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POSTMASTER: SEND FORM 3579 TO RADIO-TELEVISION SERVICE DEALER, 67 WEST 44TH ST., NEW YORK 36, N. Y.
EDITORIAL...
by S. R. COWAN
PUBLISHER

Crack-down On Gyps

Newspapers in many key cities have of late been carrying more and more stories about the arrest of local "gyp" service firm operators. In some respects this is good news indeed! These operators should be eliminated from our field by any drastic method needed to be effective. They must be eradicated fast.

But, by the same token, we regret it is necessary that such happenings should be reported so frequently in the public press because every such incident reflects damagingly and hurts the service profession as a whole. Good servicemen never get a good publicity release to offset the adverse publicity of the small minority of villains.

Gyp practices of a few irresponsible in the service field more than any other factor have caused law-makers to believe that licensing and police regulations with teeth and penalties for violators are the only solution to the problem.

The two leading opponents to promulgation of License Bills for radio-TV servicemen, strangely enough, are RETMA and NEDA—both of which are merely distant and very self-preserving cousins to the service profession. (Remember when some set-makers advertised "our TV sets need no outdoor aerial"—and the public wouldn’t accept the serviceman’s diagnosis that in that particular case the set-maker was misleading the set owner? And, remember, during the war days, when tubes were only available on priority to servicemen, when certain distributors diverted those scarce tubes to service departments of their own which they suddenly set up in order to make an extra buck?)

These two organizations, RETMA and NEDA, have taken the stand that to improve the quality of servicing and to induce more qualified men to come into the service field no restrictions whatever should be imposed. (But, do distributors confine trade discounts solely to professional servicemen—or can any Tom, Dick and Harry buy their parts over-the-counter for the same reduced price that professional servicemen must pay?) We could write a book explaining in detail why we believe these two fine organizations are "out of line" in adamantly opposing License Bills. We believe these organizations hold their respective views opposing licensing primarily for selfish and unwarranted reasons to which servicemen themselves should not be bound. In fact, the majority of servicemen and most set-makers themselves want and need properly promulgated License Laws. For that reason we advocate licensing.

Specialized Test Equipment

The peculiar and complex problems relative to servicing many TV receivers and their components happily has stimulated much ingenious thinking on the part of test equipment manufacturers.

Consequently, in this issue we are privileged to publish no less than three original articles, each describing a new piece of test equipment that is now available to the service profession. Each of the instruments respectively does a specialized job which actual experience proves the need for.

In the months ahead we plan to continue this educational programming, describing the design, characteristics and applications of new test equipment as it is put upon the market. Paramount in our selection of articles to be published are these factors: 1)—will the instrument in question efficiently, accurately and properly do the job or jobs it is purported to do?—and, 2)—does the instrument, by its functional capacity, justify being purchased?—or 3)—stated another way, will the investment a serviceman makes in any given instrument come back to him in a relatively short time?

As we have said frequently, there are only a certain limited number of working hours per week available to any serviceman. Thus every available minute must be used to optimum advantage. If the outlay of $50, $200 or even $500 for an instrument will result in a serviceman being enabled to do his tasks more easily, more efficiently and in less time—quite obviously investing in such an instrument is worthwhile regardless of the cash outlay required. Amortization of any investment is proper business thinking.

Too many service firms now are using old, obsolete test equipment. Too many are working with inferior instruments that are so badly off calibration or accuracy as to be worse than having no instrument at all. Too many service firms do not now have enough test equipment available for their expanded staff of employed technicians, and as a result, whether they realize it or not, pay the severe penalty of losing many hours daily by having workmen wasting "idle time"—hours that shop owners pay salaries for and lose income from.

Progressive service firm operators know they can’t afford to lose minutes and money that way but sad to say, they sometimes cogitate much too long about the purchase of new or additional test equipment and keep piling lost minutes on lost minutes. So, let’s modify the old adage and say: "He who hesitates loses!"
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**ASSOCIATION NEWS**

**RTG—Long Island**

Motorola's new 19 inch color receiver recently made its debut on L. I. at one of the regular Guild Technical meetings at the Irish American hall in Mineola. The lecture included a presentation of the first 19 inch color set to be offered to the public.

The program was opened by a few well chosen words by Mr. Paul Lewis, Vice President of Motorola N.Y., who promises continued effort on the part of Motorola to keep the serviceman well informed on the advancement of color TV and its problems.

**LIETA—New York**

The Long Island Electronic Technicians Assn., Inc., BOOTH No. 20, TENT ‘B’ (The Long Island Lighting Company Tent) at the Mineola Fair and Industrial Exposition, Roosevelt Raceway, N.Y. The Fair ran from October 9th thru October 17th from 12 Noon to 11 P.M. Picture shows mem-

bers, Harold F. MacFarland, William A. Carey (Assn. President) and Napoleon Revels giving out the LIETA FAIR certificate. This was a cooperative advertising venture (the certificate) on the part of sixteen of our members who operate their own businesses.

**RTTA—Penn.**

The Southern Pennsylvania Radio-Television Technicians Association met at C. A. P. headquarters Mon., Oct. 18th, with brief business session, Pres. Joseph Hauser presiding. Following the confab refreshments were served to the members and their friends. They then were guests of the new WGAL-TV transmitter and that station's latest telecasting facilities.

[Continued on page 41]
Now you can get all the benefits of aluminized picture tubes — sharper picture, superior contrast, high light output — and excellent picture tube life!

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Walsco Electronics Corporation, 3602 Crenshaw Blvd., Los Angeles 16, California.

*Patent Applied For
CHROMINANCE Systems in Color TV Receivers

by BOB DARGAN and SAM MARSHALL

Discussion of signal processing of chrominance signal in Q and I receiver.

Part 2

In the previous sections a generalized discussion of an I/Q chrominance system was discussed. This was more or less of an analysis of the various stages involved. At this point a more critical analysis of the system is in order, and to do this we will analyze the progress of a color signal from the time it appears at the output of the camera tube to the time it is seen on the screen of a picture tube. In order to make the numerical values easy to work with we will make the assumption that the signal voltages corresponding to saturated colors which are developed at the output of the color camera are 1 volt for each tube, and that a corresponding voltage of 1 volt is developed at the grid of each corresponding color gun of the picture tube.

Color-Signal Relationship Table

For ready reference we have set aside the important color signal relationships as shown in Table 1. These have already been derived in previous chapters, and we shall use them often as we trace the signal in its progress through the transmitter and the receiver.

Color Signal Analysis

To begin with, we will assume a hypothetical transmitter (Fig. 5) in which the R-Y/B-Y* signals are supposedly developed in a separate section, following which the I/Q signals are derived from them. This type of analysis is in effect the equivalent to that

Fig. 5 — Block diagram of assumed transmitter, showing how R-Y and B-Y signals may be developed initially followed by the development of I and Q.

RADIO-TELEVISION SERVICE DEALER • JANUARY, 1955
Referring again to Table 1, the values of developed I and Q are:

\[
\begin{align*}
I &= 0.74 \times 0.7 - 0.27 \times (-0.3) \\
I &= 0.518 + 0.081 - 0.599V
\end{align*}
\]

\[
\begin{align*}
Q &= 0.48 \times 0.7 + 0.41 \times (-0.3) \\
Q &= 0.336 - 0.123 = 0.213V
\end{align*}
\]

I is fed into a phase inverter which converts +0.599V to -0.599V. This signal is then fed into the I Modulator. Q is fed directly into the Q Modulator. Also fed into each of the Modulators are the 3.58 MHz subcarrier signals which position or phase the I and Q signals with reference to the color burst sync phase (see Fig. 6). Thus, assuming a color burst sync phase of 0°, the I signal is delayed 147° and is positioned as shown. The –I signal is delayed an additional 90°, placing –I as shown (dotted line). This is equivalent to positioning +I (solid line) in the phase shown.

Observe the relative positions of the R-Y and B-Y axes. R-Y lags behind I by 33°, and B-Y lags behind Q by 33°. We have now established the relative phase positions of the signals we are interested in and can continue further with our analysis.

Referring to Fig. 7 we observe that the output of the I Demodulator now contains the I signal at 0.599V at an angle of 57° behind the color burst sync phase. Similarly, the output of the Q Demodulator contains the Q signal at 0.213V at an angle of 90° behind the I signal. The resultant of these two signals has a value of 0.645V, and it lies along the red signal axis which leads the R-Y axis by 13.5°.

Various arithmetic relationships between Y, I, Q, R-Y, B-Y, G-Y, R, B, and G. These are constantly referred to.

This resultant is the chrominance signal which forms part of the composite signal transmitted along with the station carrier. At the receiver the chrominance signal is removed from the composite signal and fed into the color demodulators. As pointed out in previous installments, demodulation takes place by feeding a pair of "in phase" and "quadrature" reference signals from a local 3.58 MHz oscillator into the I and Q demodulators respectively. These reference signals are developed in the color sync section.

Reference-Phase

The manner in which the color sync section provides the "in phase" and "quadrature" reference signals for demodulating the incoming color signal is discussed in detail in the chapter on "Color Sync Circuitry and Operation". For the present it should be
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borne in mind that it is possible to provide a pair of reference-phase signals from the output of the 3.58 mc local oscillator which can be made to swing around in any position as shown in Fig. 8. This is made possible by an adjustment of a parallel tuned 3.58 mc circuit located in the connection between the output of the video amplifier and the input of the color burst amplifier as shown in Fig. 9. Through an APC (automatic phase control) loop this tuned circuit varies the phase of the local 3.58 mc oscillator with respect to the color signal fed into the chrominance channel. The output of the local oscillator constitutes the I reference signal. The Q reference signal is obtained from the output of a quadrature amplifier fed by the 3.58 mc oscillator. Thus, the tuned circuit ends up varying the phase of the reference signals with respect to the color signals in the demodulators. The phase of the previously mentioned tuned circuit may be shifted by a slug which provides the preset adjustment, and by a variable air trimmer which provides fine adjustment. The latter is the hue or phase control which is mounted as a front panel control on the receiver.

In an I/Q receiver the reference phases from the 3.58 mc local oscillator are adjusted so that they coincide with the I and Q phases of the color signal provided at the transmitter. In a color difference receiver, however, the reference phases coincide with the R-Y and B-Y axes of the color signal. The above represents the key to the manner in which a color TV receiver may be adjusted to receive I/Q or color difference signals.

As a parting thought on this subject one must bear in mind the facts that the two reference voltages from the quadrature amplifier are derived from one source, the 3.58 mc local oscillator signal. The latter provides the I or R-Y reference voltage, depending on the type of demodulation used, and the Q or B-Y reference voltage is a separate signal developed in the quadrature amplifier. Shifting the phase of the burst signal by means of the phase or hue control, shifts the phase of the I reference signal of the 3.58 mc oscillator. The latter in turn causes an identical shift in phase of the Q reference signal which constantly tracks with the I reference signal by 90°.

Let us now continue our analysis of the color signal as it enters a pair of I/Q demodulators as shown in Fig. 10. To simplify the calculations we will assume that the input voltages at the I and Q demodulators are the same as those developed at the output of the transmitter, so that:

\[ I = 0.599\text{V} \]
\[ Q = 0.213\text{V} \]

Using the formulas shown in Table 1, we can set the matrix resistor values so that the correct percentages of plus and minus I and Q are obtained to give us R-Y, B-Y, and G-Y. Following this the Y signal is added to each of these color-difference signals in order to obtain the primary color signals, R, G, and B. Thus, for the red gun:

from (6)
\[ R - Y = 0.96I + 0.62Q \]
\[ = 0.96 \times 0.599 + 0.62 \times 0.213 \]
\[ = 0.7 \text{ volt} \]

from (1)
\[ R = (R - Y) + Y \]
\[ = 0.7 + 0.3 = 1 \text{ volt} \]

For the blue gun:

from (7)
\[ B - Y = -1.11I + 1.7Q \]
\[ = -1.11 \times 0.599 + 1.70 \times 0.213 \]
\[ = -0.666 - 0.366 = -0.3 \text{ volt} \]

from (10)
\[ B = (B - Y) + Y \]
\[ = -0.3 + 0.3 = 0 \]

For the green gun:

from (8)
\[ G - Y = -0.275I - 0.636Q \]
\[ = -0.275 \times 0.599 - 0.636 \times 0.213 \]
\[ = -0.3 \text{ volt} \]

from (11)
\[ G = (G - Y) + Y \]
\[ = -0.3 + 0.3 = 0 \]

These values correspond to those obtained at the output of the camera tube.

In the above discussion we have shown how by using the various color formulas, and by applying them in an I/Q system, the correct color voltages are applied to the color guns. While only a red color signal was considered, the calculation is the same for green and blue.
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RADIO-TELEVISION SERVICE DEALER • JANUARY, 1955
a new instrument for testing and repairing CATHODE RAY TUBES

by Engineering Dept., Raytronic Laboratories, Inc.

THE test equipment manufacturers, always mindful of the problems of the service business, have now come up with an instrument that takes the fight out of customers who balk at the high cost of picture tube replacement.

This article describes a new instrument which actually repairs many of the common faults by kinescopes. Called the "Cathode Beamer" it has been successfully used by many service dealers.

What It Does

The Cathode Beamer, and its associated accessories performs two major functions: it tests TV kinescopes for quality, and repairs many of the weaknesses heretofore considered unreparable.

Test procedures include filament condition, element continuity, shorts, leakage between elements, emission, grid-cut-off, cathode condition, and gas. The repair functions include the restoration of brightness and contrast by cathode sweeping or grid expansion, the removal of high resistance inter-element shorts, the removal of low-resistance cathode-to-grid shorts, and the welding of open cathode tabs.

Electron Gun Construction

The Electron Gun (Fig. 1) is the heart of any kinescope. Its function is to provide and control a stream of electrons, and, with the aid of external magnets plus the final anode, to direct and accelerate that stream in such a way to cause scanning lines to appear on the face of the tube.

At the base of the gun is a heater, located inside a tubular cathode. The normal placement of the heater is quite close to the cylinder wall of the cathode, and thus any abnormal jarring can cause the heater to touch the cathode, creating a short. The control grid is located from three to eight hundredths of an inch (.03" to .08") from the cathode. This opening being so small is susceptible to shorts caused by foreign matter or bits of tube coating material. But, because these spaces are quite tiny, the shorts resulting are usually able to be burned off without much difficulty.

The control grid aperture determines the controlling ability of this electrode. The aperture is usually about .035" in diameter. Being so small it may become clogged with foreign matter, causing the grid to lose control. This defect may be remedied by burning off the foreign matter, or actually melting some of the metal forming the aperture. This is specially effective in restoring tubes that have lost much of their emission.

Some of the most common faults are shorts between elements, open connections to elements, weak emission, stale cathode caused by prolonged inactivity, broken cathode tab connection, and gas. All except the gassy tube are repairable, in most cases, by the Cathode Beamer. Gas which is caused by air leaking into the tube, results in a defect which cannot be repaired.

Test Procedures

Test procedures are straight-forward. Filament condition is examined with the aid of a pilot lamp in series with the tube filament. If the pilot lamp fails to light, the filament is open. If the brill-
AMERICA'S MOST DEPENDABLE ROTATOR

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- DECORATOR'S GRAY

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There is no obscuring the easily-read lighted dial.

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TRIO has a new plan which makes it convenient for the dealer and distributor to carry a complete selection of colors with no major increase in rotator investment. With this plan the home-maker has a choice of colors — even at the time of installation.

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lance is excessive it indicates a partial short in the filament. Element continuity is determined by a mutual conductance test. A neon lamp lights if continuity is present. A selector switch allows the cathode, grid, and first anode to be tested separately. Weakness of emission is indicated in this test if the lamp glows weakly or not at all on the first anode position. If the lamp fails to glow on all positions, an open cathode is indicated.

Inter-element shorts are indicated on a separate neon indicator lamp through the use of a selector switch which allows the heater, cathode, grid, first anode, and second anode to be tested individually. A short on one position will be matched by an indication of short to the other element involved. The actual value of the leakage can then be measured by a built-in Wheatstone Bridge Circuit, which measures leakage up to 20 megohms.

Emission of the tube is read on the indicating meter, and is tested from the final anode. Grid cut-off characteristics are read on the meter with the aid of a calibrated potentiometer which applies negative bias to the grid of the tube under test. Cathode condition is shown by a separate indicator lamp.

In testing for gas, a high voltage, high frequency source is applied to the pins of the tube under test. A purplish glow within the tube indicates the presence of an excessive amount of gas. Large quantities of gas will result also in a shorts indication between several elements within the tube.

Repair Procedures—Increasing Emission

Unquestionably the most interesting functions of the Cathode Beamer are the repair procedures. Previously it has been possible to restore brightness to a degree by increasing the filament voltage. This results in more heat, driving more electrons from the surface of the cathode. With such procedures, however, the eventual life of the tube is shortened, since the cathode emitting material is depleted more rapidly than under normal voltage.

The Cathode Beamer increased emission by "Cathode Sweeping," rather than by increased heat. An electrostatic charge of 600 volts is fixed between the grid and the cathode, resulting in the removal of gas ions and stale emitting material from the surface of the cathode. The operation is accompanied by visible flash in the neck of the tube. For stubborn tubes, "Super-Sweeper" is also provided which increases the amount of current used to sweep the cathode. A cathode activator which raises the filament voltage to 12.6 volts may be used to help loosen the foreign matter from the cathode before sweeping exceptionally difficult tubes.

With very old tubes, in which the cathode material is just about depleted, it is possible to increase the flow of electrons to the final anode by enlarging the grid aperture with the aid of the Cathode Beamer. The filament voltage is raised, and at the same time the Cathode Sweeper relay is energized causing the grid to become so hot that some of the metal within the aperture is melted away. This operation must be done with constant visual inspection, as melting too much metal will cause the grid to lose control. This operation is only used with very old tubes, but is quite successful if carried out cautiously.

Removing Shorts

Inter-element shorts of high resistance values are burned off by the use of the auxiliary high-voltage, high-frequency source, furnished with the instrument. The base pin of one of the elements involved in the short is connected to a suitable ground, while the high frequency coil is touched to the pin of the other element involved. A high frequency, high voltage charge then passes through the material causing the short, and burning it off. Tests have shown that foreign material within the tube envelope is the major cause of high resistance shorts.

The more stubborn low resistance cathode-to-grid shorts are burned off by the application of a high current, low voltage charge. Two values of current are available - 5 amperes and 20 amperes. This high current burns off the short existing between the two elements. Dead shorts, caused by the elements actually touching each other cannot be removed, but these are comparatively rare.

Repairing Cathode Tabs

The connection between the cathode and its connecting wire leading to the tube base is called the cathode tab. This union may break resulting in an open cathode. The distance between the two broken ends is, however, quite small, so that it could be welded, if it were possible to make the ends touch or pass close to each other by vibration. This is accomplished with the Cathode Beamer by the use of an auxiliary vibrator much like the therapeutic variety. The tube is placed in a horizontal position, and the vibrator applied to the neck of the tube. This causes the broken elements to vibrate, and at times, pass quite close to each other. At the same time a high current charge is placed on the cathode pin of the tube. When the broken elements pass close to each other, or touch each other, the high current charge jumps between the two broken ends, firmly welding them together. Tests made by tube manufacturers on tubes repaired in this way have revealed that the welds are strong and permanent. The fact that a weld has been obtained is indicated by a special neon cathode lamp in the Cathode Beamer. A steady glow indicates a good contact. A flickering or sputtering indicates an intermittent condition.

Ease of Operation

The Cathode Beamer is a fairly large instrument, and therefore is used primarily for shop work rather than on home calls. Operation is quite simple with the aid of a Master Selector Switch on the front panel and various individual push button controls and selector switches for the various test and repair procedures.

Since the majority of picture tubes employ the same basic arrangements, no selector switches are required, and the only connections to the tube are its base socket and second-anode clip. The Cathode Beamer will work with all TV kinescopes, employing magnetic or electrostatic focusing. It has been used experimentally on other types of cathode ray tubes, and has even been employed to restore the emission in receiving tubes.

Effectiveness of Repairs

One of the big questions asked by servicemen about the Cathode Beamer is "How Long Will The Repair Last." The question can only be answered by knowing the condition of the tube beyond its normal limits. But most faulty tubes go bad long before the end of their normal lives, and it is these tubes on which the Cathode Beamer works best. A good cathode which is covered by gas ions can be swept very effectively and the result can be expected to last. Conversely, the restoration of brightness to an old tube by grid expansion can only be a temporary repair, since the emitting material was practically exhausted before the tube was reactivated. The removal of shorts should be permanent.

[Continued on page 50]
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- **Impedance**: 8 ohms
- **Dispersion**: 120 degrees
- **Mounting**: 180° adjustable "U" base
- **Dimensions**: 22 1/2" diameter, 9" depth

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**LOUDSPEAKERS INC.**

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WHITE PLAINS, N. Y.
SERVICE problems that occur quite frequently in auto radio work and which give rise to ignition noise are sometimes very difficult to solve. This type of interference is most often experienced when the car motor is running and is recognized as a whine which will increase or decrease in audible frequency in proportion to the speed of the motor. Generally, its output is relatively constant over the whole radio tuning range.

Since there are many possible causes of noise in a car radio, an understanding of the voltage generator and ignition system can be helpful in curing the interference. Basically, the electrical system of an automobile is composed of the spark plugs, spark or ignition coil, distributor, voltage generator and voltage regulator as shown in Fig. 1. These items are all tied together with leads and are operated or turned on from an ignition switch. It is from these components and their associated leads that rf energy from the high tension is fed back and radiated. This energy is developed in connection with the firing of the spark plugs or with the voltage generator system. The impulses of rf energy are strong over a range of frequencies up to 100 megacycles although they may be particularly powerful over a narrow band of frequencies.

Methods of Elimination

The elimination of the interference involves possibly the lead dress of the high tension wires, the use of bypass condensers, the checking and repairing of components in the radio that may have failed, and even the use of resistors as suppressors. With regard to the latter, some car manufacturers suggest that resistor type spark plugs be installed. Also, 15K resistors may have to be used in the high tension lead to the distributor to reduce the radiation of rf energy from this source.

One of the first items to be tested when checking for defective ignition suppression components is the bypass condenser connected across the ignition coil. This condenser must be checked by substitution with another metal case type .5 µf condenser. This condenser connected across the ignition coil is shown in Fig. 2. It is most important that this condenser be located on the battery side of the ignition coil. When the power source for the radio is connected through the ignition switch it is also advisable to bypass this point with another .5 µf condenser.

Actually the interference should be suppressed at its source as much as possible, therefore a complete examination of the ignition system is desirable, with particular care being devoted to the dis-
tributor points and spark plug gaps. An examination of these electrical contacts and points should be made to make sure that these surfaces are not pitted or dirty. Also, cracked cables, where the insulation has split or fallen off, and which can give rise to easier leakage paths for high tension currents, should always be replaced.

The lead from the battery to the radio, often known as the "A" lead, is a common path taken by the rf voltages into the radio chassis. It may be possible to position this "A" lead so that a quiet spot can be located where little interference is experienced. This lead should be dressed away from any other leads or cables that pass through the firewall as well as those under the dashboard.

There is a tendency on the part of car radio servicemen to shield all the leads that pass through the firewall with braided wire when a particularly difficult noise case arises. However, many causes of ignition interference are caused by an actual component failure. Therefore, a preliminary check of the certain key components is a better procedure than the immediate shielding of all leads. One of the first measures to be taken is to substitute a good condenser for the ignition coil bypass condenser as well as the generator bypass condenser as previously stated. The voltage generator and its bypass condenser is shown in Fig. 2.

Fig. 3 — Condenser installed at voltage generator of car.

Fig. 3. (It is important that this condenser be at the armature terminal and not at the field coil terminal.) It might also be a good idea to check the voltage regulator and to determine if a .5 mf condenser has been installed. Should there be no bypass condenser at the voltage regulator, as shown in Fig. 4, one might be added and the improvement noted. Considerable reduction of ignition noise pulses can often be obtained by this addition.

One system employed by several technicians to locate the source of the interference is to turn off the ignition switch while the car is in motion. This check is good only if the radio is not also shut off when the ignition is switched off. With the radio in operation and the car coasting along, listen for the interference. If the noise cuts out immediately when the switch is in the off position the trouble is more than likely due to ignition and high tension radiation. If the noise continues at a reduced level the commutator segments and brushes of the voltage generator should be examined and cleaned.

Ignition interference can also enter the auto radio through the antenna lead. Then again, it is also possible that the chassis housing may not offer sufficient shielding for the receiver because of corroded mounting facilities, ventilating holes, housing covers, etc. To determine whether or not the ignition interference is caused by the first of the above two conditions, the aerial should first be disconnected, and the antenna terminal shorted to ground. If the level of ignition noise changes and is reduced it is then assumed that the noise is entering through the aerial. If the noise level remains the same the noise is probably being induced via the battery lead. However, this is no hard and fast rule, because when the antenna terminal is removed from the radio the rf stage is almost always detuned, thereby reducing its sensitivity. Under these circumstances there would normally be a decrease in response of the receiver to interference. Then again, the age system of the radio might alter the amplification to such a degree that the noise level would be nearly the same as before. In this case a more rigid test is to use a shielded dummy antenna which picks up no signal and provides the same circuit constants as the regular antenna.

With regard to interference entering the receiver directly, the rf stage may pick up interference through ventilating holes and through the housing or covers of the radio, especially if a high tension lead is nearby. If moving the [Continued on page 49]
THE horizontal amplifier in our modern TV receiver has to perform several functions in proper order and some are simultaneous. These may be listed in groups as below and are the end results when the tube and circuit are functioning normally with the proper operating potentials on the tube and a proper load impedance for the tube to work into.

1. Suitable amount of linear saw tooth current for proper width.
2. Beam retrace by reaction scanning within allotted blanking time.
3. H.V. pulse for H.V. rectifier power supply: (Note: The amplitude of the HV pulse is determined largely by the speed of the beam on retrace. The faster the retrace, the higher the HV pulse.)

Failure in the horizontal sweep and high voltage is usually tracked down by isolating faulty components in major groups then to smaller groups and then to component as in most other trouble shooting procedure. The exact order in which the following operations are performed varies with the particular TV set and the habits of the technician:

1. Elimination of faulty tubes—all rectifiers, horizontal, oscillator and horizontal amplifier.
2. DC voltage measurements and general de continuity.
3. Test for generation of sweep signal by checking damper boost voltage.
4. Frequency and waveform observations of grid drive with C.R.O.
5. Loading effects on the flyback transformer by the yoke and width coils. Repeat test No. 3 above.
7. Substitution of known good bypasses.

The TV bench technician should be able to make a number of well chosen tests to get down to the root of the trouble in the least possible time without performing a great number of substitution tests. It was with this in mind that the Flyback Interval check feature of the Seco Model FB-4 was developed. Briefly—it looks into the connected group of components in the horizontal amplifier plate circuit and checks the flyback resonant frequency. The "L" of the coil components and the distributed capacity in the coils and circuit are designed to tune to between approximately 50 kc to 70 kc. This represents 10 usec to 70 usec for retrace time. This characteristic establishes the period or time interval set up to produce retrace of the electron beam within the allotted blanking time. If beam retrace is too slow, horizontal fold over will result. Fig. 1 shows a block diagram of the Seco FB-4 checker. Fig. 2 shows the basic signal generator circuit and cathode follower.

The resonance indicator consists of a 6E5 tube operating the triode as a plate detector. This plate is directly coupled to the deflecting electrode in the indicator. A simplified schematic is shown in Fig. 3. Fig. 4 shows how the coils are connected to the checker for testing.

An rf signal fed to points A and B will divide proportionately across the sensitivity control and the LC components under test. The voltage drop across the LC circuit will be greatest at its resonant frequency. At this frequency the increased signal fed to the plate detector causes the tube to conduct and deflects the eye tube. A suitable range of tolerance is allowed on the "FB-OK"

[Continued on page 50]
The Work Bench

by PAUL GOLDBERG

This Month:

WIDTH PROBLEMS

THREE width problems have been chosen for this installment. With proper diagnosis of the defective raster, the problems can be solved with ease.

RCA KC568C—Insufficient width

The receiver was turned on and the raster showed a case of insufficient width. About two inches were missing on each side. The horizontal linearity was satisfactory. Adjustment of the vertical size and vertical linearity controls indicated proper vertical sweep. The high voltage also seemed okay because the brightness was good. We were able to draw a healthy arc from the high voltage cap, and there was no blooming. V116, the 6SN7 horizontal oscillator, V117, the 6CD6 horizontal output tube, and V119, V120, the 6W4 dampers were replaced individually, but they had no effect.

The diagram was then consulted and it was observed that this receiver used an air core series type of horizontal output transformer. The 6CD6, the transformer and the horizontal deflection coils are all in series and the 6W4's are effectively shunted by the horizontal deflection coils. Two 6W4's are utilized to handle the tremendous damping current, and the high positive voltage at its cathodes.

Knowing these facts, a voltage check was made at the grid (Pin #5) of the 6CD6 to see if the horizontal oscillator was supplying the correct drive. The meter measured it correctly at about 30 volts negative. P105, the width link, was then plugged in, in its alternate position, cutting out the width coil, but the trouble remained. The screen voltage (Pin #8) at the 6CD6 was also measured and was found to be correct at about 160 volts positive. Because there was no trapezoidal effect of any kind, it seemed doubtful that the yoke might be defective. Moreover, because T115 was of the autotransformer variety, it seemed doubtful that it could become defective so as to only affect the width and not the high voltage.

At this point it was noticed that the horizontal linearity control, L107, had a few discolored turns, and when adjusted from maximum to minimum seemed to have no effect on the picture's linearity. In fact it acted as if it had been completely shorted. Knowing from past experience on this model receiver that the horizontal linearity control had a tremendous effect on linearity and width when it was adjusted, L107 was replaced with a new one. The receiver was turned on and the width was now correct. Adjusting the horizontal linearity control again, it was noted that besides varying the linearity, the width could be reduced to where it was lacking one and a half inches on both sides and to where it was two inches in excess on both sides. Evidently L107 had been subjected to a heavy transient current which it could not take. This resulted in the horizontal linearity control being replaced.

(Continued on next page)
in breaking down the insulation on the wire, resulting in a shorted coil.

Sylvania 1-508-1—Insufficient width and high voltage

The receiver was turned on and it was observed that there was insufficient high voltage and width. About one inch was lacking on each side. The vertical sweep moreover, just managed to fill the screen. Reference to the diagram indicated that the 560 volt positive boost voltage was supplied to the vertical oscillator, 6C4, V116, but was not supplied to V20, 12AU7, the horizontal oscillator and discharge tube.

The first check was a voltage measurement at the high voltage fuse where the B+ supply voltage was located. The meter measured correctly at about 330 volts positive. This eliminated the low voltage supply as a possible cause of the trouble. V24 and V25, the 1B3, high voltage rectifiers were replaced individually, because if there is a plate filament leak they could affect the width, boost, and high voltage. V23, 6V3, damper and V22, 6BQ6, horizontal output tube were replaced individually but had no effect.

A scope was next set up and a waveform check made at the grid of the 6BQ6. The waveform checked correctly with the manufacturer's service data. Therefore, the horizontal oscillator was supplying the correct drive. The boost voltage was next measured at the cathode (Gr) of the 6V3, damper. Here, instead of measuring the correct 560 volts positive, the measurement was 450 volts positive. This low boost voltage we assumed was the reason for the insufficient vertical sweep and horizontal width. The screen, pin #4, of the 6BQ6, was next measured correctly at about 160 volts.

Because there was not the slightest sign of a trapezoidal effect which would accuse the yoke, I was beginning to suspect R63, the horizontal output transformer. Before doing anything so rash, as replacing it, a voltage leakage check was made of the following condensers in the high voltage section: C267A, C267B, C264, C270, but all showed no leakage. No check was made of C268 and C269 across the horizontal linearity coil as the horizontal linearity seemed okay.

It was noticed at this point after glancing at the diagram that the bleeder resistor R270, 39K, could most assuredly cause a trouble of this kind. R270 was then resistance checked and was found to measure 3K. What was amazing was that this resistor didn't have a charred or burned mark on it in any way. After replacing R270 with a new 39K-2 watt, the receiver functioned properly. The

[Continued on page 43]
testing and rejuvenating picture tubes

by Milton S. Kiver

Description of a versatile CRT tester and rejuvenator with detailed discussion of the procedures to be followed.

There is one problem that every television serviceman meets again and again, no matter how long or how short a time he has been in the business. The problem revolves around the all-important picture tube and the question it poses is this: "When is a picture tube useless?"

The obvious cases occur when the filament refuses to light, or the glass envelope is cracked or the tube is shattered. On the basis of carefully tabulated case histories, these happen less than 2 per cent of the time. How about those tubes whose emission is low or where shorts exist between two elements or where the connections to an element may be partially or fully unsoldered? Are these tubes irrevocably lost? Not necessarily! With the proper type of processing, a surprising number can be returned to function usefully for periods as long as one year or more.

A careful record of picture tube failure has shown that less than 9 per cent of the departing tubes owe their difficulty to shorts. Of the remaining 91 per cent, a full 73 per cent are waylaid by low emission and 18 per cent by varying amounts of gas. Thus, by far the highest percentage are afflicted by low emission and, as the subsequent discussion will reveal, this is the one ailment which lends itself most readily to corrective treatment.

The causes of low emission are many and diverse and not even a tube design engineer will be able to explain them all. But, and here is the crux of the matter, a tube with low emission can frequently be raised to a satisfactory operating level, in short, it can be rejuvenated by the instrument such as the one shown in Fig. 1 in a matter of just a couple of minutes. Usually the cause of low emission is contamination of the cathode emitting surface. The emission can be restored by removing the contamination from the cathode. By "sweeping" the cathode surface with a critical voltage at a proper cathode temperature, the impurities can be driven off. This instrument, the B&K Cathode Rejuvenator Tester Model 350, will do a variety of jobs.

1. It will test a cathode ray tube for all of the important factors which determine the quality of the tube.

2. It will check for continuity between base pins and the elements of the tube, and also for shorts or leakage between elements in the tube (up to several megohms). Furthermore, it not only checks for shorts, but it will actually indicate which elements are shorted together.

3. The unit will check for the amount of cathode emission and the grid bias necessary to cut the tube off.

4. The Cathode Rejuvenator Tester will also repair many of the common faults in cathode-ray tubes, such as shorts between elements, open connections to elements and low emission.

5. And last, but far from least, the instrument will predict the probable useful life of the picture tube. Here is a feature which is unique in picture tube testers.

When using this instrument the first tube check is made with the Selector switch in the "Continuity" position. In this position, you are checking for continuity of all the elements. Also, if there are any shorts between these elements, they will immediately show up by completely lighting one of the three bulbs on the front panel of the instrument. One bulb is tied into the cathode heater circuit; one is in the cathode control grid circuit and the third is in the cathode screen-grid circuit.

All possible combinations of bulb in-

Table I—Indicates lucid manner of identifying defects.
**NOTES**

1. All waveforms and voltages were taken under operating conditions. The receiver was tuned to an average strength TV signal, the Contrast control rotated fully clockwise and the Noise control was rotated fully counterclockwise.

2. The Noise control and L/D switch consists of a potentiometer, R318, and a step switch, S502. When R318 is rotated fully counterclockwise, S502 opens L position as shown in the schematic.

3. Voltages ± 15% of those shown are normal.

4. All resistors are 1% unless otherwise indicated. W. W. indicates wire wound resistor.

5. All capacitors are 15%, 500V, unless otherwise indicated. All capacitors are ceramic, unless indicated as follows: M-mica, P-paper, E-electrolytic, MP-Molded Paper.
**Video IF Alignment RA-321/322**

Place STATION SELECTOR between channels to disable oscillator. Remove fuse, F601. Connect a short length of wire to grid of mixer tube (see figure 1). Use the lowest VTVM range for all steps.

<table>
<thead>
<tr>
<th>Step</th>
<th>Signal Generator Frequency</th>
<th>Connect To</th>
<th>Output Indicator</th>
<th>Connect to</th>
<th>Adjust</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>40.5 MC Center Freq. 10 MC deviation</td>
<td>Grid of Mixer</td>
<td>Oscillograph through XTAL</td>
<td>Pin 5, V201</td>
<td>IXTAL</td>
</tr>
<tr>
<td>2</td>
<td>44.0 MC (Marker) No Sweep</td>
<td>As Above</td>
<td>VTVM</td>
<td>Pin 7, V205</td>
<td>2VTVM</td>
</tr>
<tr>
<td>3</td>
<td>42.25 MC (Marker) No Sweep</td>
<td>As Above</td>
<td>VTVM</td>
<td>As Above</td>
<td>3VTVM</td>
</tr>
<tr>
<td>4</td>
<td>44.85 MC (Marker) No Sweep</td>
<td>As Above</td>
<td>VTVM</td>
<td>As Above</td>
<td>4VTVM</td>
</tr>
<tr>
<td>5</td>
<td>4.5 MC 400 CPS AM</td>
<td>Pin 7, V205</td>
<td>Oscillograph through XTAL</td>
<td>Junction of C220 and R226</td>
<td>5XTAL</td>
</tr>
</tbody>
</table>

**Sound IF Alignment**

<table>
<thead>
<tr>
<th>Step</th>
<th>Signal Generator Frequency</th>
<th>Connect To</th>
<th>Output Indicator</th>
<th>Connect to</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>4.5 MC 1 MC Sweep</td>
<td>Pin 7, V205</td>
<td>Oscillograph through XTAL</td>
<td>Pin 7, V207</td>
</tr>
<tr>
<td>7</td>
<td>As Above</td>
<td>As Above</td>
<td>Oscillograph DIRECT</td>
<td>Junction of C235 and R242</td>
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**Alternate Sound IF Alignment – Using TV Signal**

<table>
<thead>
<tr>
<th>TV Signal, Teletext must be tuned for best picture</th>
<th>VTVM</th>
<th>Pin 7, V207</th>
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</thead>
<tbody>
<tr>
<td>6</td>
<td>6VTVM</td>
<td>L211 and Z206 (bottom) for waveform.</td>
</tr>
<tr>
<td>7</td>
<td>7VTVM</td>
<td>Z206 (top) for null point.</td>
</tr>
</tbody>
</table>

**Notes**

When the alignment procedure has been completed the setting of the tuner oscillator slugs should be checked on each available channel and corrected if necessary.

1. Tune the receiver to each available channel.
2. Place the first of the Fine Tuning control face downward and adjust the oscillator slug for best picture and sound.
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Q. I have heard that misalignment of the receiver circuits can produce a leading smear in the picture. What is the nature of the misalignment in this case?

A. This situation arises when a trap is misadjusted in such manner that the picture carrier is separated from the main portion of the curve by the trap dip, as shown in Fig. 1.

Q. Does a 60-cycle square wave, such as developed by the Genescope, appear the same on either an ac scope or on a dc scope?

A. Yes. The square wave is shown in Fig. 2. The relation of the square wave to the zero-volt level is shown in Fig. 3. We expect to find that the positive area of the pattern is equal to the negative area of the pattern, because an ac waveform has just as much positive current as it has negative current. Since the 60-cycle square wave is an ac voltage, with no dc component, the square wave is displayed in the same position on the screen of an ac scope as on a dc scope.

Q. What causes a tilted baseline to appear on the scope screen when a visual-alignment test set-up is being used?

A. If the baseline is level when no signal is applied to the scope, the trouble is usually due to hum voltage. (See Fig. 4A.)

Q. What causes an elliptical baseline to appear?

A. An elliptical baseline is also caused by hum; when there is a phase shift between the 60-cycle horizontal sweep voltage in the scope, and the 60-cycle hum voltage entering the vertical-input circuit, the ellipse appears as shown in Fig. 4A.

Q. Why would the ellipse be distorted?

A. Such distortion is observed when an automatic line-voltage regulating transformer is used to power the scope. the transformer delivers a clipped sine wave. (See Fig. 4B.)

Q. Why should leakage between tube elements be preferably tested with ac?

A. As shown in Fig. 5, the leakage may be unidirectional; as if a rectifier were in series with the leakage resistance. Accordingly, an ac leakage-resistance test is preferred. If an ohmmeter is used, a test should be made with the input leads applied both ways. Tube checkers commonly make "hot" leakage tests, since the leakage may show up only when the heater is energized.

Q. What causes a reproduced square pattern to smear in the picture carrier?
**KEY VOLTAGES**

<table>
<thead>
<tr>
<th>Component</th>
<th>Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid of Hor. Out.</td>
<td>225 Vdc</td>
</tr>
<tr>
<td>V12 pin</td>
<td>−17 Vdc</td>
</tr>
<tr>
<td>Plate of VERT. OSC.</td>
<td>650 Vdc</td>
</tr>
<tr>
<td>V10 pin</td>
<td>−62 to −30 Vdc</td>
</tr>
<tr>
<td>Plate of Vert. Out.</td>
<td>260 to 120 Vdc</td>
</tr>
<tr>
<td>V11 pin 3</td>
<td>160 Vdc</td>
</tr>
<tr>
<td>V11 pin 5</td>
<td>100 to 150 Vdc</td>
</tr>
</tbody>
</table>

All voltages are measured with a VTVM connected between the tube pins and chassis.

**RECEIVERS USING A 12AU7 TUBE IN PLACE OF A 6SN7 TUBE USE PIN 6 AND 1 INSTEAD OF PINS 5 AND 2.**

---

**TUBE LIST**

<table>
<thead>
<tr>
<th>SYM.</th>
<th>TYPE</th>
<th>CIRCUIT FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1</td>
<td>6CB6</td>
<td>1st Vid. IF Amp.</td>
</tr>
<tr>
<td>V2</td>
<td>6CB6</td>
<td>2nd Vid. IF Amp. and Sound IF Amp.</td>
</tr>
<tr>
<td>V3</td>
<td>6CB6</td>
<td>3rd Vid. IF Amp.</td>
</tr>
<tr>
<td>V4</td>
<td>6AL5</td>
<td>Vid. Det.—A.G.C.</td>
</tr>
<tr>
<td>V5</td>
<td>6CB6</td>
<td>Vid. Amp.</td>
</tr>
<tr>
<td>V6</td>
<td>6AU6</td>
<td>Sound Limiter</td>
</tr>
<tr>
<td>V7</td>
<td>6AL5</td>
<td>Sound Disc.</td>
</tr>
<tr>
<td>V8</td>
<td>12AX7</td>
<td>Sound Amp.—Sync. Sep.</td>
</tr>
<tr>
<td>V9</td>
<td>6V6GT</td>
<td>Sound Out.</td>
</tr>
<tr>
<td>V10</td>
<td>12AU7</td>
<td>Sync. Phase Inv.—Vert. Osc.</td>
</tr>
<tr>
<td>V11</td>
<td>6SN7 or 12AU7</td>
<td>Hor. Osc.—Hor. Control</td>
</tr>
<tr>
<td>V12</td>
<td>6BQ6GT</td>
<td>Hor. Out.</td>
</tr>
<tr>
<td>V13</td>
<td>1X2A</td>
<td>H. V. Rect.</td>
</tr>
<tr>
<td>V14</td>
<td>6AX4GT</td>
<td>Damper</td>
</tr>
<tr>
<td>V16</td>
<td>5U4G</td>
<td>L. V. Rect.</td>
</tr>
<tr>
<td>V17</td>
<td>5U4G</td>
<td>L. V. Rect.</td>
</tr>
<tr>
<td>V18</td>
<td>6BK7 or 6BQ7</td>
<td>RF Amp.</td>
</tr>
<tr>
<td>V19</td>
<td>6J6</td>
<td>Mixer-Osc.</td>
</tr>
<tr>
<td>V20</td>
<td>17LP4</td>
<td>Picture tubes</td>
</tr>
<tr>
<td>V21</td>
<td>21MP4</td>
<td></td>
</tr>
<tr>
<td>V22</td>
<td>21YP4</td>
<td></td>
</tr>
</tbody>
</table>
FOCUS AND CENTERING

The picture tubes used in these chassis (V-20) are pre-focused electrostatically by means of a focus electrode in the gun assembly operating at a nominal voltage of 210 volts. The use of electrostatic focus insures good result even under wide variation of line voltage.

Centering is accomplished by means of a centering unit placed on the neck of the picture tube slightly behind the yoke. The device consists of two magnetized rings which when rotated together cause the electron beam to shift thus centering the picture. If the centering range is not sufficient a slight rotation of one of the rings with respect to the other will vary the amount of range until the right point is reached.

CENTERING PROCEDURE

1. Set the unit, magnets forward, on the tube so that the magnets are about 1/4" behind the yoke. Adjust the clamp so that the unit is a sliding fit on the tube.
2. Set the magnets so that the adjusting arms are approximately 120° apart.
3. Adjust the iron trap magnet for maximum brightness.
4. Rotate the whole unit, this will cause the picture to move around a circle. Stop where the picture is most nearly centered.
5. Rotate the magnets separately, in equal distances, but in opposite directions to complete the centering.
6. Repeat steps 3, 4 and 5 if necessary.
7. Tighten clamp.
8. Readjust the iron trap magnet to give maximum brightness.

BEAM BENDER (ION TRAP)

A single magnet type of beam bender is used and should always be adjusted by sliding and rotating the unit for maximum brightness.

The adjustment of the beam bender can effect picture focus. You will usually find that only one setting of the beam bender will yield both maximum brightness and optimum focus (sharp raster lines). Do not adjust this device for removing corner shadows or improving focus if in so doing the brightness is reduced.

If two positions of maximum brightness are found use the one closer to the picture tube socket.

ALIGNMENT OF MIRACLE PICTURE LOCK

(HORIZONTAL OSCILLATOR AND A.F.C.)

This can be accomplished without removing chassis from cabinet.

1. Tune set to a channel known to be good.
2. Short phasing coil by using a clip lead across phasing coil terminal strip located on top of chassis next to horizontal oscillator tube.
3. Rotate horizontal hold control (R-4) fully clockwise.
4. Starting with horizontal frequency slug (T-3) all the way out, rotate in until picture just locks into sync. (Turn slug in 1/4 turn more).
5. Adjust horizontal size if necessary; if picture fails out of sync, repeat Step 4.
6. Adjust centering so that right hand edge of picture is visible while facing front of set.
7. Decrease contrast and turn up brightness while viewing a good picture so that the horizontal blanking porch is visible on right hand side of picture.
8. Remove the short across the phasing coil. If the picture falls out of horizontal sync, adjust the phasing coil to re-sync the picture and then carefully continue to adjust the phasing coil so that the start of the horizontal sync pulse is visible at the end of the front blanking porch. It should be noticed that the sync pulse is darker than the front blanking porch but not quite as dark as the unit portion of the picture tube.

SOUND ALIGNMENT USING TRANSMITTED TV AIR SIGNAL

1. Connect antenna and tune to a good on the air TV station.
2. Adjust fine tuning control for best picture.
3. Adjust antenna coupling for moderate signal so as to provide a sharp meter indication with adjustment of transformers.
4. Meter reading may pulsatate due to changes in signal strength; do not confuse with a peak adjustment.

INSUFFICIENT RASTER HEIGHT

Vert. Size and Lin. con. V10, V12, V14, V16, V17 Check 0.047 and 0.1 µf caps. connected to pin 1 of V19 Vert. Out. trans. Low line voltage

NO VERT. DEF.

V10, V16
Check 0.047 and 0.1 µf caps. connected to pin 1 of V10 Check 0.047 µf cap. connected to pin 2 of V16 Vert. Def. coils (yoke) Vert. Out. trans.

NO VERT. SYNC.—HOR. SYNC. OK
Vert. Hold con. Vert. Int. network V10, V16
Check 0.01 µf cap. connected to pin 2 of V15 Check 0.0047 µf cap. connected to pin 2 of V16

NO HOR. OR VERT. SYNC.—PIX SIGNAL OK
V5, V10
Check 0.01 µf cap. connected to pin 7 of V10

NO HOR. SYNC.—VERT. SYNC. OK
Hor. Hold, Phase and Freq. con. V11, V15
Check 0.01 µf cap. connected to pin 1 of V11 Check 0.001 µf cap. connected to pin 4 of V14

AUDIO HUM IN SOUND
V6, V7, V9, V9

DISTORTED SOUND

Using transmitted TV air signal

1. Connect antenna and tune to a good on the air TV station.
2. Adjust fine tuning control for best picture.
3. Adjust antenna coupling for moderate signal so as to provide a sharp meter indication with adjustment of transformers.
4. Meter reading may pulsatate due to changes in signal strength; do not confuse with a peak adjustment.

INSUFFICIENT BRIGHTNESS

In tr ap Brightness and Hor. Drive con. V12, V13, V14, V17, V20 Low line voltage

RASTER BLOOMING
Hor. Drive con. V12, V14, V16, V17 Check 0.001 µf and 0.250 µf caps. connected to Hor. Phase coil Hor. Out. trans. Low line voltage

INSUFFICIENT RASTER WIDTH
Hor. Drive and Size con. V11, V12, V14, V16, V17 Check 0.001 µf and 0.250 µf caps. connected to Hor. Phase coil Hor. Out. trans. Low line voltage

NO RASTER—SOUND OK
Brightness con. Ion trap V11, V12, V13, V14, V20 HV trans. Hor. yoke CRT connections

POOR HOR. LIN.
Hor. Drive con. V12, V14 Check 0.01 µf cap. connected to terminal 1 of Hor. Out trans. Hor. Out. trans.

POOR VERT. LIN.
Vert. Size and Lin. con. V10, V15, V17 Check 0.047 and 0.1 µf caps. connected to pin 8 of V15 Check 0.1 µf Elec. cap. connected to pin 8 of V15 Vert. Out. trans.
Do you have a vexing problem on the repair of some radio or TV set? If so, send it in to the Answer Man, care of this magazine. All inquiries acknowledged and answered.

Note: Only communications with Radio-TV Service Firm letterheads will be considered and answered. Please indicate make, model, and chassis number of receiver.

DuMont RA-312—Pix Overload and Poor Sync

Mr. Answerman:

I have a condition on a new Du Mont RA-312 chassis that has me stumped. The picture overloads on strong signals and there is poor sync action with a tendency to pull and tear out. In the sound there is some sync buzz which disappears when the strong signal is removed. I have substituted tubes in the age system, if strip and front end as well as checked the voltages, which were found to be normal.

The trouble is apparently in the age circuits but I have been unable to locate it. What suggestions do you have to help me with this problem.

Also I am not too sure that I am adjusting the age control on this receiver correctly. Perhaps this is where I am making my mistake.

J.E.
Los Angeles, Cal.

Because of the widely different signal levels TV receivers are expected to operate under, one circuit that has become more complicated is that for the Automatic Gain Control. One of the more intricate systems as used in the Du Mont RA-312 chassis is shown in Fig. 1.

The bias voltage applied to the tuner age line and first and second if amplifier tubes in the Du Mont RA-312 is proportional to the peak input rf signal.

This negative voltage is derived from two voltage sources, one at the grid of the 6BE6 tube and the other developed across the video detector load resistor as shown in Fig. 1. The negative voltage present at the grid of the 6BE6 tube is a function of the peak to average voltage and is due to grid rectification of the composite video signal. Across the video detector load resistor is developed a negative voltage that is a function of the average level of the modulation of the video signal. The negative voltage drop across the detector load resistor becomes less as the modulation increases.

The combination of these two negative voltages results in a bias voltage for the age line that is directly proportional to the peak of rf signal applied to the receiver.

The 6AT6 diode circuit provides a delay before a negative bias is applied to the rf amplifier. This is not a time delay but means that a certain level of negative must be generated to cancel out the existing positive voltage before control action will begin. A positive voltage is applied to the age line that is shunted out by the diode if no negative voltage is present to counteract it. A negative voltage of equal amount to the adjusted positive voltage is required before age action will take hold and govern the amplification of the rf and if stages.

A switch is provided in the age circuit known as the local-distant switch. When placed in the distant position additional positive voltage is applied to the age line which further reduces the negative bias voltage so as to obtain increased sensitivity for the reception of distant stations.

[Continued on page 42]
Channel Master Coupler
An entirely new system which very efficiently permits the coupling of an unlimited number of antennas to a single transmission line, has been developed by Channel Master Corporation, Elkhart, Ind. It is called the Selectenna Coupling System. Using this system, it is now possible to obtain multi-channel, multi-direction TV reception without rotators, without switches, and without multiple lead-in wires.

Jensen Display Kit
A new phono-needle kit now being offered to retailers promises almost as many advantages to the dealer as the number of needles (100) in the kit, according to its manufacturer, Jensen Industries, 2433 W. Harrison St., Forest Park, Ill.

Jensen Display Kit
The new 111 white leatherette display case containing 64 different types of needles actually supplies the entire needle through a substitution method, for 85% of all retail needle sales.

CBS Broadband Array
CBS-Columbia is making available to its distributors an antenna especially designed to have the broad bandwidth needed for color television reception: the unit maintains a flat response within 2 db. across the entire UHF and VHF spectrum. It offers an average gain of approximately 7 db. relative to resonant dipoles at UHF and approximately 3 db. at VHF. For details, write CBS-Columbia, 1400 11th Ave., Long Island City 1, N.Y.

Aerovox Ceramic Capacitors
To provide closer temperature-coefficient tolerances than those normally available, the Hi-Q Division of Aerovox Corporation, Olean, N.Y., announces its Type CNP ceramic capacitors. A newly developed and unique manufacturing process insures uniformity of temperature coefficient and consequently the capacitors can be supplied in close temperature-coefficient limits without individual TC testing. Type CNP units are available in a non-insulated tubular style.

AIR Shav-Pak
The AIR Shav-Pak is especially designed for operating standard AC electric shavers in automobiles, homes, trucks, boats and planes. It plugs into cigarette lighter receptacle on dash and is small enough to be kept in glove compartment, and is attractively packaged. Complete information is available by writing to the manufacturer, American Television and Radio Co., 300 E. Fourth Street, St. Paul 1, Minnesota.

Authorized Multivoler
Authorized Manufacturing Company, 919 Wyckoff Avenue, Brooklyn 27, New York, has just released the Model 2291 Multivoler Power Supply. Fitting in a pocket, tool box or tube caddy, it conveniently provides a range of variable DC voltage from minus 150 through 0 to plus 150, as well as an AC range of 9 to 155 V. An added feature provides one amperes of 6.3 filament voltage at separate terminals.

Astrolic Convertible Microphone
The newest addition to The Astatic Corporation's microphone line is a new design of the convertible hand and desk stand type. Exceptional performance quality is claimed for the new Astatic unit, which is being produced in both crystal and ceramic versions. Both have excellent frequency range: the Model M402, crystal, 30 to 10,000 c.p.s., with flat response; the Model M301, ceramic, 30 to 8,000 c.p.s., with slightly rising characteristics in the medium range.

"Precision" Signal Generator
Precision Apparatus Co., Inc., 92-97 Horace Harding, Elmhurst, N.Y., announces a new basic test instrument, the Model E-500 Sine-Square Wave Signal Generator, covering the audio-video range, which provides accurate sine and square wave signals for direct performance, efficient testing. Because sine-square wave testing is a most reliable indicator of frequency response, phase shift, amplitude distortion, etc., analysis with the Model E-500 streamlines amplifier test procedure.

Concert-Line Mike
Shore Brothers, Inc., 225 W. Horion Street, Chicago 10, Ill., announce their new Model "333" High Fidelity Studio Microphone, which is a unidirectional microphone which has 33 extended frequency response: 50-15,000 c.p.s., plus or minus 2½ db. (2) The world-famous, patented "Uniphase" system; (3) small size, slim design, matchless beauty. The "333" is recommended for professionals and hi-fi enthusiasts who demand the highest quality for their recordings in the home.

Sonotone LP Cartridge
A new single-needle high-fidelity ceramic cartridge is announced by Sonotone Corporation, Elmsford, N.Y. Known as the IP, this new cartridge features high compliance and an extended frequency response. It is available in two versions—one for fine groove records (33⅓ and 45⅝) and the other for standard groove records (78⅝). The IP does not require either equalizers or pre-amplifiers and is unaffected by moisture or temperature.
CORRECTION NOTICE
On page 58 of the Oct. '54 issue of RTSD the new Tung-Sol Tube Characteristics Manual should have been listed as being available only through Tung-Sol distributors at a price of seventy-five cents.

ASSOCIATION NEWS
from page 6
National Electronic Technicians & Service Dealers Associations (N. Y.)
The necessity of having an impartial board, composed of various segments of the service industry, Government and public, to examine applicants for licenses and issue licenses would be primary requisite for a good license bill.
This opinion was generally agreed upon at a meeting in New York of the National Electronic Technicians and Service Dealers Associations. The meeting was attended by delegates representing associations in New York, Pennsylvania and New Jersey.
Joseph Forman, association counsel, gave a review of the licensing bill pending in New York City and some of the problems that confronted the formation of the bill.

Radio TV Guild of L. I. (N. Y.)
The following men were chosen to be our officers for the coming year: Murray Barlowe, President; Jim Lyons, Vice President; Chris Stratigos, Corresponding Secretary; Bob Henderson, Recording Secretary; Jim Thornton, Treasurer; George Volkens, Sergeant at Arms. The three Trustees elected for Nassau were Art Cey, Jack Wheaton, and Ralph Bavaro. The five Trustees elected for Queens were Chet Amble, Jim Clifford, Pritus, Henry Rogers and Len Silverman. The three Trustees elected for Suffolk were George Kooldl, Sam Margolis, H. McDonald, Gerry Rawlins and Fred Strickland.

TISA-Denver Elects
Newly reorganized group reelects Robert A. Miller, President; Tom Sampson, Secretary; Angelo Gusman, Andy Andrews, Wayne Young, Bill Dwinelle, Dick Sebaugh and George Kelso, directors. Now boast 35 members in Denver locale.

INSTRUMENT CLINIC
from page 34
wave to vary in width across the scope screen?
A. The variation (shown in Fig. 6) is the result of deflection non-linearity in the horizontal sweep system of the scope.
Smart Servicemen
Are Modernizing Current TV Sets

And...

Making dollars

By Using
Conversion Chassis CC-1

And...

...The Only Truly
Universal Plug-In* Replacement
Rectifier That Can Also Be
Bolted and Soldered

* PATENT APPLIED FOR

Get a copy of the latest Selenium Rectifier Replacement Guide from your distributor

ANSWERMAN
[from page 39]

The adjustments in this circuit are not involved and can be examined before preceding to other checks. The age delay control usually has to be touched only after the replacement of a tube and even then not very frequently.

Select the strongest station to be received. Starting at full counter-clockwise position rotate the delay age control clockwise until the picture overdrives with resultant poor sync lock-in and buzz in the sound. Just before this overload occurs is the proper position for this control setting. It is adjusted on the strongest channel to be received in all cases.

Once the age delay control has been set up the noise control can be touched up if it is suspected of being out of the proper setting. The noise control is positioned so that noise pulses do not disturb the deflection oscillators.

After setting up the age delay and noise controls, if the receiver is not performing normally, or more particularly, if it is not possible to easily adjust the age delay control it would be desirable to determine if the .0033 µf condenser is leaking. Measure the voltage drop across the 1.8 megohm grid leak resistor with the 6BE6 tube removed. If a voltage is found to exist across this resistor it is the result of current through it and the only way this can result is for the .0033 µf condenser to be leaking.

If the circuit continues to overload check the if transformers to determine if one of them is shorted primary to secondary.

Of course one of the best checks on an age system that can be made is to use a bias box and determine if the circuits will operate normally when sufficient negative voltage is applied. This has been previously discussed in the May 1954 issue.

Further Information On Muntz 21"-Arcing

A number of our readers have written in with regard to the item which appeared in the November issue on the above set. Their consensus is that high voltage arcing is caused by a breakdown of the stand-off insulator for the 1B3 socket. Properly cleaning this stand-off should remedy the above condition. If this doesn’t help, replacement is necessary.

Thanks to all of you fellows who took the trouble to write us on this score. We most certainly welcome further correspondence of this nature for we certainly don’t know all the answers.
WORK BENCH
[from page 23]

boost voltage which was obviously diminished by the defective R270, is naturally the plate voltage for the 6BQ6, horizontal output tube. If it is lowered due to a defect of this kind it would naturally cause the insufficient width and poor high voltage.

PIX TUBE TESTER
[from page 24]

ications are shown and interpreted in Table 1. After the tube has been allowed to warm up, the indications for a normal tube would be an unlit H bulb, and half lit G-1 and G-2 bulbs. Since the H neon bulb is situated between heater and cathode, no light means that the circuit between these two elements is open, a condition which is desirable. The G-1 neon bulb is located between cathode and control grid. If no shorts exist between these two elements, only one side of the neon indicator will light up. If a complete short exists, both sides of the neon bulb will light up. And if the grid circuit is open, permitting no grid current to flow, the G-1 indicator will remain unlit. The same arrangement is employed with the G-2 bulb and its indications carry the same significance.

Note the simplicity that is obtained by using neon bulbs as indicators. By reading the three lights and comparing them, you immediately uncover any open connections or any short circuits between tube elements and furthermore determine which elements are affected.

If a tube shows no open connections or no shorts, the testing procedure continues to the emission check. If a short does exist in the tube, the emission test is skipped and the procedure for removing shorts is instigated.

Emission Test

The emission test is simple and straightforward. The selector switch is rotated to the Emission position and then an Emission pushbutton is depressed. If the meter reads over 300 microamperes, the tube is good. The customer can see the meter pointer on "Good" at 300 microamperes or more. If the emission is low, tube regeneration is in order. More on this in a moment.

A second test in the Emission position for tubes which meet the minimum [Continued on page 46]
"Satisfied Customers - Not Call Backs."

That's right. I rarely get a complaint callback when I've used Tung-Sol Tubes. That makes for a lot of happy customers. I've found Tung-Sol's regular line of tubes more uniform and more dependable than the so-called 'super' grades of tubes.

TUNG-SOL® dependable PICTURE TUBES

Construction of a large electronics laboratory for engineering and research, to cost nearly $1,500,000, began on Monday, November 29th, in Wayland, Mass., 20 miles from Boston, according to Charles F. Adams, Jr., president of Raytheon Manufacturing Company. Grading of the 73-acre site has been under way throughout most of the summer. The contract has been let to Vappi and Company, Inc., of Boston, who were lowest bidders for the project. The building will have approximately 150,000 square feet of floor area.

700 radio-and-electronic firms will exhibit in the 1955 Radio Engineering Show, a gain of 16% over 1954. This expansion, which is needed to keep pace with the growing radio industry, has been made possible, says William C. Copp, Exhibits Manager, by the addition of exhibits in the Kingsbridge Palace, a large skating rink on Jerome Avenue, two-thirds of a mile south of the Kingsbridge Armory. Dates are March 21 to 24. IRE has scheduled its 1956 Convention in the New York Coliseum and has booked its entire facilities. It is the first definite booking for the gigantic four floored exhibition hall scheduled for completion March 1, 1956.

An outstanding jobber educational program is in progress through SREPCO's Fall Color TV School. The 12-week course includes material presented in the Summer School sessions which was attended by 135 men. New developments in preparation to service color equipment are included in the instruction. Louis Sandor is teaching the fundamentals of color signal and its application to all types of receiving equipment, using color receivers, color bar and dot generators, and all modern test equipment needed to demonstrate "set-up" and maintenance technique.

The Armed Forces Communications Association will devote its annual convention to the vital topic of "Global Communications" when it meets, May 19 to 21, 1955 at the Hotel Commodore, in New York City, according to George W. Bailey, its President.

In planning for the largest participation in some years, T. L. Bartlett of RCA. Exhibits Chairman, says that the New York Chapter, which will be the host to the national organization, has made provision for approximately 35 manufacturers' exhibits in addition to those of the military services.

A basic schedule of 27,000 Raytheon color television sets to be produced before the end of 1955 has been announced by Henry F. Argento, vice president and general manager of the television and radio operations of the Raytheon Manufacturing Company. Argento said 2,000 of the color sets will be produced during the remainder of this year. They will utilize a 19-inch three-gun color tube, and will sell for $1,095; the schedule calls for 25,000 Raytheon color sets, using a 21-inch color tube, to be produced during 1955.
News from RETMA . . . Average weekly production of television receivers during October, a four week reporting period, was at the highest level on record and unit output for the month was second only to five-week September of this year . . . On recommendation of the Service Committee of RETMA, President Glen McDaniel recently sent a letter to Mayor Robert F. Wagner of New York City expressing the Association's opposition to the licensing of television set servicemen and offering RETMA's assistance in correcting any TV service abuses. Calling attention to recent newspaper articles concerning actions by the office of the Brooklyn District Attorney in investigating fraudulent practices of TV servicemen, Mr. McDaniel said the spotlight was turned on dishonest practices of a few and inferences were made that this may be the operational pattern of many service technicians . . . The activities of the Radio-Electronics-Television Manufacturers Association in the field of television technician training will be presented in detail during the 48th annual convention of the American Vocational Association in San Francisco Dec. 3-7 . . . Latest RETMA dealer-census figures indicate that in less than two years, the number of retail radio and television dealers in the country increased by nearly 12,000.

S. N. Shure, president of Shure Brothers, Inc., manufacturers of microphones and acoustic devices, has announced plans to begin construction of a modern, one-story plant in Evanston, Illinois, a suburb of Chicago. The new building, occupying 80,000 sq. ft. (on industrial property covering 220,000 sq. ft. for future expansion), will serve as the new home for the entire Shure organization. It is expected the plant will be completed in the spring of 1956.

Color-television service meetings have been conducted by Simpson Electric Company in the Los Angeles area and Arizona. The meetings are primarily of the demonstration type, in which a color-TV chassis and suitable test equipment are set up in the meeting hall, and correct methods of testing shown. The new Chromatic Probe and Chromatic Amplifier are among the testing devices which are used, and technicians are instructed in proper methods of checking chrominance circuits with the new devices.

Developments in color TV throughout the nation: RCA's 21-inch, three-gun shadow mask type picture tube is now in production at that company's Lancaster, Pa. plant, and is being made commercially available to TV set manufacturers . . . Motorola's production record for 1954 has approached 10,000 units . . . Manufacturers claim that two main factors inhibiting sales of color sets are the high price of the individual sets and lack of programming . . . Motorola-Philadelphia is offering their 19-inch color TV receiver on a free-look, free-installation basis to commercial establishments . . . Seymour Mintz, president of CBS-Columbia, purportedly predicts industry will standardize on 22-inch rectangular tube size, rendering the 21-inch size obsolete because of its essentially round configuration.

A new Admiral 17-inch table model television receiver containing "printed circuits" equivalent to over one-half of all normally exposed wiring, has been announced by Stanley Lundy, vice-president-sales, Canadian Admiral Corporation. This compact, lightweight set, "The Traveller," Model T1802X, weighs only 51 pounds, about 40% lighter than Admiral's previous 17-inch model. It features the new vertical "Printed" Robot chassis with full tube complement recently introduced by Admiral in 21-inch table models, and uses a shorter-length 90° deflection 17 inch tube.

“SATISFIED? I SURE AM!”

I don't know anything about tubes, but I do know that the serviceman used Tung-Sol Tubes to fix my set and now it works as well as the day I got it.

TUNG-SOL®
dependable
TUBES—DIAL LAMPS

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Replacement Controls

75° at your distributor
suggested list price

Speed servicing of 'hidden'
or rear-end TV volume controls

[Image of a knob with the text: Two fingers are all you need to install a Snap-Tite. Just push it into the chassis mounting hole — it snaps into place.]

You need no tools — no nuts, lock-washers, or other hardware.

Six spring clips grip panel for positive, non-twisting mounting.

Shaft is molded, high strength polystyrene, finger-tip knurled and slotted for screw-driver adjustment. Extends 1/2" from face of mounting surface.

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Name

Company

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City... Zone... State... (1259-A)

[from page 43]

requirement of 300 microamperes concerns the cut-off characteristic of the tube. This is important because it is directly related to the contrast range of the screen. The lower the bias voltage needed to cut a tube off, the better will be the contrast of a picture on that screen.

Here is how the test is performed. With the selector switch in the Emission position, the Cut-off control is rotated until the meter reads 0 microamperes. If this is achieved with the Cut-off control pointer within the "good" range, then the cut-off characteristic of the tube is good. If the cut-off reading is higher (the pointer is to the left of the "good" position of the scale), the tube may still be usable if its emission current is exceptionally high. However, if the emission current is near 300 microamperes or below and the cut-off control does not fall within the "good" range, the tube is bad.

Additional Instrument Functions

Three of the most important functions of the Cathode Rejuvenator Tester is removing inter-element shorts, repairing open elements and restoring emission. Let us consider how each is accomplished.

Repairing Inter-Element Shorts:

Put Selector switch in the Dynamic Intensifier-Lo position. Press the Dynamic Intensifier-Lo button for 1 or 2 seconds. An arc should develop between the shorted elements and if successful, you should be able to burn out the shorts with this arc. After each attempt at removing shorts, the tube is tested for shorts. In attempting to repair the tube; if the arc does not burn out the shorts in the Dynamic Intensifier-Lo position, an Intensifier-Med position is available and if necessary, a still more powerful Dynamic Intensifier-Hi position. There will be some cases which will not respond to any of these treatments and for these tubes nothing can be done. But many will respond and if tube emission is good, you have a tube which is practically as good as new.

Repairing Open Elements:

If the continuity test shows an open G1 or G2, the probable cause is a bad solder connection at the base pins. For an open G1, try soldering pin #2, and for an open G2, try soldering pin #10.

If the continuity test shows an open cathode, it may actually be a break in the weld between the cathode and its connecting tab, or very weak emission from the cathode. First try restoring emission. If that does not work, you can attempt to weld the cathode tab as follows: Turn the Selector switch to the Dynamic Intensifier-Hi position. With the non-metallic handle of a screw...
What Magazines Do Servicemen Subscribe To?

Many magazines claim they reach radio-TV-electronic servicemen. Only three, by being members of an accredited circulation audit bureau, prove without question, just what coverage they really have.

These are the facts! All of the circulation figures shown herein are the actual A.B.C. or B.P.A. audited circulation figures which are now current—and represent the true circulation each respective magazine provided its advertisers between January and June 1954.

<table>
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<th>Service Dealer</th>
<th>Service</th>
<th>Technician</th>
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<td>1b Service Managers Employed by Above Firms</td>
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<td>3a Part-Time Servicemen</td>
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<td>*</td>
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<tr>
<td>3b Firms Doing Electronics Industrial Servicing Only</td>
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<td>5 All Other Distribution Combined</td>
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<td><strong>Total Average Monthly Distribution Jan.-June 1954</strong></td>
<td><strong>65,706</strong></td>
<td><strong>51,204</strong></td>
<td><strong>49,928</strong></td>
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</table>

*Both "Service" and "Technician" include their Industrial Electronic Service Firm and Part-time Serviceman coverage in with those shown as classifications 1a, 1b and 1c whereas "Service Dealer" shows them as separate entities.

†3,084 of this 54,656 “effective circulation” is PAID.

Now you have proof positive that "Service Dealer" has more paid subscribers amongst and reaches every month more radio-TV service firm owners—more retailers having service departments and more industrial electronic service firms than any other publication—and at much lower advertising cost per thousand readers. (Incidentally, effective January 1955 the average monthly circulation of "Service Dealer" will exceed 70,000.)

That's why in 1955—and the years ahead—more of the leading tube, parts, instrument and accessory manufacturers will advertise more dominantly in "Service Dealer" than in any other service field publication . . . to keep more of the nation's servicemen informed of their new products and the merits of their lines.

RADIO-TELEVISION SERVICE DEALER—published by COWAN PUB. CORP.

Main Office; New York City—Branches in Cleveland, Chicago and Los Angeles

RADIO-TELEVISION SERVICE DEALER • JANUARY, 1955

47
driver, tap lightly on the neck of the tube. Watch carefully as you press the Dynamic Intensifier button for a few seconds. If the weld takes, you will see a bright flash. Then the tube is tested for continuity. If the continuity is good, the tube is checked for emission.

Restoring Emission:

Reactivation of the cathode of a picture tube is one of the most important applications of this instrument. Investigations during the design of the instrument revealed that optimum results are obtained when reactivation is carried out in graded steps. Thus, for the initial charge, the Selector switch is set to the Dynamic Intensifier-Low position. Then the Dynamic Intensifier button is pressed momentarily. After the tube has been treated in this position, its Emission is carefully checked. If the emission current is over 300 microamps, the rejuvenation of this picture tube has been satisfactorily completed.

It may be that a still greater charge is required to bring the tube back to the desired emission range. For this there are two additional Dynamic Intensifier positions available, each stronger than the first. In one of these two positions the majority of low emission cathodes will be reactivated to a useful level. However, there will be some instances where nothing the instrument does will cause the tube to return to normal. In those cases the tube is useless.

Life Test Function of Tester

A unique feature of this cathode Rejuvenator Tester is its ability to indicate the approximate life expectancy of picture tubes. This particular test is based on the mass of the emitting material that is in the cathode and also on the amount of gas present in the tube. The instrument is so designed that the life of a picture tube is directly proportional to the manner in which the needle falls to zero when the Life Test push button is depressed. If the meter reading falls rapidly to zero, there is either a considerable amount of gas in the tube or there is only a small mass of active emitting surface left. In either case, the expected life of the tube is quite short.

On the other hand, a momentary pause and then a slow descent of the needle will indicate a fairly long life. A serviceman, by practicing on several new and several gassy tubes, will soon be able to determine with a fair amount of accuracy which tubes have a long useful life and which can be expected to die out shortly. Here is a valuable piece of information, both to the technician and the customer.
aerial lead or others under the dash- 
board brings about an increase or de-
crease in the interference it is advisable to 
investigate all leads that can cause such a 
change, particularly the antenna lead terminal which should be checked for a poor or open con-
nection.

There are other components in the 
receiver itself which if defective can give rise to ignition interference as de-
scribed above. The following dis-
cussion will show how this is brought 
about. From Fig. 5 it can be seen that the 
aerial and lead-in are designed as a 
definite part of the rf tuned circuit. This 
also includes the lead-in cable. The lat-
ter has a specified dimension that is part of the total input capacitance and in-
ductance. In fact, the type of cable used and its inherent capacitances and inductances should be as originally de-
dsigned for best alignment of the rf stage.

Going one step further it might be pointed out that noise pickup often can 
be reduced if the antenna stage is prop-
erly aligned. The auto radio is designed by most car manufacturers to have the 
aerial fully extended when the rf stage is 
aligned. However, it is generally possible to touch up the aerial trimmer with the aerial collapsed; but maximum 
sensitivity cannot be obtained under these conditions. Therefore, when aligning the antenna stage be sure to 
align the receiver with the antenna ex-
tended to a length generally used by 
the customer.

In Fig. 5, Cn is shown as the added 
capacitance of the dipole antenna, and 
Cg the capacitance of the lead-in. Coils, 
La and Lb (usually 3 microhenry) in 
conjunction with the condenser Cb comprise an ignition noise filter. Ct is the 
aerial trimmer and is also used for de 
blocking purposes to prevent the age 
voltage from appearing on the antenna. 
The tuning coil is Lp, a permeability type. All of these components are part of the input circuit and can effect the 
tuning and interference filtering. How-
ever, since Lp and Lb are very small in 
value it is often possible for these coils to have a shorted turn and not ap-
preciable reduce the rf sensitivity. This 
would permit ignition noise to pass into the rf circuits and then onto the mixer circuit. Cb and Cg are components that 
should not be overlooked when looking for trouble in this circuit.

The filter chokes as shown in Fig. 5 
are designed to be effective at the rf 
frequencies that the ignition system 
produce. The best check of these choke 
colls is to substitute a proper replace-
ment part. Service literature usually 
provides resistance values for the rf 
chokes. However, because of consider-
ing allowable tolerance of these chokes 
and the inaccuracies of most ohmmeters 
at low resistances, a resistance check is 
found wanting, and may postpone the 
completion of the repair. Unquestion-
ably, the best check is to substitute a 
new choke for the suspected one.

In addition to the above, there are 
other components associated with the 
power or "A" lead that can cause igni-
tion interference if they fail. Referring 
to Figure 6 we observe a condenser 
known as a spark plate or feed-through 
type because of its construction. This 
condenser is used because other types 
would have too much inductance at 
high frequencies for this purpose. Asso-
ciated with the condenser we usually 
find a choke coil. The condenser gen-
erally has one plate, the outside ground 
connection being riveted to the radio 
housing. If this rivet becomes loose 
ignition noise will be heard. The choke 
coil is seldom found to be defective un-
less too much current has been drawn 
th rough it. If this happens the insulation 
and covering will be visibly charred.

As pointed out previously one of the 
important tests is to make sure that all 
ground points are fastened securely. If 
there are two chassis making up the 
car radio both of them should be bonded 
to the frame of the car as well as to 
each other.
A NEW INSTRUMENT
[from page 16]

manent. But, since many shorts are
cased by foreign material within the
tube envelope it is quite possible that
new shorts may form at a later date.
The Cathode Beamer should be a
welcome addition to many shops, be-
cause it will enable them to repair sets
for their customers at much lower costs
than would be involved in tube replace-
ment. At the same time the shop can
make good profits, because the amount
of time involved in the use of the Cath-
ode Beamer is relatively slight. From
the overall viewpoint, the Cathode
Beamer will not result in fewer picture
tube sales, since it can only postpone
rather than eliminate picture tube re-
placement. The shops now using this
new instrument are reporting excellent
results from its use. It is one of many
pieces of test equipment that actually
pays for itself.

Fig. 3 — Resonance indicator.

sector which has been determined by
testing a great many makes and models
of sets.

Application
The method of connecting the check-
er for determining the self-resonant fre-
quency of the horizontal plate load is
done by attaching one of the two test
leads to the TV chassis and the other
to the primary plate lead going to the
horizontal amplifier tube plate. The
frequency control knob is scanned and
if the eye tube opens in the "FB-OK"
sector, the coil components can be con-
sidered to be OK. Should the eye tube
fail to open at all, it would indicate
severe transformer loading either in the
transformer itself, a faulty width
coil or a faulty yoke. In this case then
the process of elimination starts. If the
transformer by itself is OK, the eye
tube will open in the transformer sec-
tor. Stock transformers and yokes can
be checked for inductance by the com-
parison method. With the "Selector"
switch in the "yoke" position, the ap-
proximate inductance range is from
5 mh to 250 mh. 50 mh will read on
the dotted line separating the trans-
former and yoke sector. The "Selector"
switch connects a 270 mh coil across the output jacks in "yoke" posi-
tion.

By knowing that the flyback capacitor
frequency is correct, it also verifies
transformer and yoke matching. This in-

H.O.T. TESTER [from p. 21]

Fig. 4 — How coils are connected.
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- Rider's "TV Field Service Manual" data sheets
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- Auto Radio Installation and Service
- Advanced Data on New Circuitry
- Production Changes and field service data on receivers

- New Tubes
- New Test Equipment, operation and application
- Hi-Fi Installation and service
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- Service Short Cuts & Shop Notes
- Explanation of difficult circuits

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Check whether firm is: ☐ Service Organization or ☐ Dealer having Service Dept.
If some other type of company describe:
IF STUDENT, Name of School

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formation is especially useful when installing replacement flyback transformers.

Other inductances can be checked by the comparison method by adding a fixed capacitor across the coil under test so that the combination will tune within the frequency limits of the checker. (Note: This capacitor should be ten times or larger than the distributed capacity to minimize error.)

Example: To check a ringing coil, place a 0.01 or 0.02 µF capacitor across the coil to make it resonant in the upper part of the transformer sector. The TV technician is always on the lookout for a good coil checking device will be welcomed on his bench.

COLOR

[from page 12]

simplified in the analysis, any color or combination of colors chosen would produce the same results.

To help the reader visualize the demodulation process of the I and Q color signals (that make up the red bar under discussion) along a pair of I and Q references axes Fig. 11 is provided. Here we see a pair of correctly phased I and Q reference voltages which have been produced by the local 3.58 mc oscillator. Notice that the incoming signal develops I and Q components along the locally generated demodulating axes, these components being the original I and Q signals developed at the transmitter.

On the other hand incorrectly phased locally generated reference axes produce incorrect values of I and Q. This naturally results in the production of incorrect colors as seen on the picture tube screen.

Color-Difference System Analysis

In an H-V-B-Y system the in-phase and quadrature signals from the lo-
Fig. 12 — Demodulation of red color signal in an R-Y/B-Y system.

We are now ready to analyze the progress of the color signals developed along the R-Y and B-Y axes. This analysis is made with the aid of the simplified block diagram of a color-difference system as shown in Fig. 13.

Referring again to Fig. 12, we observe that \( R = 0.645 \) V. It can easily be shown mathematically that its component along the R-Y axis is equal to 0.63 V. This voltage appears at the output of the R-Y demodulator.

Similarly, the B-Y component of the color signal is \(-0.15\) V. This value appears at the output of the B-Y demodulator.

Fig. 13 — Block diagram of an R-Y/B-Y demodulation system.

It should be recalled at this time that the original R-Y signal at the transmitter was compressed, that is, it was divided by 1.14, and the B-Y signal likewise divided by 2.03. This was...
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done in order to prevent overmodulation of the rf carrier on certain colors. In order to restore the color-difference signal to their original relative values we process them at the receiver by multiplying the received R-Y signal by 1.14, and the B-Y signal by 2.03. This is done by suitable adjustments of the circuit constants in the respective color-difference amplifiers shown in Fig. 13.

The new B-Y signal now becomes:
\[ B-Y = -0.15 \times 2.03 = -0.3V \]

Similarly, the new R-Y signal becomes:
\[ R-Y = 0.63 \times 1.14 = 0.7V \]

At this point the G-Y signal may be obtained by mixing the following amounts of B-Y and G-Y (see Table 1, (12)).
\[ G-Y = -0.51(R-Y) - 0.19(B-Y) \]
\[ = -0.51 \times 0.7 - 0.19(-0.3) \]
\[ = -0.357 + 0.057 = -0.3V \]

The luminance or Y signal remains unchanged in the color-difference system, and is equal to 0.3V. The Y signal, added to the various color-difference signals produces the following results:
\[ R = (R-Y) + Y = 0.7 + 0.3 = 1V \]
\[ B = (B-Y) + Y = -0.3 + 0.3 = 0 \]
\[ G = (G-Y) + Y = -0.3 + 0.3 = 0 \]

Thus the correct color signal voltages are reproduced at the color picture tube grids.

A question that might arise at this point is why the factors, 1/2.03 and 1/1.14 were not used in the color-difference signals derived from I and Q. The answer is that the relationships given in formulas 6, 7, and 8 of Table 1 already include these factors.

In comparing the 1/Q and color-difference systems we might point out the fact that while it is true that the higher color video frequencies (0.5 to 1.5 m/c) are not reproduced in a color-difference receiver, subjective analysis at the present state of the art seems to indicate little difference in the viewing acceptance of both systems. It really is difficult to distinguish one from the other.

In addition, the elimination of the 33° tuned phase shift circuit required in 1/Q demodulation, plus the elimination of the 1 delay line in the 1 demodulator output, plus the greater gain possibility of reduced color frequency circuits, plus the possibility of direct mixing of the R-Y/B-Y signals in the color picture tube, all these factors have contributed toward a definite trend in color-difference receivers.

RTSD Oct., 1954—"Black Diagram Analysis of Color Transmission and Reception"—p. 16 (Reduced Color Difference Signals)

[To be continued]
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