such tests—plus uncompromising quality control at every step of

manufacture, assure you that RCA Silverama is the finest replacement TV-picture tube modern science and technology can produce.

But most important to your business: this superior tube is priced to compete with other name brand picture tubes. Thus for no extra cost you can provide the business-building extras of assured quality performance, fewer complaints, callbacks and in-warranty failures—plus the brand-name your customers want and trust, RCA Silverama. See your authorized RCA Tube distributor today!



Automatic testing. 26 different tests for major characteristics are performed on this automatic test unit. A tube failing a single test is automatically rejected.



Final checkout. At the end of the production line, just prior to packaging, sample batches of Silverama picture tubes receive a focus check for additional assurance of quality.

RCA ELECTRON TUBE DIVISION, HARRISON, N. J.



The Most Trusted Name in Television

27F-54—RCA Tube Division
Prepared by Al Paul Lefton Co., Inc.

In Electronic Circuits . . .

ALL AROUND PROTECTION

NEW MICROFUSE
THE PIGTAIL VARIETY (278000) SERIES

THE PLUG-IN VARIETY (272000) SERIES

THE SUB-MINIATURE FUSE HOLDER (No. 281001)

New Indicating 3AG Fuse Posts

It GLOWS when the FUSE BLOWS

It's **LITTELFUSE** First!
DES PLAINES, ILLINOIS