NOVEMBER, 1954

# Radio-Television SERVICE DEALER

TV - AM - FM - SOUND

*Includes 3 Sections*
1. VIDEO SPEED SERVICING SYSTEMS
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The Professional Radio-TVman's Magazine

Reaching Every Radio TV Service Firm Owner in the U.S.A.

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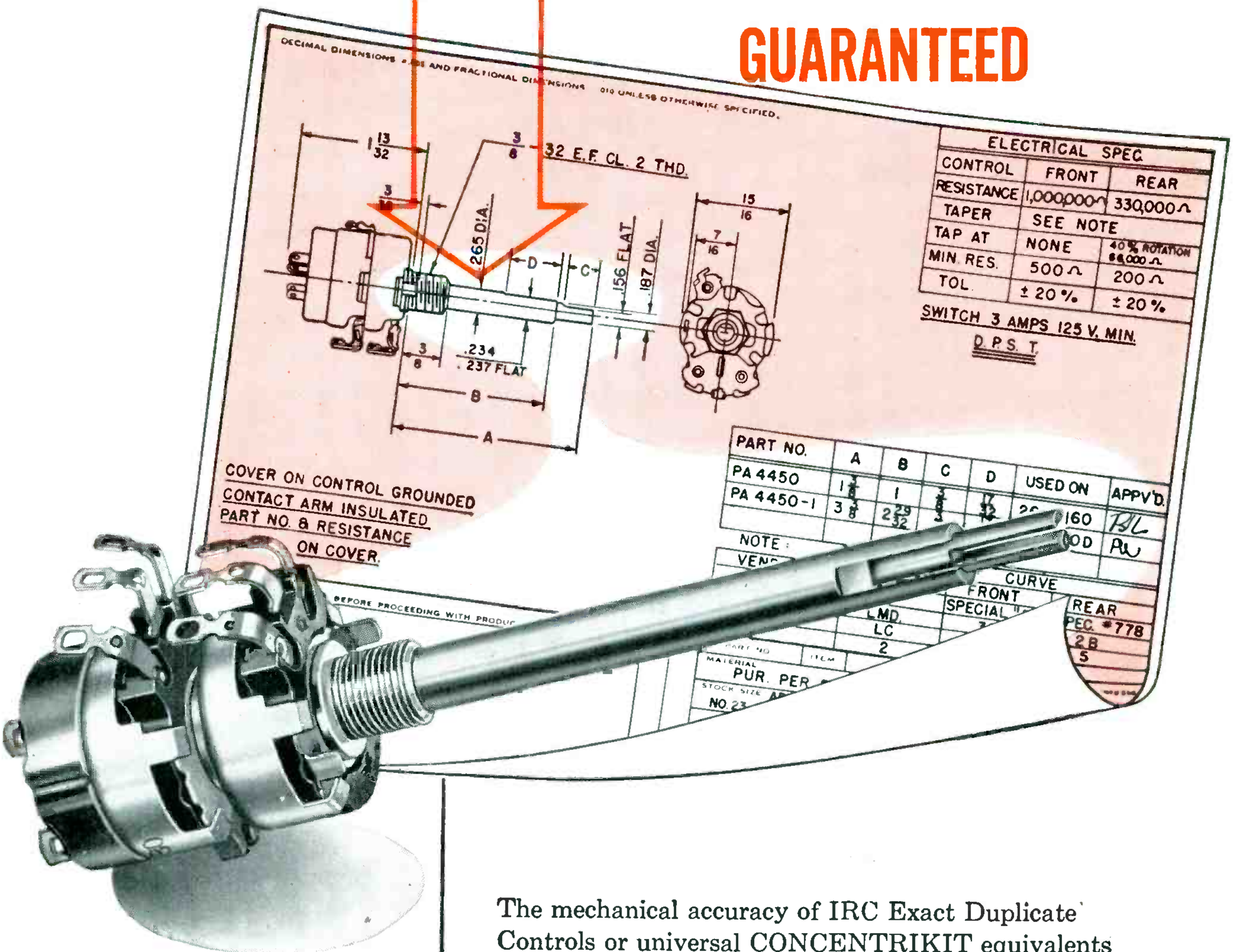


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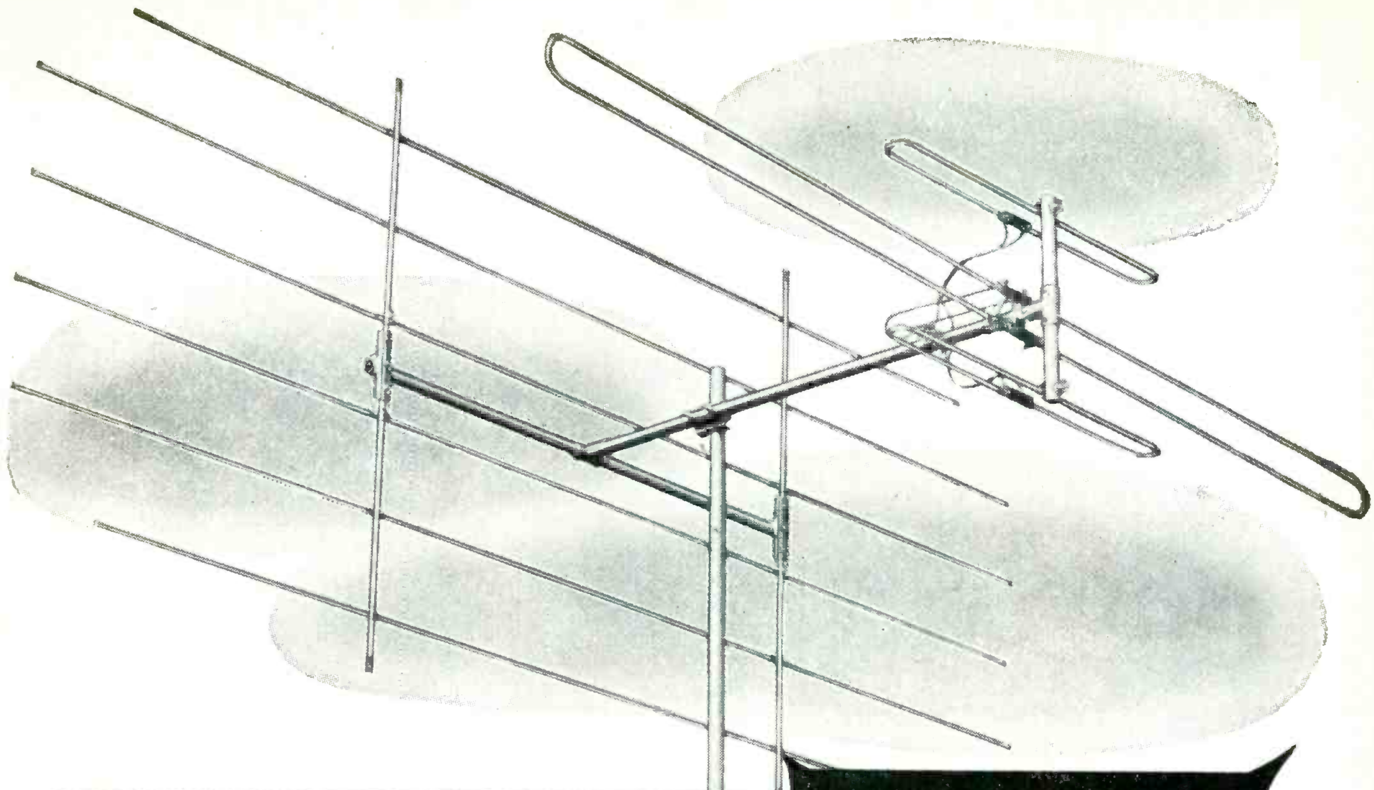

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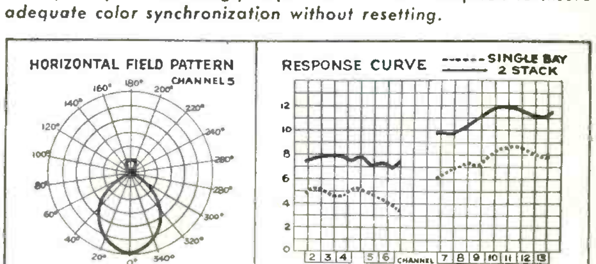


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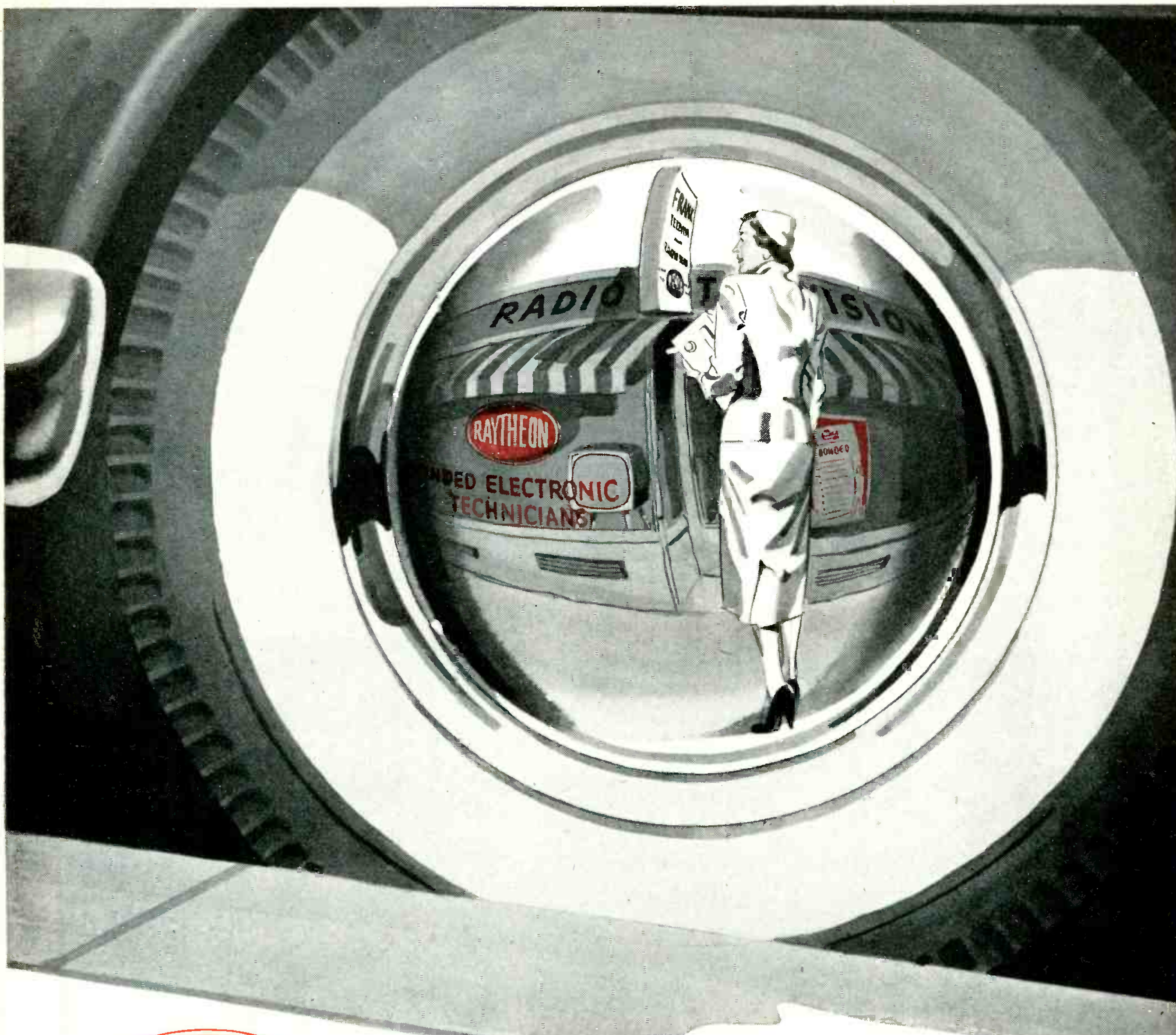
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COWAN PUBLISHING CORP., 67 West 44th Street, New York 36, N. Y.

VOL. 15, NO. 11 NOVEMBER, 1954


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RADIO-TELEVISION SERVICE DEALER is published monthly by Cowan Pub. Corp., 67 West 44th St., New York 36, N. Y. Subscription price: $1 for 2 years in the United States, & U.S. Poss. Elsewhere $1 per year additional. Single Copies 25c. Reentered as second class matter Sept. 25, 1950 at the Post Office at New York, N. Y. under the Act of Mar. 3, 1879.



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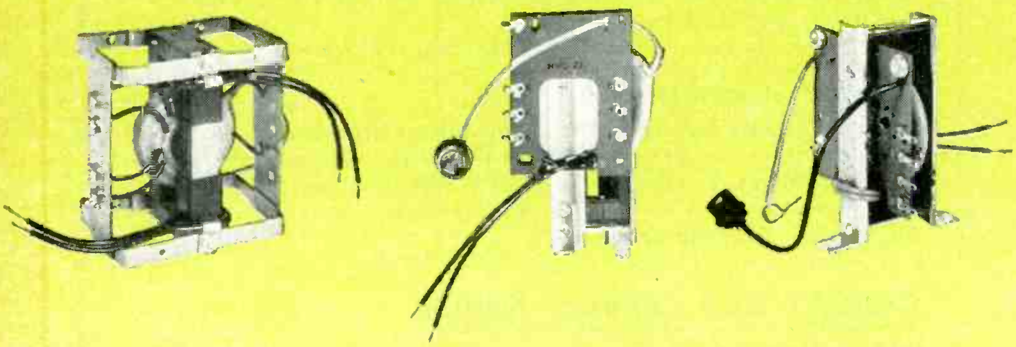

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# EDITORIAL... 

by S. R. COWAN
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### Wholesale Servicing

Traveling around the country of late I notice that an ever-increasing number of old, well-established service organizations with competent staffs of technicians are doing repair work on a wholesale basis. Some work with neighboring local smaller service firms who are overloaded, or who have been stumped by a real "toughie." Other wholesale service firms also work with many part-time independent servicemen who often find they haven't the necessary skill and equipment to do jobs they have gotten. Wholesalers also do a fine job for those retail stores who prefer to sell only and not handle their own service.

These wholesale service operations are commendable. Most of the public's disfavor with radio-TV servicemen stems from the incompetents rather than from gyps; for even now there are many more of the former than of the latter. So much must be learned fast about the many types of screwy TV circuits that off-brand and private label set makers have produced of late, and so much capital must be invested in new test equipment of special character for each serviceman, that we are truly amazed that the public has gotten such fine service as it has.

It is common knowledge that for many years doctors who are general practitioners have unhesitatingly called in a "specialist" when an unusual case arose. So it is perfectly fitting and proper that servicemen should do likewise.

### Published Price Schedules

The Radio TV Service Dealers' Association of Spokane, Washington recently published and distributed to all members for store display, a fairly complete tabulated list of "suggested minimum prices as a public service so that the consumer may have some way of knowing what his repair bills should run." The price chart also states: "We do not believe anyone can charge less than these prices and yet give the customer the service and protection he is entitled to."

We regret that the association did what has been done because it is our opinion, based upon a quarter century of close contact with service firm operators, that the idea is not workable. During the past several years in many key cities, yours truly has given a lecture to thousands of service shop owners entitled, "How to Determine What Prices You Must Charge for your Services." The research upon which the lecture was based, the cost accountants, tax and business experts who participated in its preparation include the leading authorities in their respective fields. That the pricing plan we proposed is sound and proper is attested in that never a single complaint has been lodged by any of the many firms who have put it to work.

### New Type Manufacturers Service Policy

Recently General Electric announced that retailers selling their TV sets would give customers a 90-day free service policy, said service (if required), and the replacement of defective parts (if necessary), to be handled by the GE Distributor.

For many years it has been the regular practice of new car dealers to give their customers a "standard parts and service warranty—4,000 miles or 4 months." The service work and labor cost, when necessary, being paid for by the selling dealer; the needed replacement parts being furnished to the dealer by the car manufacturer. So, to some degree, the new GE policy on TV sets is not very different from the General Motors policy on its cars.

### Printed Circuit Servicing

Printed circuits are now being used more than ever before by many radio and television manufacturers. In fact, some set makers have gone "all out." Thus servicemen will, in the future, find themselves working more and more with a new medium which requires an entirely new servicing technique.

In this, and frequently in subsequent issues, our editors will cover all phases regarding the servicing of various kinds of printed circuits. It is a new art, and must be given careful study, otherwise a technician can cause much trouble and loss of revenue for himself.

As a matter of fact, next month we'll have two articles of import. One is on a new TV receiver chassis for custom made sale and installation, that uses printed circuits throughout, each segment of the circuit being isloated on its own plug-in panel which can be "pulled out" to simplify servicing. This receiver, incidentally, operates by remote tuning control. (Remote tuners are "hot" sales and installation items now—customers "go for" them once they see how they operate.) The other printed circuit receiver to be covered next month is a unique battery operated tiny portable that employs no tubes, only transistors.

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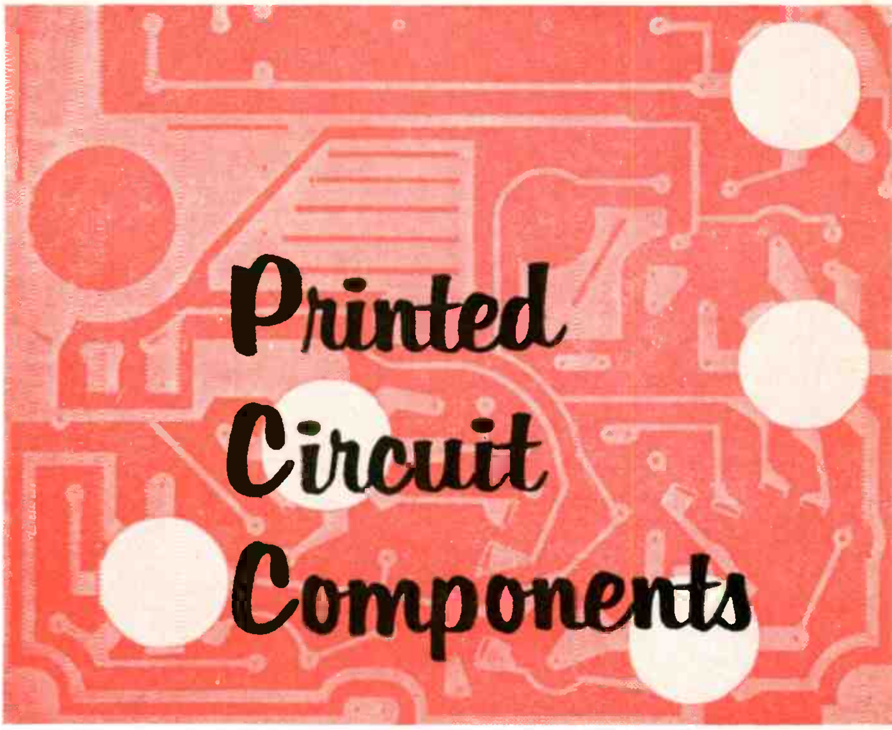
# Replacing Printed Circuit Components



Our sincere thanks to the Technical Publicity Department of the *Admiral Corporation,* from whose Service Manual No. S559 this material was made available.

### Replacing Capacitors, Resistors, Couplates and Peaking Coils

Defective resistors, couplates, ceramic disc and wax encased paper capacitors can be replaced by either of the following two methods:

1. If the leads extending from the defective component are long enough for a replacement component to be soldered to it, cut the leads where they enter the defective component. See *Fig. 1.*

2. If there is not enough length in the leads extending from the defective component to use the method described above, cut the defective component in half. Then cut through each half of the component until it is broken away from its lead. By performing this procedure carefully, enough extra lead (inside

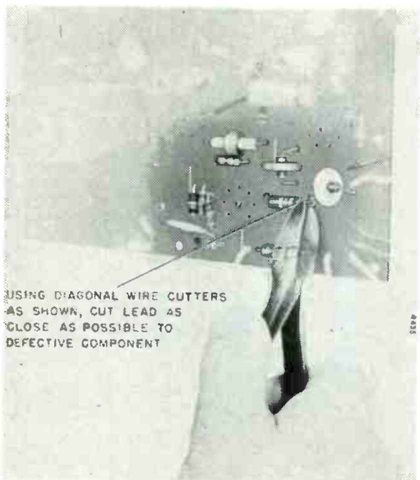



Fig. 1—Cutting a defective resistor free of the printed circuit board.

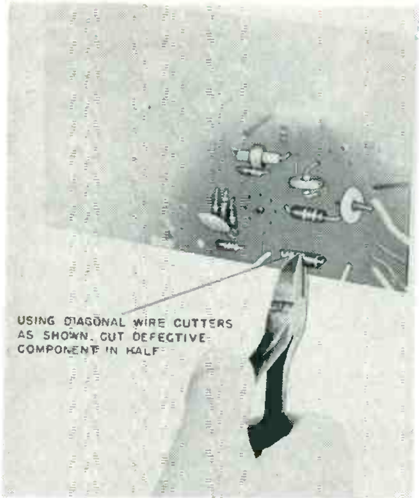



Fig. 2—Cutting a defective resistor apart so as to have maximum lead length left.

component) will be gained to permit soldering the replacement component to it. See *Figs. 2* and *3.*

Clean off the ends of the remaining leads, leaving as much of the leads as possible. Make a small loop in each lead of the replacement component and slide the loops over the remaining leads of the old component. See *Fig. 4.* Caution should be taken not to overheat the connection since the copper foil may peel or the original component lead may fall out of the board. This is possible due to heat transfer through the leads. The lead length of the replacement part should be kept reasonably short to provide some mechanical rigidity.

In some cases, components are mounted in such a manner that neither of the above methods can be used. To replace such a component it will be necessary to completely unsolder the defective component and replace it. The following procedure should be used whenever it is necessary to unsolder any connections to replace defective components.

1. Heat the connection on the wiring side of the board with a small soldering iron. When the solder becomes molten, brush away the solder. Do not overheat the connection. See *Fig. 5.* A 60 watt bulb placed over the component side of the board will facilitate location of the connections on the wiring side since the board is translucent. In the process of removing the solder, caution must be taken to prevent excessive heating.


Fig. 3—Cleaning remaining leads of component that has been cut apart.

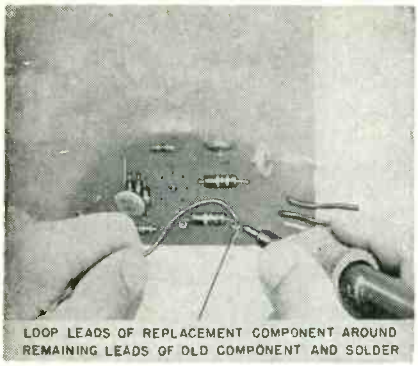



**Fig. 4—Soldering replacement resistor in place.**

Therefore, do not leave the iron on the connection while brushing away the solder. Melt the molten solder, remove the iron and quickly brush away the solder. It may require more than one heating and brushing process to completely remove the solder.

2. Insert a knife blade between the wiring foil and the "bent-over" component lead and bend the lead perpendicular to the board. (It may be necessary to apply the soldering iron to the connection while performing this step as it is sometimes difficult to completely break the connection by brushing.) Do not overheat the connection.

3. While applying the soldering iron to the connections, "wiggle" the component until it is removed.

4. Remove any small particles of solder imbeded in the Silicone Resin using a clean cloth dipped in solvent.

5. A thin film of solder may remain over the hole through the board after removing the component. Pierce the film with the lead from the new component after heating the solder film with the soldering iron.

6. Insert the leads of the new component through the holes provided. Cut to desired length and bend over the ends against the copper foil. Resolder the connection with 60/40 low temperature solder.

7. It is recommended that the cleaned area be recoated with clear lacquer or sprayed with Krylon for protection against shorts. If the Krylon spray is used, it will be necessary to cover the top of the tube sockets and chassis ground connections with masking tape to prevent the contact surfaces from becoming coated.

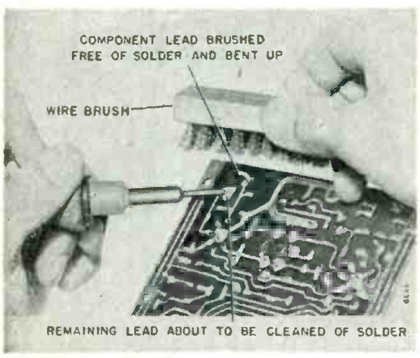



**Fig. 5 — Removal of component mounted in such a manner that its leads cannot be cut to free it from the board.**

### Replacing Coils

The terminals lugs of these components are not "bent-over" against the foil in most cases. Therefore, brushing is not necessary. Heat one connection until the solder becomes molten and wiggle the coil back and forth until the connection is broken. Continue wiggling and apply the soldering iron to the other connections and lift the coil from the board while the solder is still molten. Insert the replacement coil in the exact same position and solder the connections. Cover the connection points with a coat of lacquer or Krylon.

### Replacing Ratio Detector and I.F. Transformers

There are seven soldered lugs on a ratio detector or transformer and six on the radio *if* transformers. Replacing these components requires more time and patience than required for other components. The following procedure is recommended:

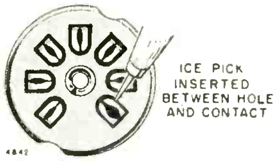



**Fig. 8 — Tightening of intermittent tube socket contacts.**

1. Apply the soldering iron to one of the connecting lugs. See *Fig.* 6.

NOTE: On some transformers, it will be necessary to bend the mounting lugs perpendicular to the board while the solder is molten, so as to be able to brush away the solder.

2. Cut off the transformer lugs as close to the board as possible. Repeat step (1). See *Fig.* 7. Use a cloth dipped in thinner to clean away any specks of solder stuck to the board.

3. Insert the replacement transformer and solder the connections.

NOTE: No special precautions are necessary when mounting the new transformer. It is not necessary to twist the transformer mounting lugs of the new transformer before soldering.

4. Cover the connection points with a coat of lacquer or Krylon, observing the precautions given previously.

### Tube Socket Repair

Intermittent tube socket pin contacts can usually be repaired by bending the contacts so they grasp the tube pins better. A small pick or similar tool should be used between the socket hole and the socket contact. See *Fig.* 8.

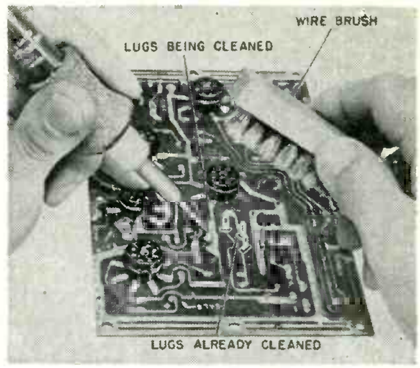



**Fig. 6 — Removing defective can-mounted transformer.**

### Replacing Tube Sockets Mounted on Wiring Side of Board

The following instructions are for complete tube socket replacement. Separate instructions are given for replacing the sockets mounted on the wiring side and components side of the board. Be sure to replace tube sockets with exact type as originally used.

The tube sockets are of the miniature type with an additional grounding lug extending to the tubular center shield (center connection) at the bottom of the socket.

Removal of the tube sockets from the wiring side of the board should be performed as follows:

1. Apply the soldering iron and brushing procedure to each lug as given in earlier instructions for removing components.

2. It may be difficult to break the entire connection by brushing. Therefore, after brushing, apply the soldering iron a second time to each lug. Insert a knife blade between the wiring foil and socket lug. Bend the lug upward from the foil. See *Fig.* 9. DO NOT PERFORM THIS OPERATION ON THE GROUNDING LUG.

3. After all socket lugs have been

*[Continued on page 61]*

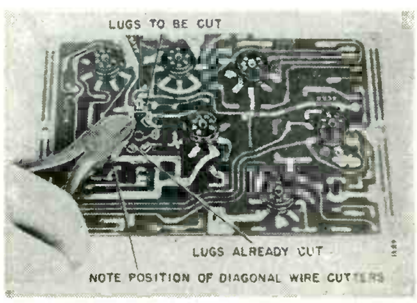
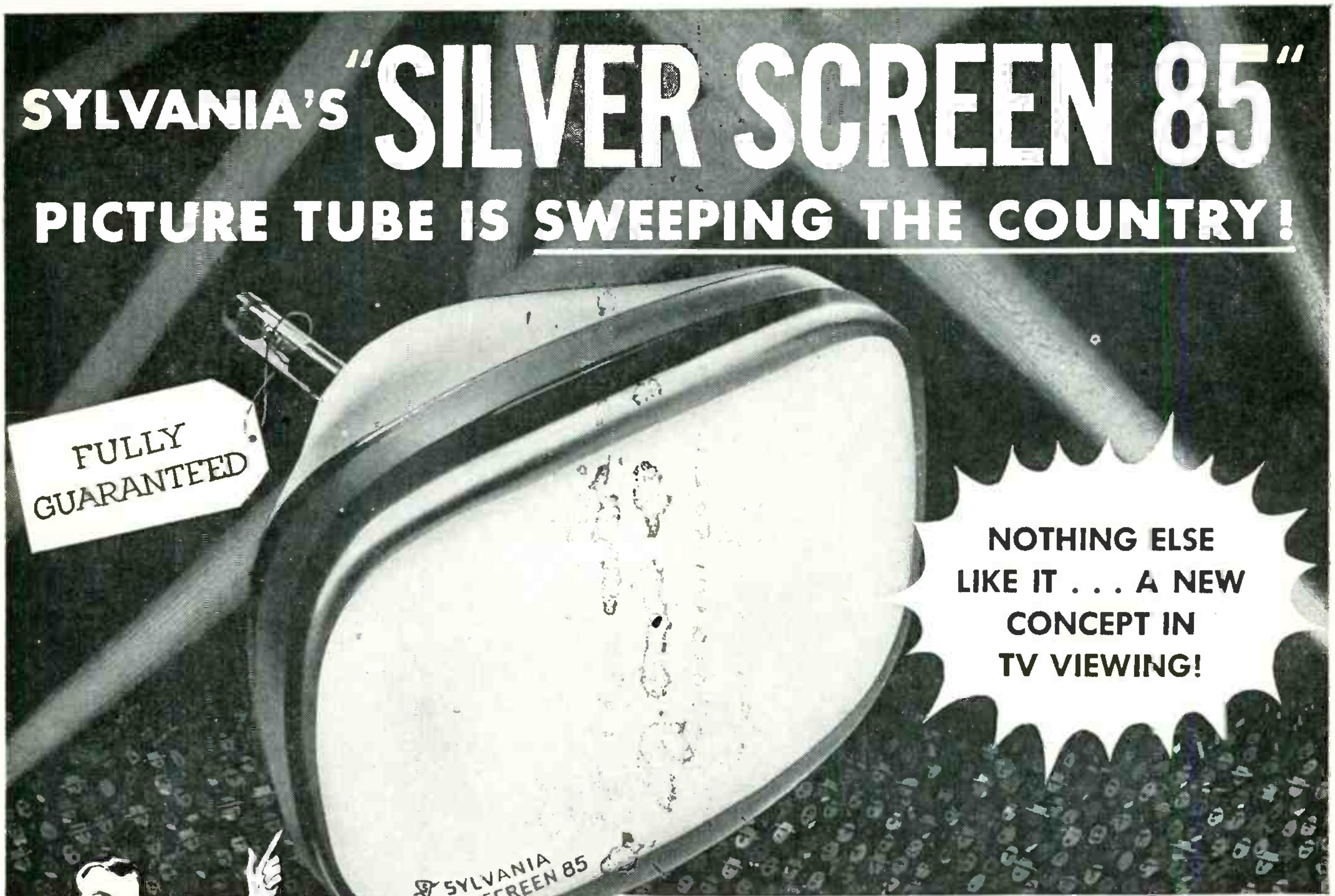



**Fig. 7—Cutting off lugs of defective transformer to permit easier removal.**





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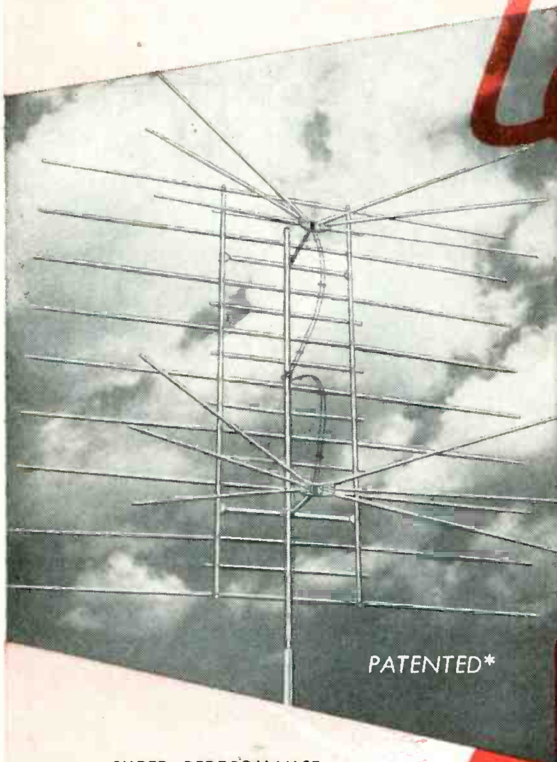


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# Block Diagram Analysis of COLOR TRANSMISSION and RECEPTION

by **BOB DARGAN**
**and SAM MARSHALL**

**From a forthcoming book entitled *"Fundamentals of Color Television."***

## Part 3

### I & Q Signals

With their amplitudes compressed as in equation II-8 and II-9 the color-difference signals could be used to modulate the color subcarrier. Thus, a set of color video sidebands could be obtained preparatory to modulating the channel carrier. This would be done were it not for the fact that the most effective transmission and reception of small areas of certain colors may be obtained by using combinations of certain other colors.

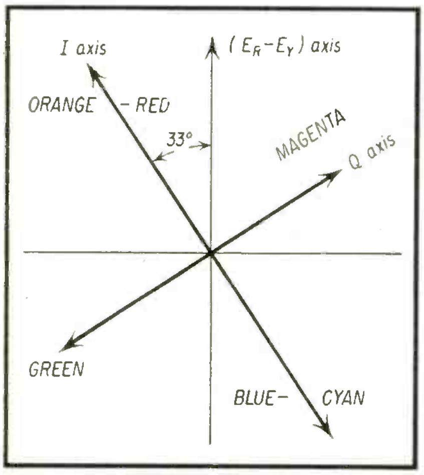


Fig. 12—Relative positions of I, Q, and $E_R - E_Y$ axes. Since small area detail is perceptible between colors such as red and blue, a line joining these regions is made the I axis or the one where the highest color video frequencies are apportioned.

This principle has been discussed in Chap. I.

Exactly which small area color patches should be treated in this manner is a second point to be considered, for it has been found that to try to reproduce all small color areas would be wasteful. This is brought home more effectively by showing that small adjacent blue and red areas are easily distinguishable from each other. On the other hand blue and green are not. From this we may gather that small area color detail in the range between the blues and reds should be transmitted; on the other hand small area color detail transmission between blues and greens is a wasteful process. This concept is generally discussed in the literature under the heading of "Relative Color Acuity."

As a result of the above it was decided by NTSC to select, as one of the new color-difference signals, a color signal displaced 33° from the $E_R - E_Y$ line. See *Fig. 12*. Extending this line from the orange-red region through the origin and into the blue-cyan region we obtain an axis of colors where the greatest relative acuity of small area color detail is obtained. For reasons which will be shortly apparent, we call this the "I" axis.

Inasmuch as the second color-difference signal modulates the subcarrier 90° out of phase with the first color-difference signal, the second color-difference signal must be perpendicular to the first as shown in the figure. We call the axis of the second color-difference signal the Q axis, Q indicating the quadrature position (90° phase displacement) of the second axis with the first.

Let us now take inventory of what the color signals consist of up to this point. First, they have been reduced in relative amplitude to prevent overmodulation; and second they have been rotated in color phase so that maximum relative color acuity is effected. Of course, it must be remembered that at the receiver these processes are reversed

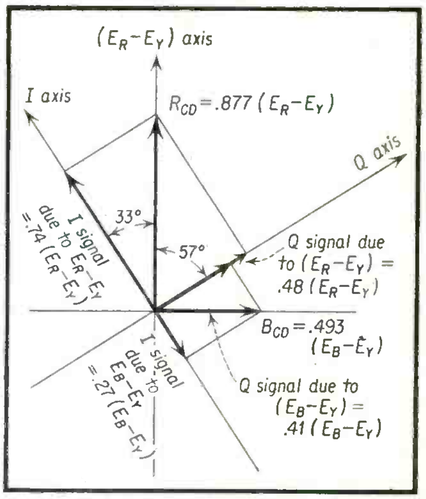


Fig. 13—How I and Q signals are obtained from $E_R - E_Y$ and $E_B - E_Y$ signals. Maximum values are indicated.

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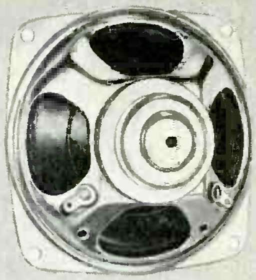

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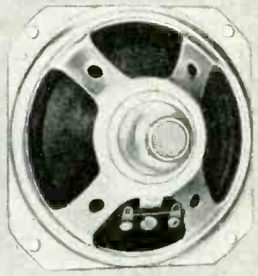

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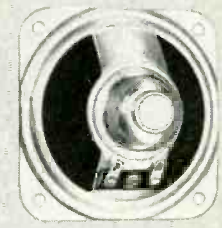

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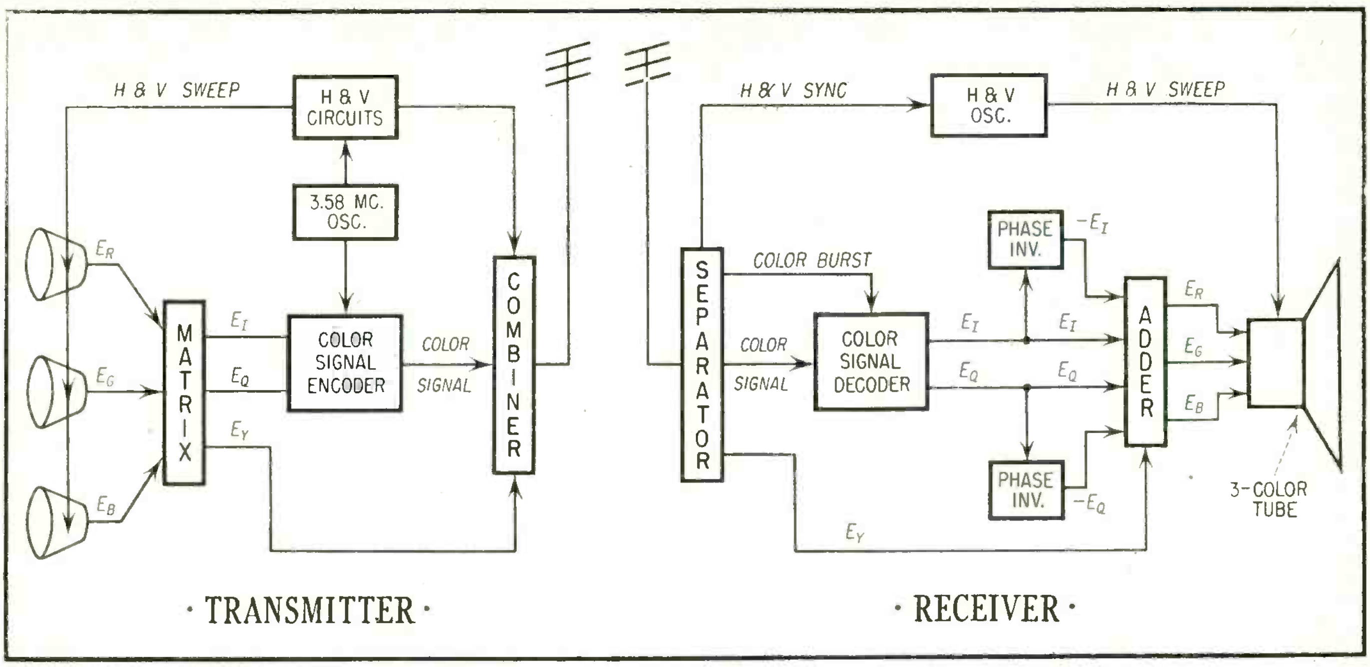


Fig. 14—Block diagram of color TV system utilizing $E_Q$ and $E_I$ color mixture signals.

and the original color signals are restored.

A few additional items must be cleared up at this point before we can go further in our analysis. The first item refers to the new name we give the I and Q signals. Instead of color-difference, we refer to them as "color-mixture" signals, since we no longer have a color-difference signal in the strict sense of the word, but rather a mixture of various amounts of different color signals as will shortly be shown.

The second item refers to the Q axis. Compared to the I axis, the color range of the Q axis corresponds to a range of low color acuity; that is, in this range the transmission of small area color detail is a wasteful process because for these colors small detail is indistinguishable. As will shortly be seen it is for this reason that reduced modulating bandwidth is utilized for the Q signal.

The third item refers to the amplitudes of the I and Q signals. Reference to *Fig. 13* will reveal that by shifting the $R_{cd}$ signal 33° its effect on the signal along the I axis is to produce a signal with the following amplitude:

I signal due to $R_{cd}$:

$= .86\ (R_{cd}) = .86 \times .877\ (E_R - E_Y)$

$= .74\ (E_R - E_Y)$ (II-10)

Similarly the effect of the $B_{cd}$ signal on the signal along the I axis is to produce a signal with an amplitude:

I signal due to $B_{cd}$:

$= -.5\ (B_{cd})\ -.5 \times .493\ (E_B - E_Y)$

$= -.27\ (E_B - E_Y)$ (II-11)

Thus, the total projected I signal derived from the red and blue color difference signals is:

$E_I = .74\ (E_R - E_Y) - .27\ (E_B - E_Y)$ (II-12)

By a similar analysis it can be shown that Q can be derived to be equal to the following:

$E_Q = .48\ (E_R - E_Y) + .41\ (E_B - E_Y)$ (II-13)

By expanding the terms of equations (II-11) and (II-12) we obtain the following *color-mixture* values.

$E_I = .6E_R - .28E_G - .32E_B$ (II-14)

$E_Q = .21E_R - .52E_G + .31E_B$ (II-15)

Notice that the projection of most of the I signal is "In-phase" with the red color difference signal. It is for this reason that we call it the I signal.

We now have two new color signals, $E_I$ and $E_Q$, which are called color-mixture signals. These may now be used to modulate the color subcarrier in order to obtain a resultant single color video signal which modulates the master channel carrier.

An expanded version of the block diagram of *Fig. 9* to include the I and Q signals is shown in *Fig. 14*. Observe that the $E_Q$ and $E_I$ signals in the transmitter are formed directly in the matrix from the $E_R$, $E_G$ and $E_B$ signals according to the values given in equations II-14 and II-15.

In the receiver the $E_I$ and $E_Q$ signals developed at the output of the color signal decoder are first processed through phase inverters to obtain negative $E_I$ and $E_Q$ signals. These signals are then mixed in the adder circuit where the

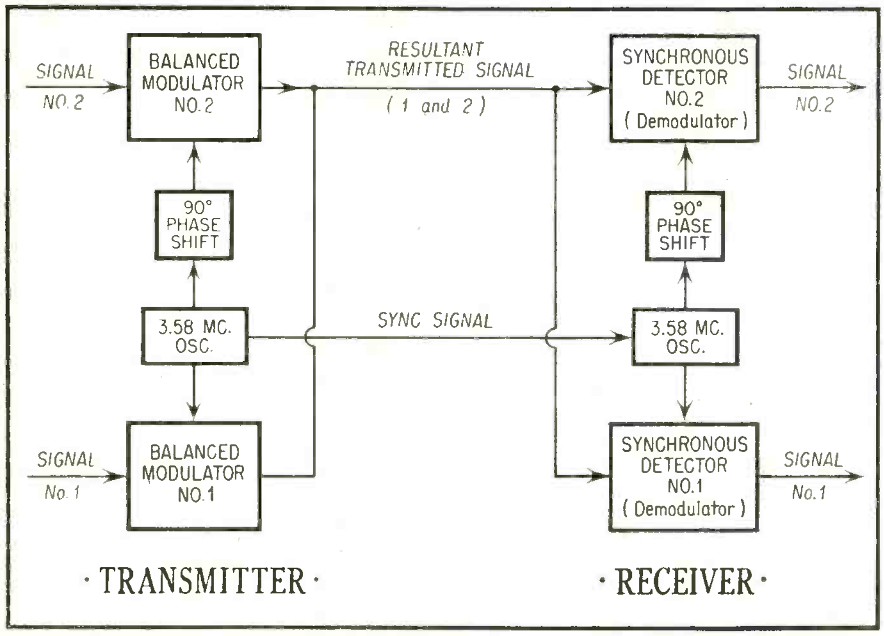


Fig. 15—Block diagram of two-phase modulation system of transmission and reception.

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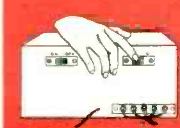

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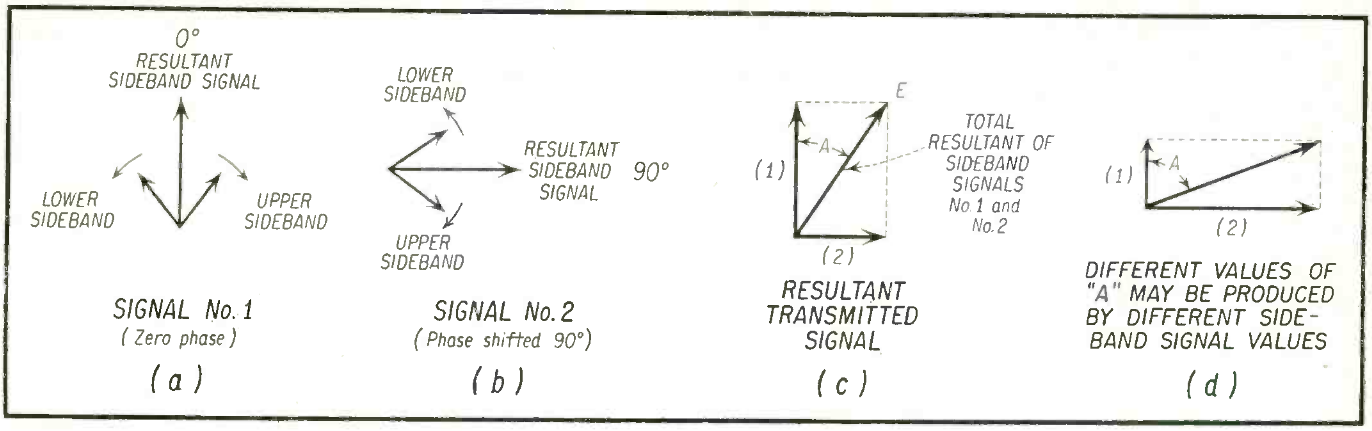



**Fig. 16—Vector diagram of signals No. 1 and No. 2 combined by two phase modulation process. Above signals contain resultant sideband energy contents of original signals No. 1 and No. 2.**

action that takes place is equivalent to one in which the *color-difference* signals are first obtained and then combined with the $E_Y$ signal to produce the primary color signals $E_R$, $E_G$, and $E_B$.

The color-difference signals may be obtained from the color-mixture by the following equations:

$$E_R - E_Y = .96\,E_I + .62\,E_Q \qquad \text{(II-16)}$$
$$E_G - E_Y = -.28\,E_I - .64\,E_Q \qquad \text{(II-17)}$$
$$E_B - E_Y = -1.1\,E_I + 1.7\,E_Q \qquad \text{(II-18)}$$

### Two-Phase Modulation & Detection

It was pointed out previously that the Y signal, which contains the brightness information, is transmitted as a conventional B & W video signal. We then went one step further and pointed out that the color signal consists of the information contained in the I and Q signals. It now remains to be seen how the I and Q color signals are processed at the transmitter so that they are sent out as a *single* signal without interfering with each other.

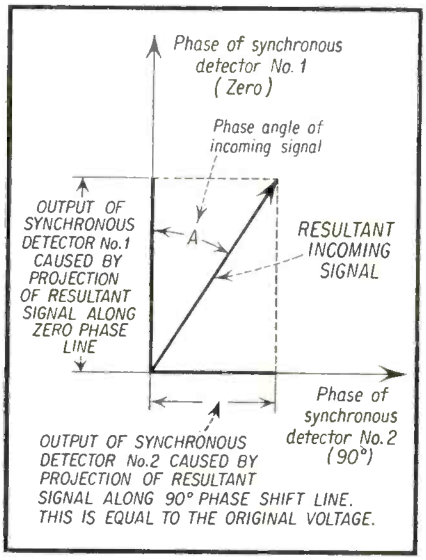



**Fig. 17—Incoming signal is converted into its two components.**

Two signals may be transmitted on the same frequency if:

1. Two separate carriers of the same frequency are used, but separated by a phase displacement of 90°.
2. One of the signals amplitude-modulates one of the carriers, and the other signal amplitude-modulates the other carrier.

A block diagram illustrating these conditions is shown in *Fig. 15*. Here, signal No. 1 is fed into a balanced modulator together with the carrier of a 3.58 *mc* oscillator. Signal No. 2 is also fed into a balanced modulator together with a 3.58 *mc* oscillator signal displaced 90° with respect to the first 3.58 *mc* signal. The output of both modulators contains the sideband energy content

*[Continuel on page 18]*

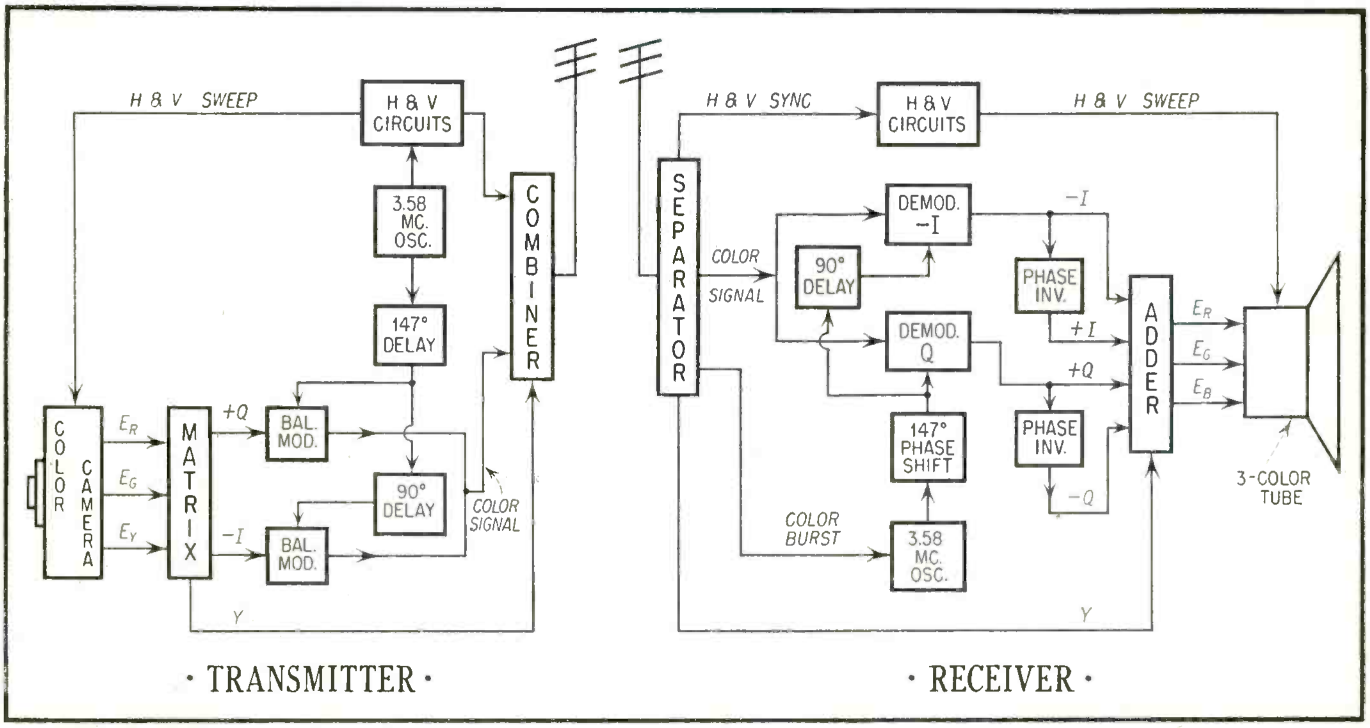
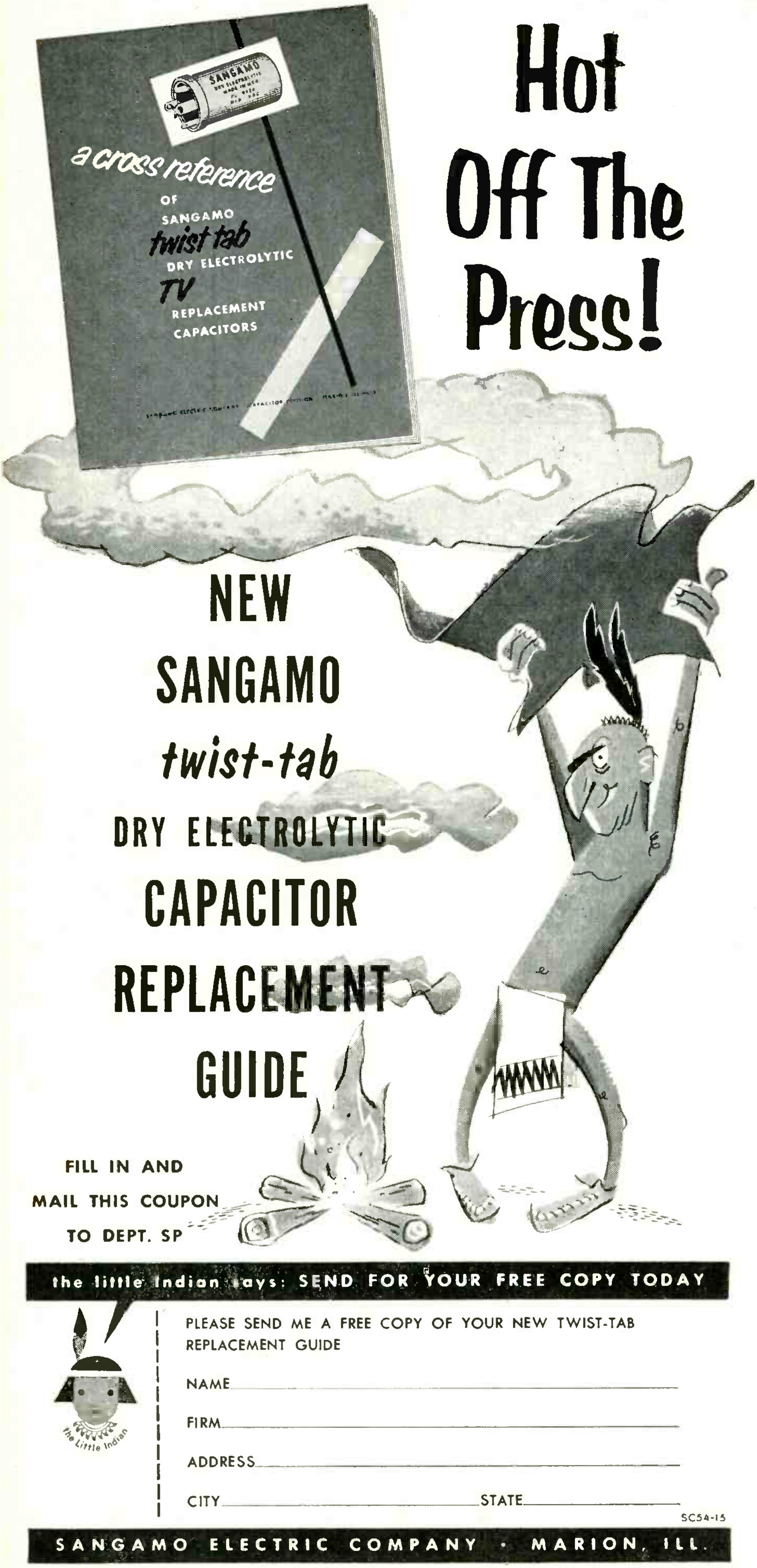



**Fig. 18—Simplified block diagram of TV system showing how positive and negative I and Q signal may be obtained.**




# ASSOCIATION NEWS

### P.R.S.M.A.—Philadelphia, Pa.

P.R.S.M.A. presented Winston Electronics, Inc., manufacturers of Win-Tronix test equipment at an open meeting held at the Broadwood Hotel, October 12, 1954. There was a lecture and demonstration of equipment necessary for aligning, adjusting and trouble shooting of color TV receivers. Speakers: Winston H. Starks, Ralph Weinger and Daniel Kursman. Almo Radio Co., A. C. Radio, Radio Electric Service Co. and Albert Steinberg & Co. were the sponsors.

### CETA—New York

The membership of the Certified Electronic Technicians Association, at its sixth regular business meeting, appointed Clifford Shearer, who is Director of Advertising for Radio Merchandise Sales, Inc., as Chairman of the Public Relations Committee. The Certified Electronic Technicians Association is a non-profit organization composed of television-electronic technicians who have proven their ability by successful completion of the Advanced TV Training Course taught under the auspices of RETMA and have been accredited by the industry as technically competent by industry standards. Technicians for the RETMA Advanced Courses are selected from among those who are best qualified to complete the course successfully. An important function of "CETA" is to operate in close harmony with the local RETMA Service Committee and the RETMA instructional staffs to make sure that members may receive advanced instruction as new developments in the industry make new upgrading necessary.

### ESFETA—New York

An exchange of practical and successful suggestions for increasing interest and attendance at meetings of Radio and TV technicians associations took place Sunday, September 12 at a meeting of the Empire State Federation of Electronic Technicians associations, Inc. Present at the meeting in the Victorian Room of the Hotel Arlington, Binghamton, were delegates representing Southern Tier Chapter, RSA of Binghamton, Radio Technicians Guild of Rochester, Ulster Electronic Technicians Association of Kingston, Radio Television Guild of Long Island, and two associations interested in ESFETA, Inc., Syracuse Television Technicians Association and Mohawk Valley Television Technicians Guild of Utica.

## COLOR TRANSMISSION AND RECEPTION

[*from page* 15]

of signal No. 1 and signal No. 2 as shown in *Fig. 16*.

These sideband signals combine in the outputs of both balanced modulators thereby producing a resultant transmitted signal as shown in (c). The characteristics of this circuit are such that the 3.58 *mc* carriers are balanced out or suppressed, leaving only the sideband energy in the output.

Assuming that signal No. 1 is in phase with the carrier, it will have a zero phase as shown in (a). Signal No. 2 has a 90° phase shift as shown in (b).

A signal with a 90° phase shift with respect to a second signal is said to be in quadrature with respect to this signal. Thus, signal No. 2 is quadrature with signal No. 1.

The resultant transmitted signal is equivalent to the combined effects of 1 and 2 in quadrature, and forms a single signal with an amplitude phase angle A as shown in (c). It should be obvious that various phase angles "A" may be obtained depending on the amplitudes and direction of signals No. 1 and No. 2. (See *Fig. 16 (d)*.)

To extract the original signals No. 1 and No. 2 at the receiver, we employ a pair of synchronous detectors as shown in *Fig. 15* in conjunction with a 3.58 *mc* oscillator which is synced into exact phase with the oscillator at the transmitter. The zero phase oscillator signal is fed into synchronous detector No. 1. A second oscillator signal displaced 90° from the first is fed into synchronous detector No. 2. In each synchronous detector the oscillator signal provides a carrier which operates on the resultant transmitted signal in a manner shown in the diagram of *Fig. 17*.

First, the oscillator signal provides a zero reference phase for the synchronous detector No. 1, and a 90° reference phase for detector No. 2. In this manner, and by virtue of its properties, an incoming signal with a phase angle A, has an output at detector No. 1, which is proportional to the projection of this signal on the zero degree reference phase line. Similarly, the output of detector No. 2 is the projection of the incoming signal on the 90° phase line. These output signals are identical to the original signals No. 1 and No. 2.

Thus it is seen, that the two-phase modulator at the transmitter does its job by first providing a phase difference of 90° between two signals No. 1 and No. 2, after which it combines these quadrature signals into a single resultant signal of a definite phase and amplitude. On the other hand, the synchronous detector at the receiver undoes what the two-phase modulator does by first providing a pair of 90° phase displaced reference carriers to the signal so that the resultant is resolved back into the original signals No. 1 and No. 2. In color TV the No. 1 and No. 2 signals are the I and Q signals which are used to modulate the two-phase system just described.

A further expansion of the simplified block diagram of the entire system is illustrated in *Fig. 18*. Except for an additional block, marked "147° delay" in the transmitter, which will be explained shortly, and the addition of the two-phase modulation and demodulation system just explained, the expanded block diagram of *Fig. 18* corresponds to the previous block diagram of *Fig. 14*.

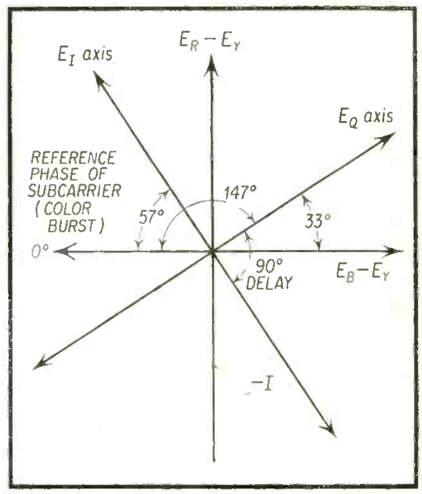



**Fig. 19 — Relative phase of color burst (subcarrier signal) with respect to the I and Q signals.**

In the selection of the reference phase for the subcarrier (or the color burst signal) it was found that the most suitable value is one where the I axis is 57° displaced from the subcarrier. This value is specified in the FCC Color Signal Specifications. Reference to *Fig. 19* shows how this axis fits in with the I and Q axis.

The phase delay values indicated in *Fig. 18* may be a little confusing when compared with *Fig. 19*, but a little analysis will prove that they are correct. For instance, in *Fig. 19* the phase delay of the Q signal with reference to the subcarrier is shown as 147° This is easily reconciled with *Fig. 18*. Also, the phase delay of the –I signal in *Fig. 18* is 147° + 90°. Reference to *Fig. 19* also points up this fact. By using these phase delays and feeding a negative I and a positive Q signal we obtain the required color signal output modulated by the I and Q signals.

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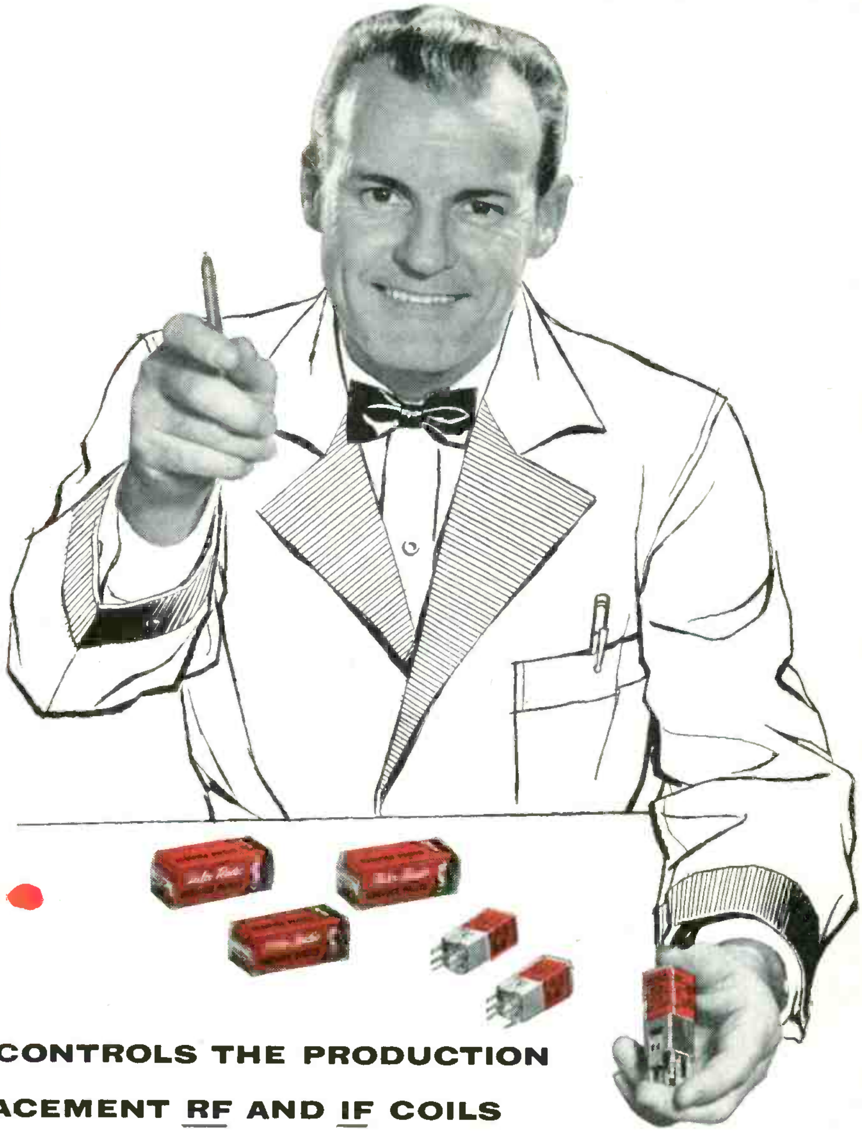

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**H. J. Shulman of CBS-Columbia has been reappointed chairman of the Service Committee of the Radio-Electronics-Television Manufacturers Association. J. F. Rider of John F. Rider Publisher, Inc., was reappointed vice chairman of the committee for fiscal year 1954-55. The group supervises RETMA activities in connection with the development and presentation of the industry-recommended television technician training program and also has prepared additional material in the fields of consumer and technician education.**

**RETMA has also announced that during the first seven months of this year, shipments of radios, excluding automobile sets, to dealers topped the 2.6 million mark; manufacturers' sales of both receiving and cathode ray tubes gained sharply in August from the level of July and established new highs in monthly sales for this year, and the production on television receivers in August more than doubled the rate of July and was at the highest point for any month this year.**

A series of television service schools featuring printed circuit service techniques has been arranged by Admiral Corporation, according to announcement by Max Schinke, national service manager, who said that the service schools will cover black and white service techniques, general problems, antennas, etc. In addition, Hugh Wyeth, television specialist, will discuss automation and the entire manufacturing procedure of the printed circuit board.

**KING-TV, Seattle, is showing color television movies daily. The station launched the color series with a full color feature, "Alice in Wonderland," on August 13th. This was the first time that a station west of the Rockies had originated motion pictures in color. KING-TV's new Continuous Motion Color Camera (discussed in the August issue N. E. W.) was used for televising the color movie. This camera is the only one of its type in existence. Color programming is at 4:30 p. m. on Monday, Wednesday and Friday, and at 4:00 on Tuesday and Thursday, plus additional film time not scheduled.**

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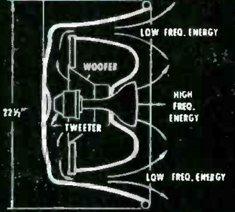


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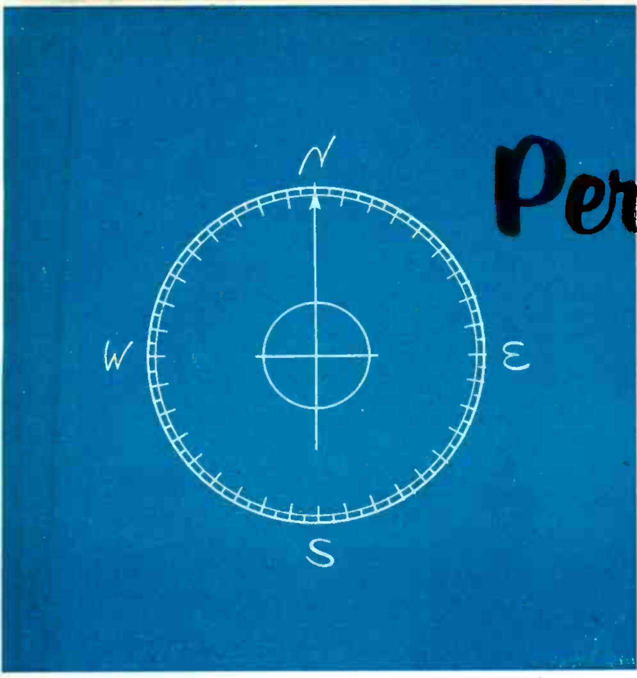



# Performance and Market Analysis

by **Arne Benson and Bernard Nussbaum**
**Roto-King Division**
**JFD Manufacturing Co., Inc.**

***A revealing discussion of the parameters involved in the design of a marketable antenna rotator.***

IN today's television market, where in some quarters, the competition has become intense—a profitable source of business remains that has been virtually untouched. That source is the antenna rotator. It has been overlooked in most installations—and yet—in so many installations—the rotator could profitably have been used and as enthusiastically welcomed by television owners.

A rotator helps extract maximum performance from an antenna. It means a viewer can tune in easily to a completely clear and interference-free picture. Its basic function is saleable to consumers—and its potential market is equally extensive.

The rotator's sales strength lies in fringe areas employing highly directional, broadband, or narrow band antennas; especially in former single and two channel areas which have become multi-channel areas. The rotator provides optimum reception because it permits the antenna to be rotated in the direction of optimum reception. With the advent of hundreds of new channels throughout the country, thousands of set owners are finding their antenna installations inadequate, due to the antenna's inability to pick up new stations from directions other than a narrow angle in the forward direction.

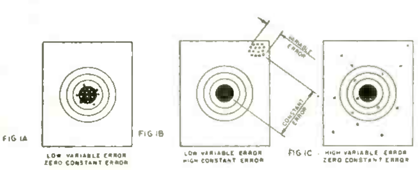



**Fig. 1(A-C)—A typical representation of the meaning of repeatability and ambiguity.**

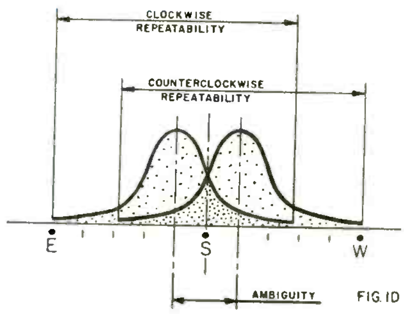



**Fig. 1D—An example of ambiguity—the difference in antenna orientation resulting from poor repeatability.**

Metropolitan areas, too, where critical reflections affect reception, are becoming choice rotator markets.

A rotator can be sold with a new-set installation or in conjunction with older antennas as a replacement measure. The logical outgrowth of realizing the rotator business potential is to stock them—sell them—and install them with a minimum of trouble and complaints.

Now, which rotator should a dealer sell? Which is mechanically and electrically the soundest? What does one look for in a rotator? Obviously the rotator to stock and sell quickly with best results is the one that incorporates the following basic characteristics.

1) Highest Accuracy
2) Greatest Inherent Strength
3) Optimum Power (Torque)
4) Ease of Servicing

A dealer should know his product—he should be aware of the above characteristics of a rotator—so that he, in turn, can present it adequately to his customers.

### Nine Factors Influence True Accuracy

In rating a rotator's accuracy, one must consider repeatability, freedom from ambiguity, tracking, optimum speed of rotation, fast braking action, elimination of wind drift and coasting, automatic line voltage, sensitive switch and wavy dial readability, compensation for length of lead and other installation variables.

### Repeatability and Ambiguity

Repeatability is defined as the ability of a rotator to return to the same point in repeated trials (See *Fig. 1D*) . . . while ambiguity is the difference in antenna orientation which results when the same point on the control unit dial is approached from left or right. An apt illustration is to compare repeatability and ambiguity to rifle marksmanship. A rifleman who places several shots within a small circle, as in *Fig. 1A*, has good repeatability. Good repeatability implies consistency, low variable error. If this cluster of shots is in the upper corner of the target far from the bullseye, as in *Fig. 1B*, the good repeatability remains but a large constant error is added. If the shots are scattered all over the target, it indicates high variable error but low constant error, as shown in *Fig. 1C*.

A good rifleman places his shots within a small circle—the bullseye! A similar analysis applies to a rotator as drawn in *Fig. 1E*. The rotator should

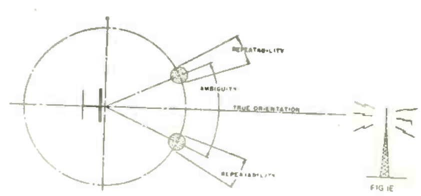
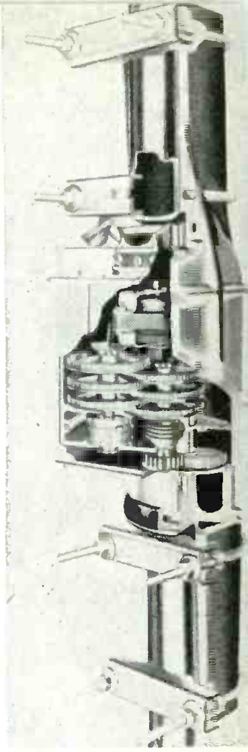



**Fig. 1E—The variance of a rotator (as defined by repeatability and ambiguity) from the course of true orientation.**

# of Rotators



perform with a low variable error and zero constant error.

Engineering data, relating to these factors, should be closely scanned by a dealer before bulk quantities are ordered.

### Tracking

Tracking is the degree of correspondence between the antenna orientation and the direction indicated on the rotator control unit. Some rotators, tested by the writer, have been off as much as 90 degrees in their tracking. A good rotator must track to well within 10 degrees. The chart in *Fig.* 2 indicates almost perfect tracking.

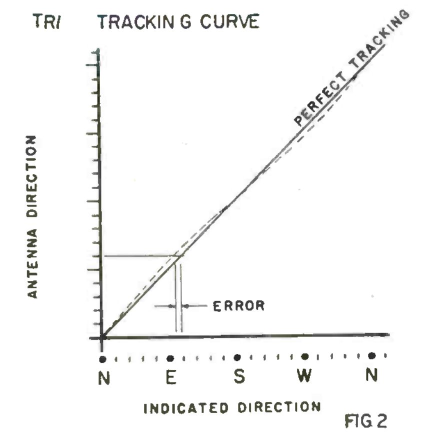



FIG 2

**Fig. 2—Perfect tracking and almost perfect tracking is shown here in the dotted line and solid line alongside.**

### Optimum Speed of Rotation

In arriving at the Optimum Speed of Rotation figure—several factors come into focus. They are: antenna's rotating speed, reaction time of operator, directivity of antenna, braking time, speed of motor driving antenna. Only a correct assessment of *all* these elements can result in the proper optimum speed of rotation, so that an operator tuning for best reception can manipulate the rotator without "hunting" back and forth. It was found by JFD rotator engineers that an optimum rotational speed of one revolution per minute effected the most accurate performance. The resulting improvement is shown in *Fig.* 3. A rotator designed for a 1 RPM rotating speed can present a control sensitivity to within 3 degrees. With faster rotators, "hunting" is required for accurate tuning.

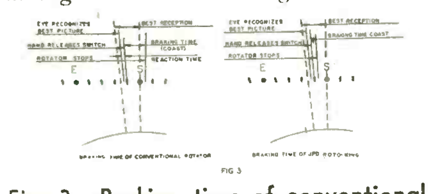


**Fig. 3—Braking time of conventional rotator as contrasted to braking time of JFD Roto-King.**

### Fast Braking Action

The distance travelled by an antenna after the rotator switch lever is released is termed "coast." To be functionally accurate, a rotator's braking action must cut "coast" to a minimum—it must stop within the sector of best reception. Some rotators depend upon the low efficiency of their worm and gear transmissions to reduce coasting. The better rotators incorporate a braking device at the low torque end of the gear train. Other rotators have *no* mechanical provisions for adequately preventing "coast." The better rotators, incorporating low torque end braking actions, will come to a complete stop to within 5 motor revolutions or less than ½ degree of antenna rotation.

Since a fast braking action is one of the more apparent elements in accuracy—with special appeal to the consumer—a dealer should particularly require fast braking action of a rotator.

### Elimination of Wind Drift

Due to wind loading, an antenna will change orientation. A worm gear or the friction of a spur gear train is insufficient to hold an antenna in the face of heavy winds. *Only* a brake designed for the purpose will stop wind drift. Braking action effectiveness varies from one rotator to the other.

The rotator to select is the one whose braking action will prevent *all* wind drift even with wind velocities measuring up to 100 MPH.

One of the most common shortcomings of rotators is the inaccuracy of the indicator created by normal line voltage fluctuations. The system of automatic line voltage employing the principle of saturable reactors is perhaps the most efficient. Such a design in operation tends to make the effects of normal line variations on the direction indicator virtually imperceptible. *Fig. 4A* illustrates how a system of automatic voltage regulation stabilizes line fluctuations. The reduction of direction indicator variation that results is pictured in *Fig. 4B*.

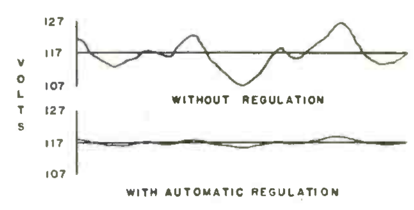



FIG. 4A

**Fig. 4A—Voltage fluctuations are shown here *without* regulation—and with automatic regulation.**

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## WESTON MODEL 985 *CALIBRATOR*

### FEATURES

**SCALE CALIBRATION:** Crystal calibrating points are available at 1.5 and 4.5 megacycles throughout the entire scale. A scale shift knob is provided to align the scale with the crystal calibrating dots.

**SCALE PRESENTATION:** Slide rule type in which one scale is visible at a time. Ten scale range bands available... total scale length of 8¼ ft.

**DUAL MARKERS:** 4.5 mc side band markers permit simultaneous observation of video and sound carrier.

**INTERNAL MARKERS:** Special circuitry provides an internal marker of either a positive or negative pulse suitable for Z-axis intensity modulation of the scope pattern. Marker is visible even at the sound trap frequencies.

**HETERODYNE DETECTION:** With an input sensitivity of 500 microvolts, the local TV receiver-tuner channel oscillator frequency can be determined without tuner disassembly.

**BAR PATTERN GENERATOR:** Amplitude modulated signals of the band oscillator at 400 cycles and 300 KC are available for linearity checks.

### SPECIFICATIONS

**Frequency Range (with Variable Frequency Oscillator):** 4-110 megacycles in 7 bands. 170-260 megacycles in 3 bands.

**Output Attenuator Range:** 100% to 1%

**Crystal Marker Accuracy:** 1.5 mc position ± 0.01%; 4.5 mc position ± 0.01%

**Internal Modulation Frequencies:** 400 cps, 300 KC, 4.5 mc

**Heterodyne Input Sensitivity:** 500 microvolts (VFO)

**Linearity Adjustment:** Horizontal—400 cycles, Vertical—300 KC

**Dual Markers:** video and sound . . . available for either Z-axis intensity modulation of scope or conventional marker pip display.

## WESTON MODEL 984 *SWEEP GENERATOR*

### FEATURES

**BLANKING:** Special circuitry produces a zero output reference base which is essential for relative gain measurements.

**RF OUTPUT:** Frequency modulated signal, TV channels 2 to 13 inclusive, complete FM coverage available by means of two preset selector positions. *Frequencies are fundamentals of the oscillator frequency.*

**IF/VIDEO OUTPUT:** Frequency modulated signals ranging to 50 megacycles, continuous tuning, signals free from harmonics.

**SWEEP WIDTH:** Full 10 megacycles on all channels.

**Z-AXIS TERMINAL:** For use with the Model 985 Calibrator.

### SPECIFICATIONS

**Sweep Width:** 0-10 Megacycles (continuously variable for both IF and RF)

**Output Voltage (RMS):** 0.1 Volt . . . sweep is linear

**RF Output:** TV channels 2 to 13 preset. Complete FM coverage available by means of two additional preset selector positions.

**IF/Video Output:** 50 Megacycles (continuous tuning)

**Horizontal Sweep for Oscilloscope:** Phase adjustment range . . . 165° Frequency . . . Power Line 60 cycles per second.

# WESTON 980 LINE | TV TEST EQUIPMENT

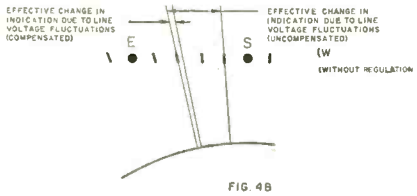



Fig. 4B—Lower variance in dial indications when voltage fluctuations are compensated.

### Sensitive Switch and Easy Dial Readability

A sensitive switch and easy dial readability are prime pre-requisites in arriving at the optimum speed of rotation. Good repeatability depends to a great extent on a sensitive switch and an easy-reading, finely calibrated direction indicator.

### Compensation for Length of Lead and Other Installation Variables

The problem has always existed of completely compensating for length of lead-in, line voltage variation and other variables when installing a rotator. In today's new model rotators, this problem has been solved for the first time. Advanced circuitry techniques and high quality components combine to provide the perfect compensation for installation variables. By this means, full accurate deflection of the indicating needle is maintained despite length of lead-in. See *Fig. 5.*

In short, accuracy is not a cut and dried affair. Many elements, working together, constitute accuracy. In most cases, dealers should require complete information regarding the rotator they buy. They should ask themselves the question: how does this rotator's accuracy measure up against the elements of: repeatability, freedom of ambiguity, tracking, optimum speed of rotation, fast braking action, elimination of wind drift and coast, automatic regulation of line voltage, sensitive switch, easy dial readability, compensation for length of lead and other installation variables.

All these elements are important! For example, a rotator, lacking in only *one* respect—automatic line voltage regulation—may be as inaccurate, in effect, as a rotator lacking in *all* the above qualifications.


Fig. 5—Full deflection of control unit needle is shown—when a rotator's long lead-in is compensated. Note contrast with full deflection and limited deflection.

### How to Measure a Rotator's Strength

A rotator's strength is measured by 1) its resistance to downthrust and bending movement 2) by the designed strength of its moving parts. See *Fig. 6.*

In its resistance to downthrust, a rotator at least should support the dead weight of a 2-bay stack of a 10 element channel 2 Yagi. In its resistance to bending moment, the same rotator—mounting the heaviest antenna—must withstand the bending and lashing punishment of a near hurricane. To do this, the rotator housing must resist the bending moment of approximately a thousand foot pounds.

Consequently, the construction of a rotator is most important. A rotator can either have an offset or inline construction. Both are adequate—but the latter inline construction has one decided advantage that makes it the more desirable. An inline construction utilizes the full inherent strength of the entire antenna mast. It thereby supports, in a direct line, the heaviest antenna array. An inline rotator will support any load, limited only by the ultimate strength of the metal itself.

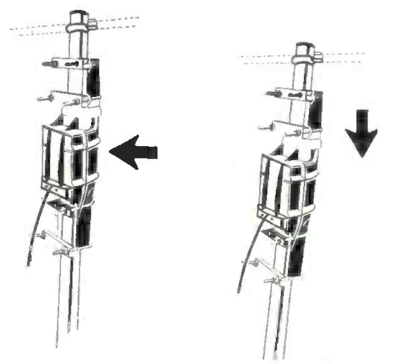


Fig. 6—Shown here is the effect of wind and weather upon a rotator as defined by "bending moment and downthrust."

### Balanced Design Delivers Maximum Strength

A rotator must achieve a balance between the strength of its component parts and the stress imposed upon them by the rotator's operation. Each single component must stand up under varying conditions of weather, too.

Unfortunately, there is no sure way of a dealer knowing beforehand—just how durable a rotator will be under such adverse conditions as frost and extreme heat. He must rely upon the manufacturer, himself, to test the rotator and supply him with the facts.

Various tests, like the JFD Life Test, *are* being conducted by rotator manufacturers. A rotator is placed in an atmosphere chamber (like the one shown in *Figs.* 7 and 8) and subjected to temperatures of from 50 degrees below to 180 degrees above zero. A dealer can analyze published reports of such tests —and act accordingly.

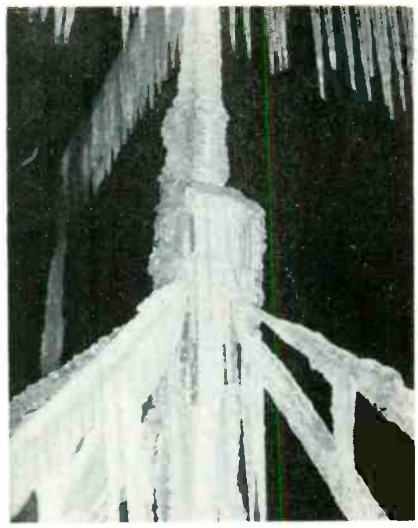


Fig. 7—A rotator's ability to operate under heavy icing conditions pictured here is a leading factor in judging its strength.

### Planned Power Means Top Rotator Efficiency

In measuring power or torque of a rotator, the tendency is to over-simplify. While raw torque is certainly a factor, other factors, too must be considered. They are local line voltage conditions, length of lead, and temperature changes.

For example, line voltage conditions will vary from area to area, resulting in a change of torque. Similarly, the length and quality of the lead will affect torque . . . the longer the lead or poorer its quality, the lower a rotator's torque. Temperature too, affects torque. See the graphs in *Fig. 9.* A higher temperature results in lower torque—contrary to popular belief.

It can be seen then that voltage, lead and temperature changes affect the

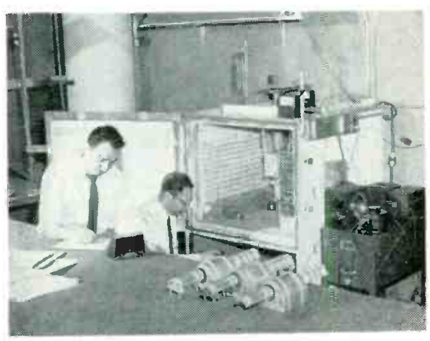


Fig. 8—Rigid tests in the JFD Environment Chamber, pictured above, are conducted to test the Roto-King's Balanced Design.

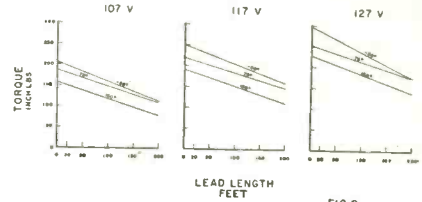



Fig. 9—A rotator's torque will vary with voltage changes as exemplified here.

torque of a rotator—conditions which the designers of a rotator must take into account.

### Servicing—It Should Be Fast and Effortless

One last and most important consideration remains to the dealer in judging the worth of a rotator—both from the standpoint of the serviceman and customer. That is the servicing element.

From the serviceman's viewpoint, a rotator should be designed to minimize expensive callbacks when trouble does arise. The rotator should require the least amount of time lost in repairs.

At the same time, a viewer wants the interruption in his viewing pleasure cut to a minimum. It might be stated that a customer's reaction is perhaps the most important consideration of all.

A rotator should be designed so that when breakdowns occur—the rotator can be serviced quickly and easily.

The dealer should take care in selecting a rotator with a semi- or completely detachable power unit—wherein most of the servicing problems will arise. The JFD Roto King detachable cartridge power unit is an example of such a power unit.

So at last, a dealer has assessed a rotator's worth in terms of highest accuracy, greatest inherent strength, optimum power and easy servicing . . . what *now?*

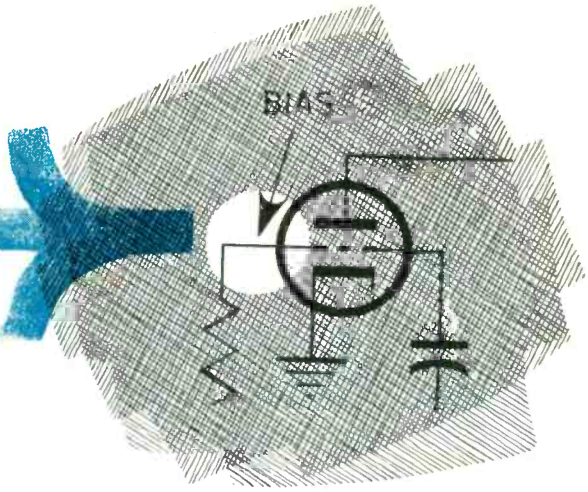
*NOW*—to bring that million dollar rotator business home—a program of comprehensive sales promotion should be followed.

### How a Dealer Can Promote Rotator Sales

A dealer must advertise strenuously using all the tools of advertising available to him. The amount of rotator traffic that he handles will depend, to a great degree, upon the extent of advertising the dealer does. The promotional-minded dealer will use newspaper ads, window streamers, direct mail, TV slides and scripts plus radio commercials. This material is available to the dealer through his distributor who in turn can avail himself of the material and facil-

*[Continued on page 64]*

# Key Test Points




**Part 2**

by **Steve Travis**

The second installment of this article discusses rapid testing methods as applied to the horizontal output and deflection systems.

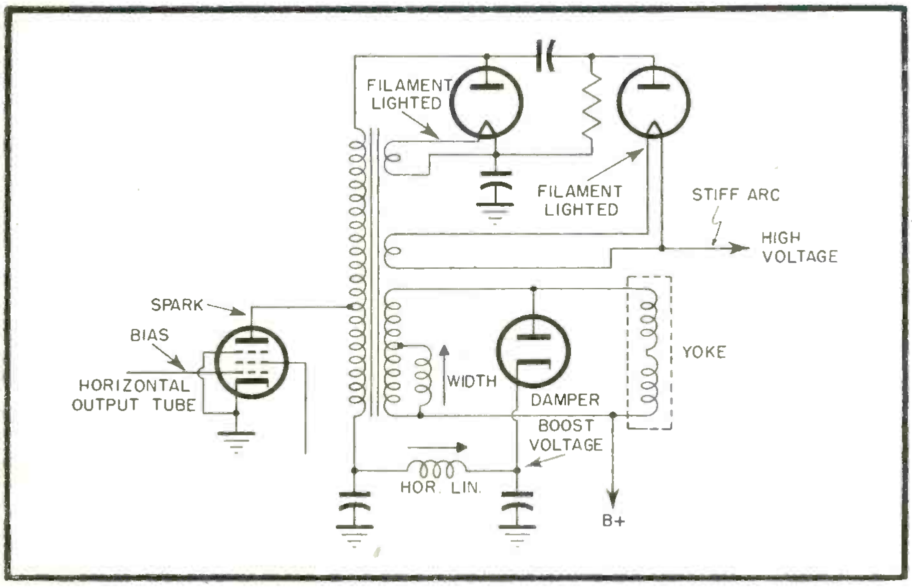



Fig. 5—Conventional horizontal output system.

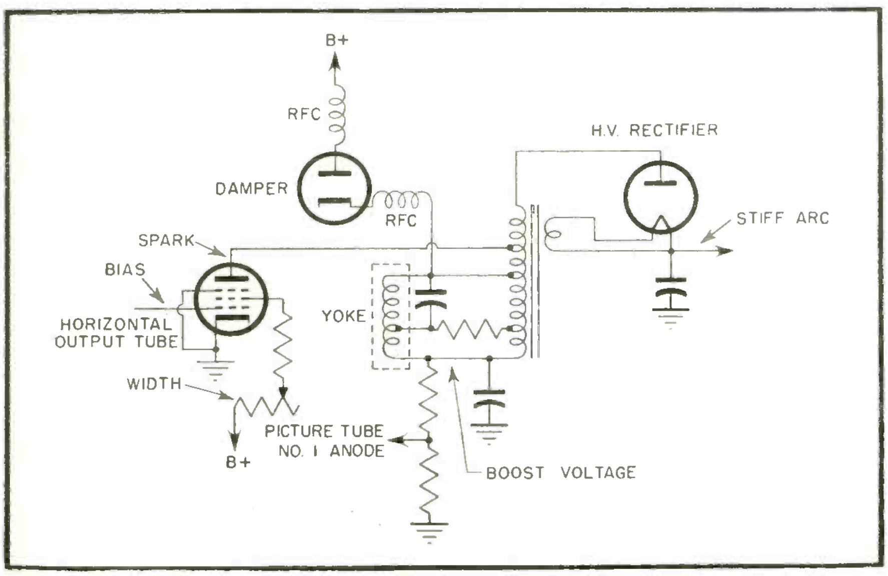



Fig. 6—Autotransformer type horizontal output system.

### The Horizontal Output Circuit

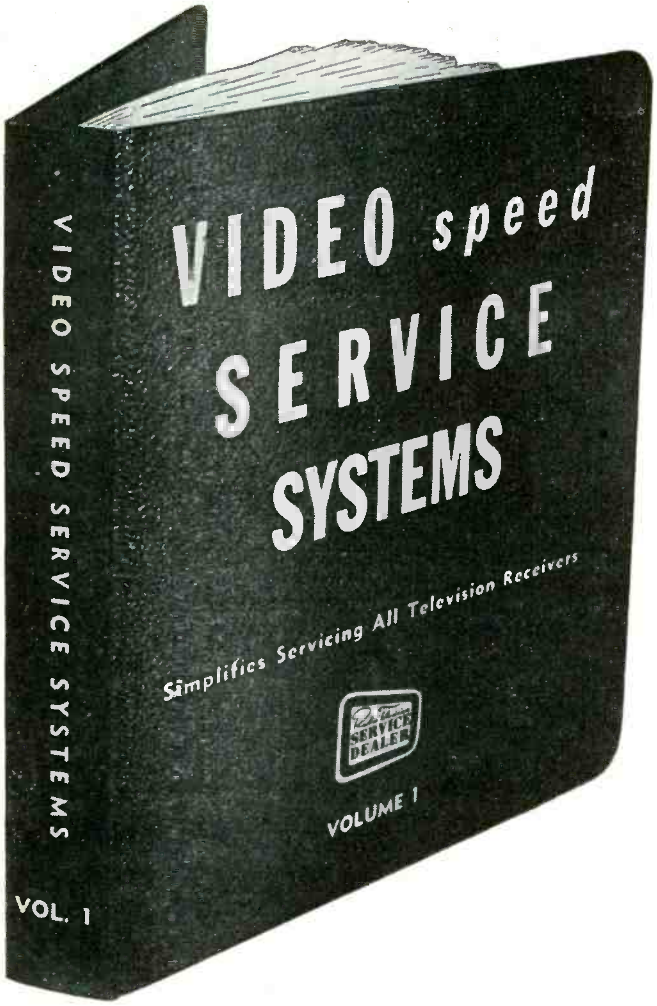
Another equally good key test point is the grid bias at the horizontal output tube. If a negative voltage, over and above the fixed negative supply, is measured at the grid of the horizontal output tube it indicates that the tube is being driven by the horizontal oscillator signal. It is the only way in which the additional bias can originate because it is voltage derived due to the grid drawing grid current on the positive portions of the signal. Naturally this check can not be made with the horizontal output tube removed from the socket as the grid condenser can not be charged by grid current flow in the tube if the tube is removed. By measuring the grid bias at the horizontal output tube it can quickly be determined if the signal is reaching the tube. Before performing the check, as with all others, it is important to determine that the tube is good.

### The Cathode of the Damper Tube

The cathode of the damper tube is an excellent test point to ascertain if the deflection voltages are being delivered from the transformer to the yoke. If this is occurring the yoke and transformer will resonate at about 71 kilocycles and develop a transient oscillation at this frequency. The first portion of the oscillation cycle will cause the electron beam to be returned from the right hand position on the picture tube to the left hand side where the beam will start the next trace. It is this first portion of the transient oscillation that returns the beam. After the return of the beam the transient pulses cause the cathode circuit to charge to a higher positive voltage than the original B plus voltage. The rectification in the damper diode of the transient voltage builds up a damper cathode circuit boost B plus voltage that may be used to operate other cir-

*[Continued on page 60]*

# FOR GREATER PROFITS

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# TV INSTRUMENT CLINIC

## PART 5

***Based on CHALLENGE CLINIC demonstrations, this new series discusses many measurement and test problems raised by service technicians.***

**By ROBERT G. MIDDLETON**

*Field Engineer,*
*Simpson Electric Co.*

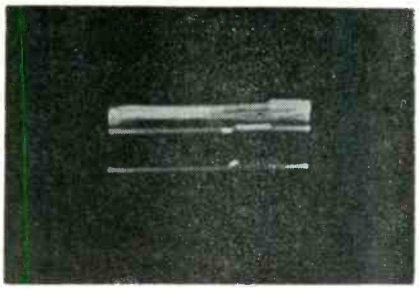


Fig. 1—Video waveform with evident signal compression.

*Q.* If a video amplifier is operating in a non-linear manner which compresses the camera signal, what sort of pattern will be observed on the scope screen?

*A.* This situation, which leads to white saturation of the picture, is shown in Fig. 1. To determine the amount of picture compression, a d-c scope should be used. The resting position of the scope trace, when no signal is applied, indicates the zero-

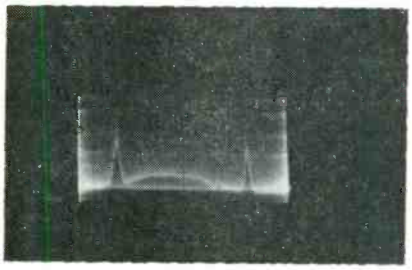


Fig. 2—Blurred image caused by open scope testleads.

volt level. When the signal is applied to the scope, the pattern rises up a certain amount above the zero-volt level. If there is no compression, the excursion of the sync pulses will occupy 25% of the total excursion of the signal.

*Q.* When using open test leads to the scope, the pattern is often blurred badly with interference. What can be done to clear up the pattern?

*A.* This situation (shown in *Fig. 2*), is caused by pick-up of pulse voltages from the stray field of the picture tube by the open test leads. A

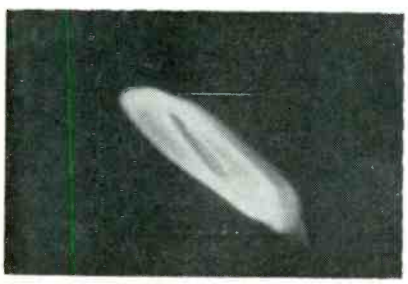


Fig. 3 — Variable amplifier phase shift effects.

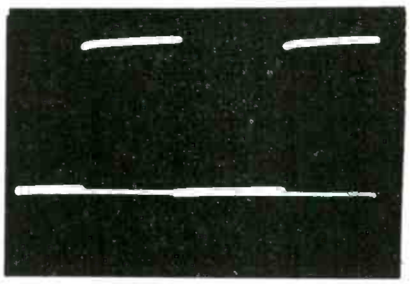


Fig. 4—60 cycle square wave without curvature.

shielded lead should be used to the scope to screen out such interference.

*Q.* Why does the elliptical pattern appear blurry when an amplifier is tested for phase shift with a sweep generator?

*A.* This situation is shown in *Fig. 3.* It is due to the fact that the video amplifier has different phase shifts at different frequencies.

*Q.* What does curvature in a reproduced square wave indicate?

*A. Fig. 4* shows a 60-cycle square wave without curvature, and *Fig. 5* shows a 60-cycle square wave with curvature present. This curvature is not caused by frequency distortion, but by hum distortion. In other

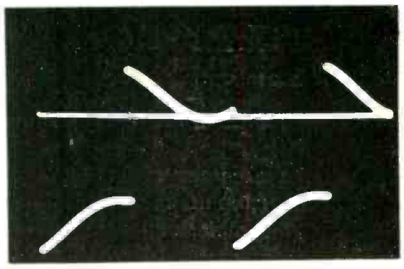


Fig. 5—60 cycle square wave with curvature present.

cases, it may be found that the curvature is caused by frequency distortion. In still other cases, a combination of hum distortion and frequency distortion may be encountered.

*Q.* What causes unsymmetrical tilt and curvature in the output waveform from a square-wave generator?

*A.* A situation of this sort is illustrated in *Fig. 6.* It is usually advisable to check the condition of the large electrolytic bypass capacitors in

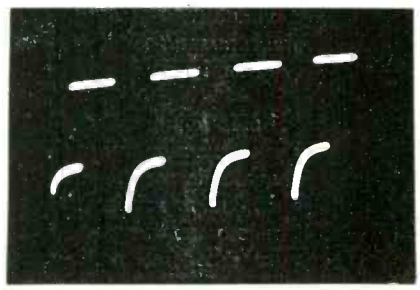


Fig. 6—Unsymmetrical tilt and curvature due to poor filters.

the instrument when this type of trouble is encountered.

*Q.* Why would the forward trace cross the zero-volt reference line in a sweep-alignment job?

*A.* Cross-over of the zero-volt reference line, as shown in *Fig. 7,* is caused by displacement of the zero-volt reference line, and by partial cancellation of the forward trace voltage in the circuits under test. This situation may be encountered, e.g., when aligning a front end; the local-oscillator voltage which is pres-
*[Continued on page 58]*

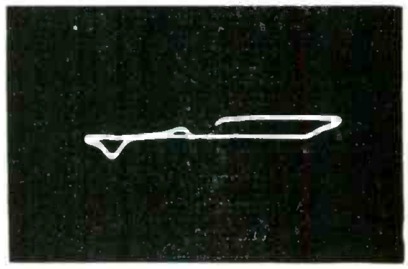


Fig. 7—Cross-over of zero refence line is shown above.

# understanding and servicing

# Horizontal Output Transformer Circuits

by Oscar Fisch

*A discussion of the operating principles of horizontal output transformers, together with procedures designed to facilitate rapid servicing and replacement.*

THIS is the first of a series of articles dealing with horizontal output transformers. The purpose of the series will be to treat this topic in all the phases which may be of interest and of use to the serviceman. Such a treatment naturally falls into two phases; first a discussion of the structure and function of the transformer and second, a study of trouble-shooting procedures in circuits in which the horizontal output transformer is involved.

It will be found that there are three major considerations to be taken into account when evaluating horizontal output transformers. These are:

1. Impedance Matching
2. High Voltage Production
3. Power Handling Capability

These will be appropriately discussed in the course of this series.

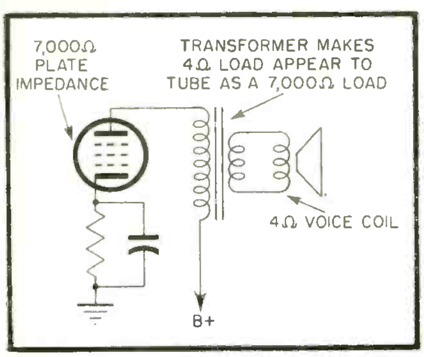



**Fig. 1A—Output transformer matching voice coil impedance to plate impedance of output tube.**

### The Impedance Matching Function

Not too many years back, a straight comparison could have been made between the horizontal output transformer and audio output transformer, so familiar to most of us. In each case, the object is to deliver as much power as possible from the output tube to the device receiving the power. Thus, in the case of a radio receiver the object would be maximum power transfer from the audio output tube to the speaker voice coil, while in the case of the TV receiver it would be from the horizontal output tube to the horizontal deflection coils.

It is a well known fact that in order to accomplish this maximum transfer of power, the impedance of the source of power and that of the load must be equal. To take a specific case, suppose a radio receiver uses a speaker with a 4 ohm voice coil, and an output tube having a plate impedance of 7000 ohms. Obviously, the 4 ohm load is nowhere near the 7000 ohm source, and if nothing were done about it, very little power would be transferred to the speaker. This is where the output transformer plays its part. While it is common knowledge that a transformer may be used to step up and step down voltages, it should be realized that it may also be used to step up or step down impedances. Thus, as indicated in *Fig. 1A*, the output transformer matches the voice coil impedance to the plate impedance of the output tube. Now that the impedances have been matched, there will be a maximum amount of power transferred from the output stage to the speaker.

The case is quite similar for the horizontal output transformer of early television days. As mentioned previously and as indicated in *Fig. 1B*, it serves a matching function, this time to match the impedance of the horizontal deflection coil to that of the horizontal output tube. Again, having obtained this match, conditions are ideal for maximum power transfer from the horizontal output stage to the horizontal deflection coil.

### High Voltage Production

However, the function of the horizontal output transformer, strictly as a matching device was doomed to a short life. Before long, a very important new function was added, namely that of simultaneously acting as a step up transformer in the high voltage power supply for the picture tube second anode. These two functions, namely impedance matching and high voltage production, remain as the most important functions in present day receivers. Because of this dual function, it is not correct to refer to this transformer simply as a horizontal output transformer, but rather as a horizontal output and high voltage transformer. Of course, no self-respecting serviceman would use such a long winded label, so we simply call them "flyback" transformers. The reason for this

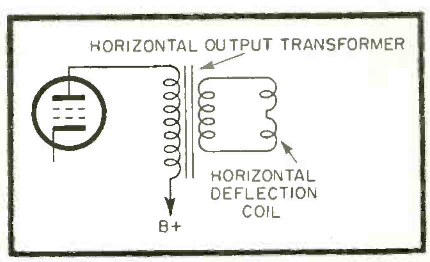



**Fig. 1B—H.O.T. matches impedance of horizontal deflection coil to that of the output tube.**

| TABLE I | |
|---|---|
| *With no DC flowing through horizontal coils of yoke* | |
| YOKE Induct.-mh | TRANSFORMER Terminal No. |
| 8 – 10 | 7, 6▲, or 8▲ & 5 |
| 10 – 14 | 8, 7▲, or 9▲ & 5 |
| 14 – 20 | 9, 8▲, or 10▲ & 5 |
| 20 – 30 | 10 & 4 |

▲ Alternate connections.

| TABLE II | |
|---|---|
| *With DC flowing through horizontal coils of yoke* | |
| YOKE Induct.-mh | TRANSFORMER Terminal No. |
| 8 – 10 | 6 or 7▲ & B+* |
| 10 – 14 | 8, 7▲, or 9▲ & B+* |
| 14 – 20 | 9, 8▲, or 10▲ & B+* |
| 20 – 30 | 10 & B+* |

* B+ or horizontal-centering control.

Fig. 4—(Tables I & II)—Connections of horizontal coils of deflecting yoke to 231T1 transformer when inductance of the horizontal coils is known.

| TABLE III | | | |
|---|---|---|---|
| *RCA YOKE type or stock No.* | *Deflecting Angle degrees* | *Horizontal Coils* | |
| | | *Inductance mh* | *DC Resistance ohms* |
| 201D12 | 50 – 57 | 8.3 | 13.5 |
| 206D1 | 66 – 70 | 10.3 | 13.2 |
| 211D2 | 66 – 70 | 13.3 | 23.5 |
| 74952 | 66 – 70 | 28.5 | 44.0 |

Fig. 5 (Table III)—This table is used in conjunction with Table II when the inductance of the horizontal deflection coils is unknown. Inductance and dc resistance of the horizontal deflection coils are tabulated for four different yokes; by comparing resistances and using Table III, inductance is estimated.

goes back to the fact that the return trace or "flyback" portion of the horizontal sawtooth wave may be considered as the input to the transformer from which the high voltage is derived.

### Other Functions

In addition, the horizontal output transformer has taken on a number of other functions, which are, however, secondary in importance to the two previously mentioned. These additional functions include width control, the provision of voltage pulses for keyed *agc* circuits, the provision of pulses for *afc* circuits, and still other functions in connection with color TV. Each of these will be discussed in the various installments to follow.

### Impedance Matching

Let us examine the impedance matching function in further detail. At the outset it must be noted that we will encounter two basic types of transformers. One of these is called the "isolated secondary" type, while the other is termed the "auto transformer" or "single tapped winding" type. For the sake of simplicity, the older or isolated secondary type of transformer will be discussed first. In glancing at a typical circuit, such as that shown in *Fig. 2*, it will be seen that from the point of view of circuitry, the basic function of impedance matching is somewhat obscured by the inclusion of circuits for damping, for obtaining a boosted B+ voltage, for width control, and for an *agc* pulse voltage. The basic circuit for matching is shown by the heavy lines.

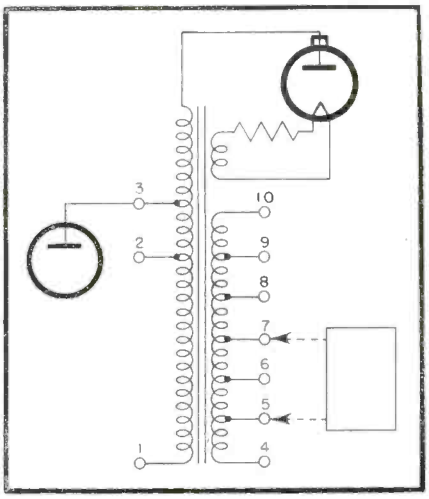


Fig. 3—RCA type 231 T1 Horizontal Output and High Voltage Transformer Schematic.

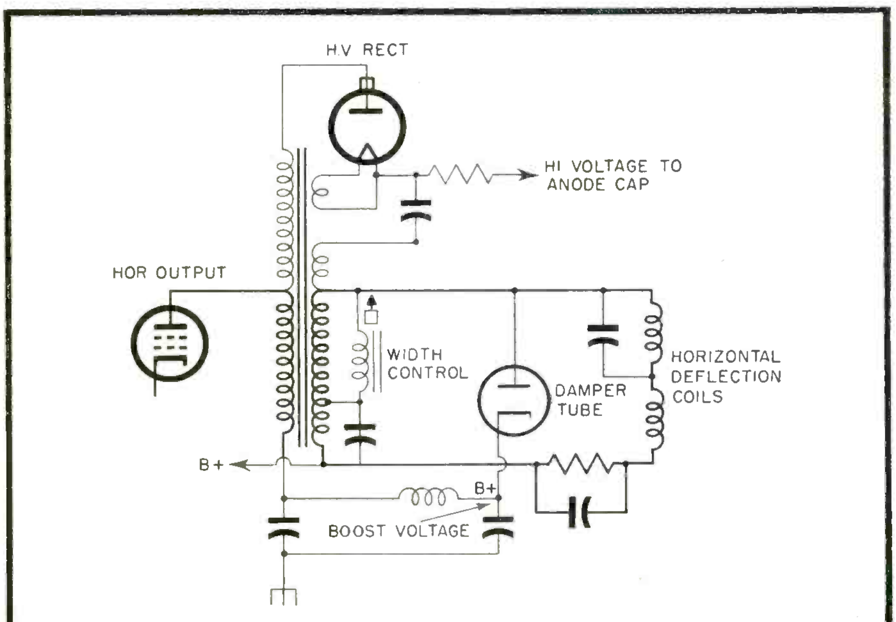


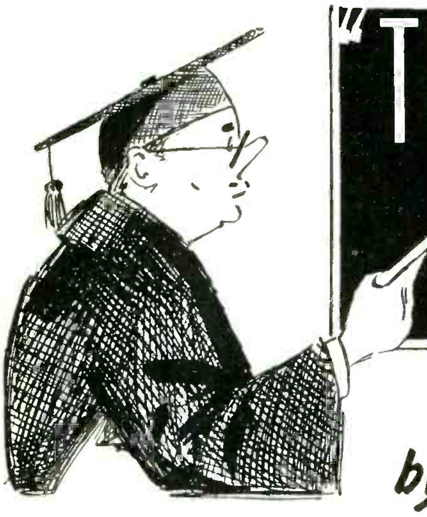
Fig. 2—Typical horizontal output circuit. Heavy lines show the basic impedance matching circuit.

Horizontal output transformers which are designed for replacement purposes are supplied with a tapped secondary, in order to accommodate yokes of different inductances. *Fig. 3* shows an RCA Type 231T1 horizontal output transformer which illustrates this point. The secondary winding is tapped as shown. Tables I and II of *Fig. 4* serve as a guide for the selection of the proper taps. Notice that two tables are supplied, one for circuits where no *dc* flows through the horizontal deflection coils and another for the case where *dc* does flow through these coils.

As an example, suppose this transformer were to be used with horizontal deflection coils having an inductance of 12 mh, in a circuit where no *dc* flows through the coils.

At this point there may be a slight fly in the ointment. Suppose you do not know the inductance of the horizontal deflection coils? How can you use Table II? To take care of this problem, the manufacturer supplies Table III of *Fig. 5*. Here the inductance and *dc* resistance of the horizontal deflection coils are tabulated for four different yokes. By comparing resistances and using Table III, the inductance may be estimated. Suppose for example, the inductance of the horizontal deflection coils is unknown. Checking with an ohm-meter gives their resistance as 15 ohms. Comparing this with the figures given Table III would indicate that the inductance would be about 8.5 mh if it were 50-57 degree yoke, or about 10.5 mh if it were a 66-70 degree yoke. Now that the inductance is known, or estimated, we may proceed as follows:

*[Continued on page 57]*



# "The Answer Man"

## by BOB DARGAN

**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.

### Muntz 21" TV Excessive Arcing

*Mr. Answerman:*

I have a Muntz 21 TV receiver on my bench that has a peculiar trouble. This trouble is something that I have never seen before. There are corona arcs all over the picture tube. If I go near the picture tube or any part of the assembly I get shocked. I have tried another picture tube with the same results. I thought perhaps the trouble might be in the yoke or associated assembly. I removed everything from the picture tube except the high voltage lead and the CRT socket. I still can draw an arc from the glass of the picture tube. I even removed the CRT socket and with only the high voltage lead connected into the naked tube I still had the same condition.

Aside from this arc on the outside surface of the picture tube I have high voltage but I'm unable to adjust the beam bender to bring in the raster. I am shocked every time I touch it. I've made all tests that I can think of but am unable to find the cause.

*L.I.C.*
*Sarasota, Florida*

Many technicians do not use a metal covered bench top that is connected to a common ground with their test equipment. This is possibly because so little alignment work is done on TV receivers these days. Probably this is the situation with respect to this service bench. Otherwise the metal shield would ground out the voltage that is appearing on the picture tube surface.

The voltage that is causing the corona and the arcs you mention is most likely *rf* and not *dc* voltage. Many technicians are misled into thinking that the arc drawn from a high voltage lead to chassis is always *dc*. This is not so as we shall soon bring out.

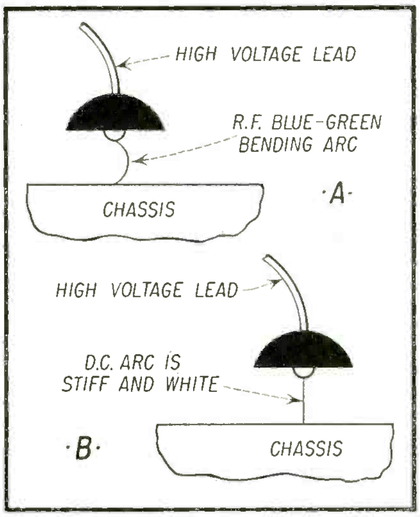



**Fig. 1—The difference between a *dc* arc and an *rf* arc.**

Considering the arc that is drawn from a high voltage lead, if the arc is stiff and white as shown in *Fig. 1B* it is a *dc* arc. If it is blueish or green it is *ac* arc.

Undoubtedly the high voltage was not measured. Being able to draw an arc to chassis you probably thought that high *dc* voltage was present. The arc under closer examination would have been found to be blueish or greenish; and not stiff but bent as shown in *Fig. 1A.*

This *rf* arc that is being obtained at the high voltage lead should have been rectified by the high voltage rectifier tube. The most probable cause of this not occuring is a short in the high voltage rectifier tube as shown in *Fig. 2.* When the high voltage rectifier tube shorts plate to filament the *rf* voltage is applied directly to the picture tube inner coating. Since the inner and outer aquadag coatings for a filter capacitance of about 500 to 1000 uuf the *rf* voltage is passed through this condenser and appears on the outside of the tube. Under this condition the glass will have *rf* voltage on it, and coming in contact with it will cause shock and possible *rf* burns. The *rf* voltage will also cause arcs from the glass to other nearby points.

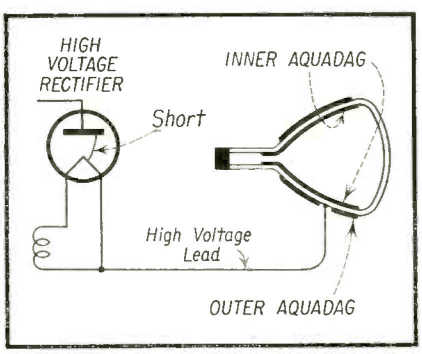



**Fig. 2—A short in the high voltage rectifier tube will cause *rf* voltage to be found on the outside of the picture tube.**

### Capehart Weak Pix

*Dear Mr. Answer Man:*

I have a Capehart chassis that is three or four years old. The receiver shows a very weak picture and there is just a little sound. It appears that the receiver won't pass signals through the *if* strip.

I have sparked the grid and plate circuits of the *if* stages and the noise can be heard plainly in the speaker and seen on the picture tube. Even though there is a faint picture in the background there is no snow as should accompany a weak signal.

I feel the trouble is in the *if* strip because the local oscillator is working and the tuner voltages are normal. Also plate and screen voltages are as called for. I have substituted tubes for all those that could cause this condition these being the 6AG5-6CB6 variety.

*F.V.*
*Chicago, Ill.*

Sparking or shock exciting circuits is in many cases a very misleading trick. It gives the impression that the particular stage will pass signals when it actually won't. The technician then searches in other sections of the receiver and thereby wastes a lot of time. The dis-

*[Continued on page 56]*

**Mfr:** Admiral **Chassis No.** 21B1

**Card No:** AD21B-19

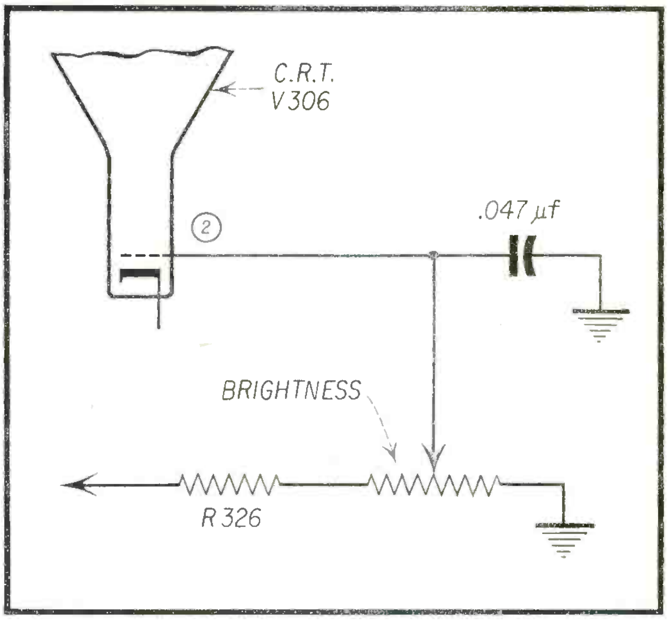
**Section Affected:** Raster

**Symptom:** Low brightness

**Cause:** Resistor *R326* increases in value

**What To Do:**

Replace: *R326* (100 K).

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**Mfr:** Admiral **Chassis No.** 21B1

**Card No:** AD21B-20

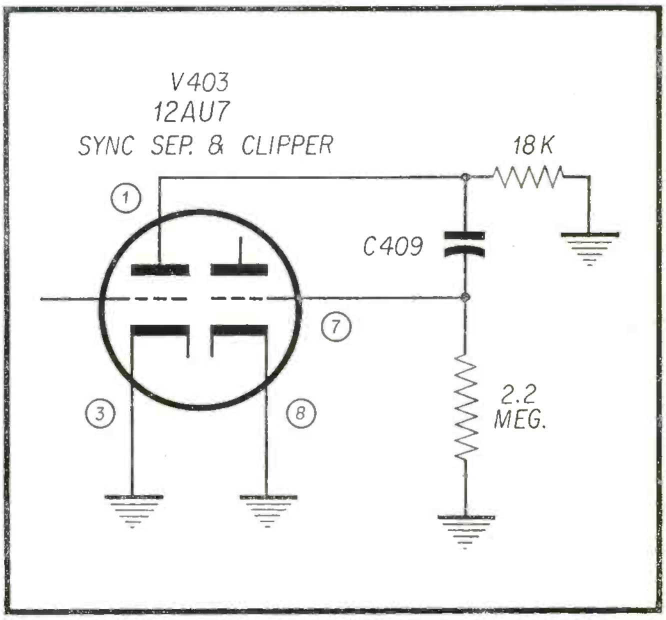
**Section Affected:** Sync

**Symptom:** No vertical and horizontal sync

**Cause:** *C409* shorted

**What To Do:**

Replace: *C409* (.02 *uf*).

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**Mfr:** Admiral **Chassis No.** 21B1

**Card No:** AD21B-21

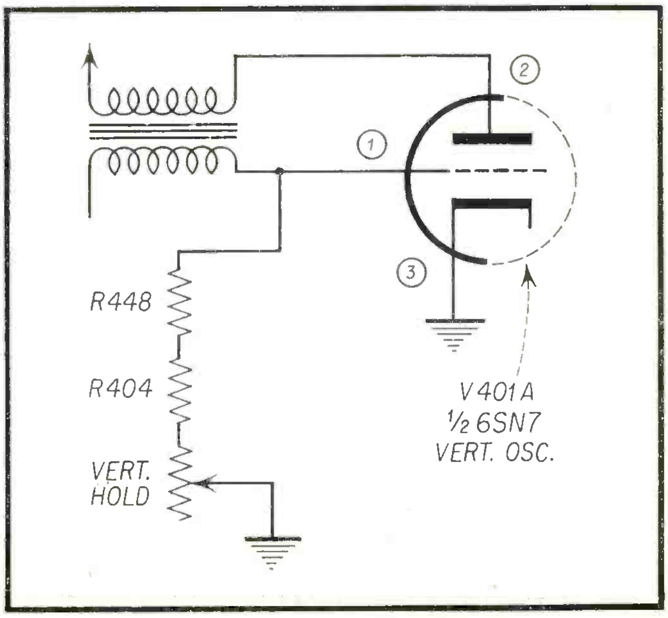
**Section Affected:** Sync

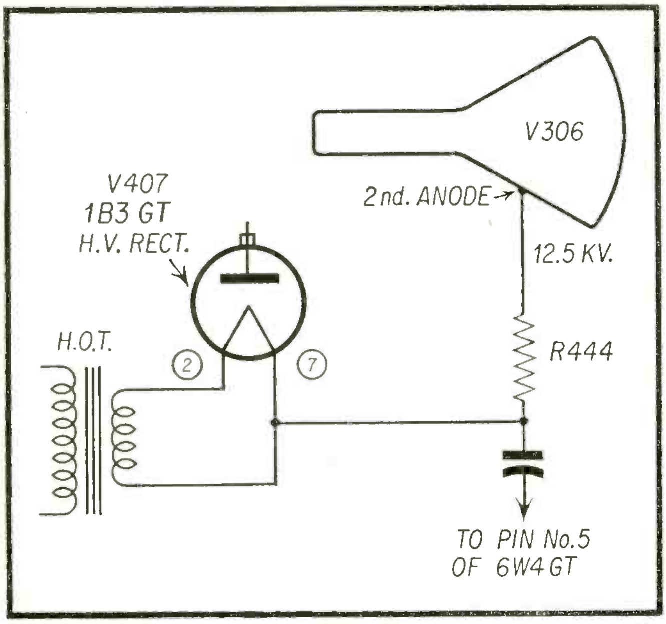
**Symptom:** Vertical hold out of range

**Cause:** Resistors increase in value

**What To Do:**

Replace: *R448* (150 K) and *R404* (1.2 meg)






**Mfr:** Admiral **Chassis No.** 21B1

**Card No:** AD21B-22

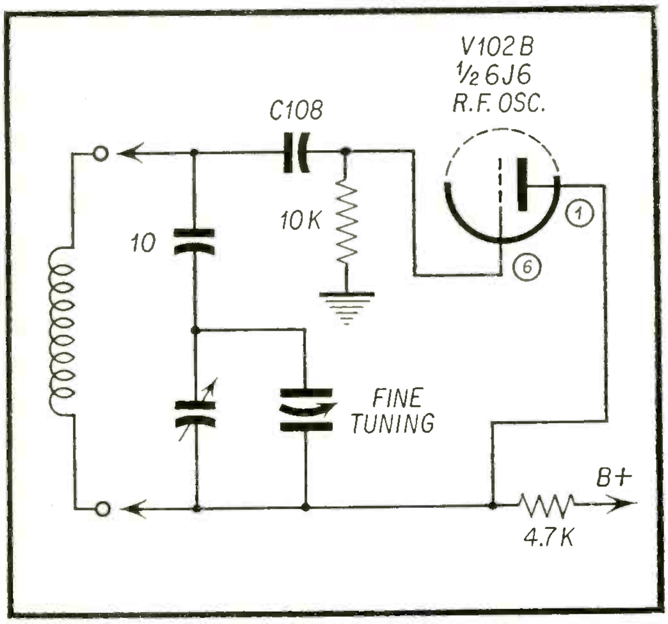
**Section Affected:** Raster

**Symptom:** Raster blooms when brightness control is advanced

**Cause:** Poor high voltage regulation caused by *R444* increasing in value

**What To Do:**

Replace: *R444* (470 K).




**Mfr:** Admiral **Chassis No.** 21B1

**Card No:** AD21B-23

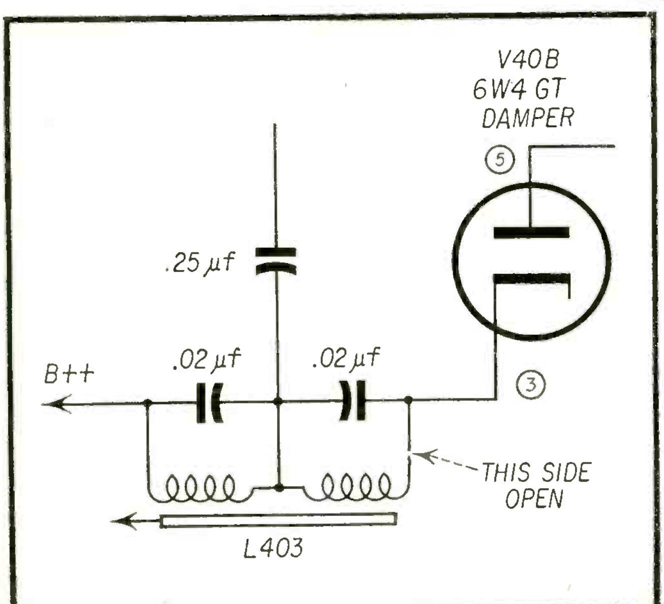
**Section Affected:** Pix & Sound

**Symptom:** Snowy pix, flicker, frying sound in speaker

**Cause:** *C108* shorts intermittently

**What To Do:**

Replace: *C108* (20 *uuf*).




**Mfr:** Admiral **Chassis No.** 21B1

**Card No:** AD21B-24

**Section Affected:** Raster

**Symptom:** No raster, no B+ at horizontal osc. plate. Voltage okay at pin #3 of damper

**Cause:** *L403* open

**What To Do:**

Replace: *L403*, Horizontal linearity coil.

**Mfr:** Muntz **Chassis No.** 17B1

**Card No:** MU17B-1

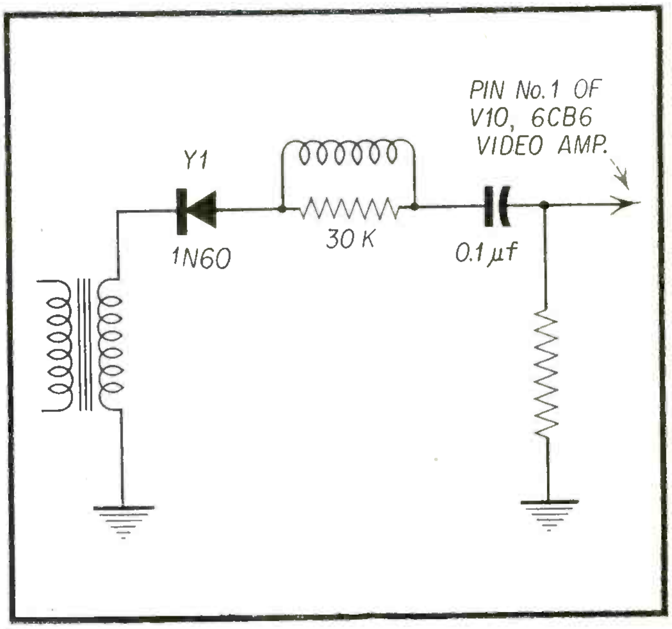
**Section Affected:** Sound and Pix

**Symptom:** No sound, no pix. Sound & pix comes in when IN60 is jumped with fingers

**Cause:** Defective video detector

**What to Do:**

Replace: Y1 (IN60) video detector.

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**Mfr:** Muntz **Chassis No.** 17B1

**Card No:** MU17B-2

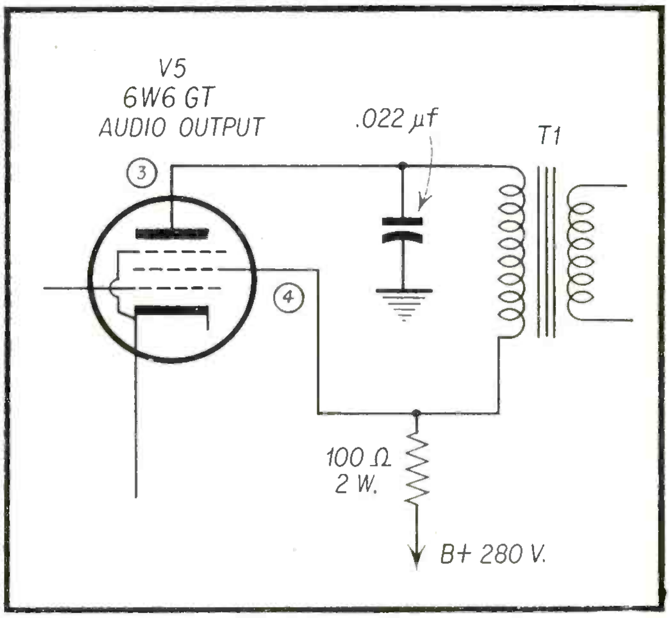
**Section Affected:** Sound

**Symptom:** No sound

**Cause:** Open primary of audio transformer

**What to Do:**

Replace: T1 audio output transformer.

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**Mfr:** Muntz **Chassis No.** 17B1

**Card No:** MU17B-3

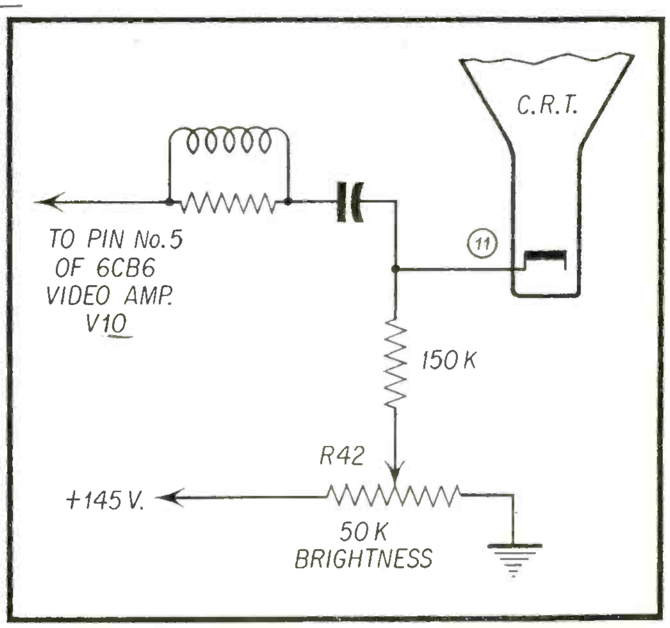
**Section Affected:** Raster

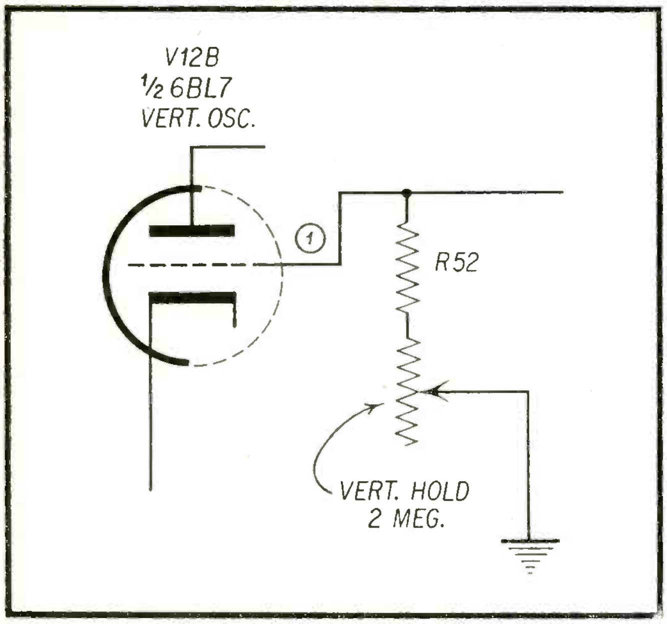
**Symptom:** No control of brightness with brightness control

**Cause:** Open brightness control

**What to Do:**

Replace: *R42* (50K) Brightness control.






**Mfr:** Muntz **Chassis No.** 17B1

**Card No:** MU17B-4

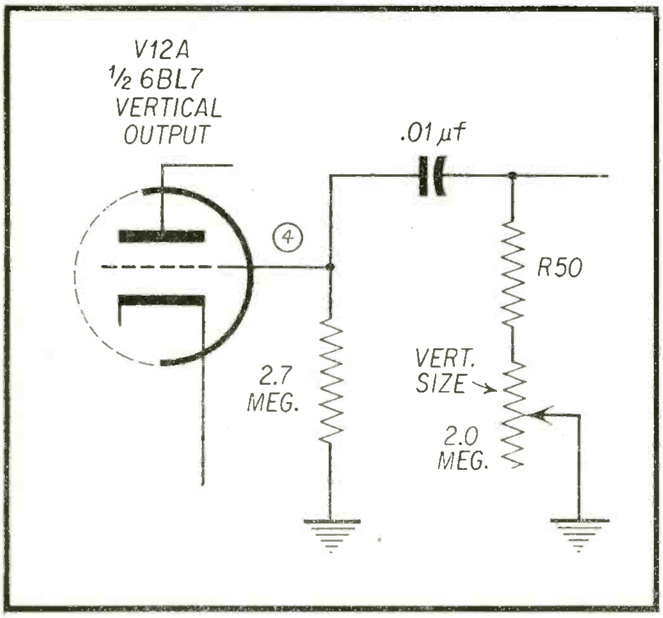
**Section Affected:** Sync

**Symptom:** Vertical hold drifts out of range

**Cause:** *R52* changes in value

**What to Do:**

Replace: *R52* (2.7 meg).




**Mfr:** Muntz **Chassis No.** 17B1

**Card No:** MU17B-5

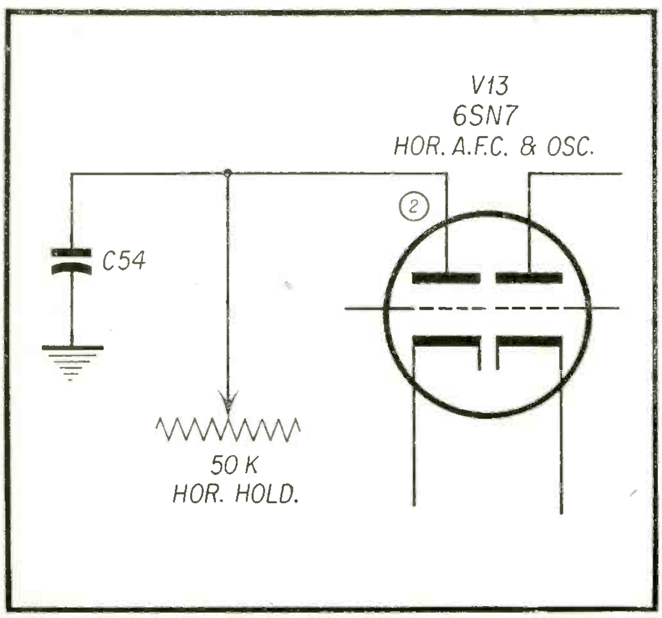
**Section Affected:** Raster

**Symptom:** Vertical size shrinks

**Cause:** *R50* increases in value

**What to Do:**

Replace: *R50* (1.2 meg).




**Mfr:** Muntz **Chassis No.** 17B1

**Card No:** MU17B-6

**Section Affected:** Raster

**Symptom:** No high voltage

**Cause:** *C54* shorted

**What to Do:**

Replace: *C54* (.047 *uf*).

**Mfr:** RCA **Chassis No.** KCS68C

**Card No:** RC68-7

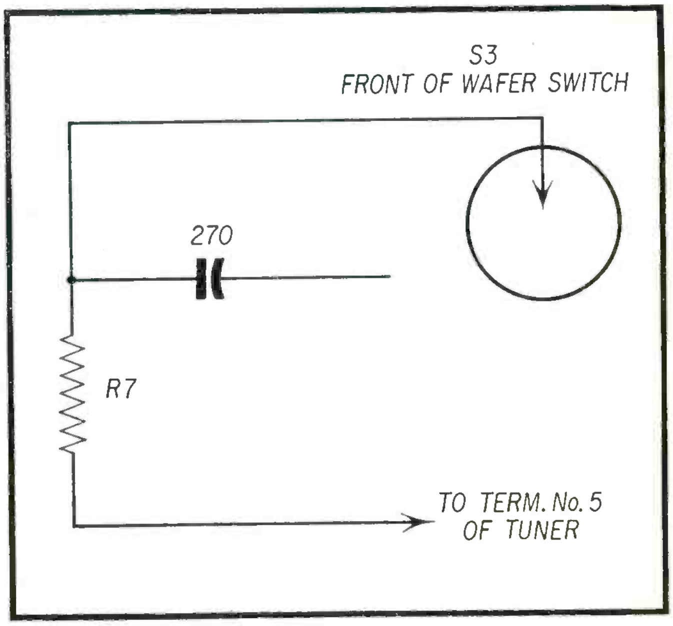
**Section Affected:** Pix and sound

**Symptom:** No pix and sound. *R7* (1K) burned

**Cause:** Shorted tube overloads resistor

**What to Do:**

Replace: *R7* (1K) and 6BQ7 (*RF*) which is probably shorted.

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**Mfr:** RCA **Chassis No.** KCS68C

**Card No:** RC68-8

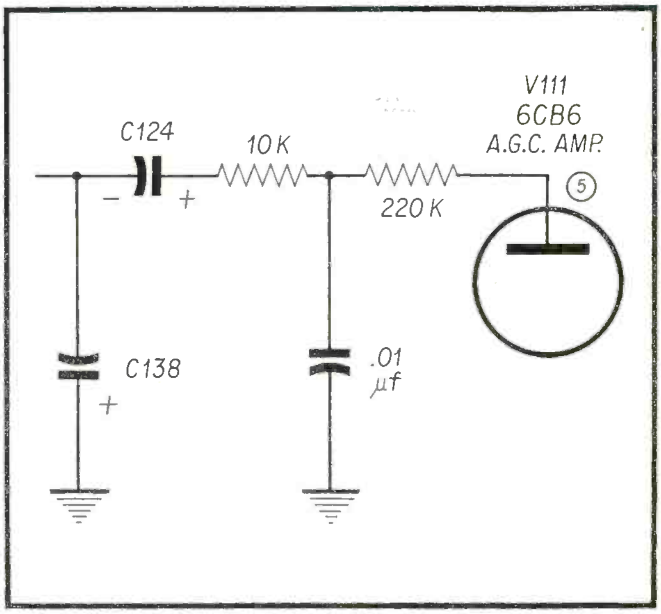
**Section Affected:** Pix and sync

**Symptom:** Black horizontal bars in pix, and erratic horizontal hold

**Cause:** Insufficient filtering caused by open filter condensers

**What to Do:**

Replace: *C124* (2 *uf*) or *C138* (2 *uf*); or both.

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**Mfr:** RCA **Chassis No.** KCS68C

**Card No:** RC68-9

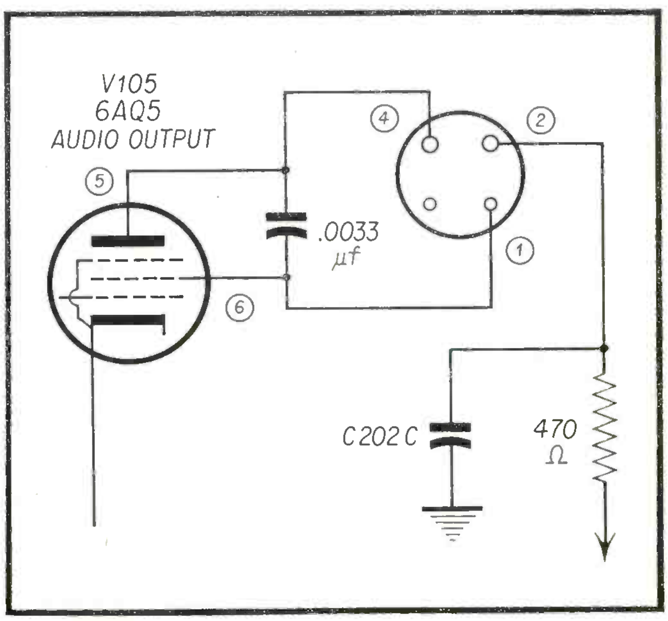
**Section Affected:** Sound

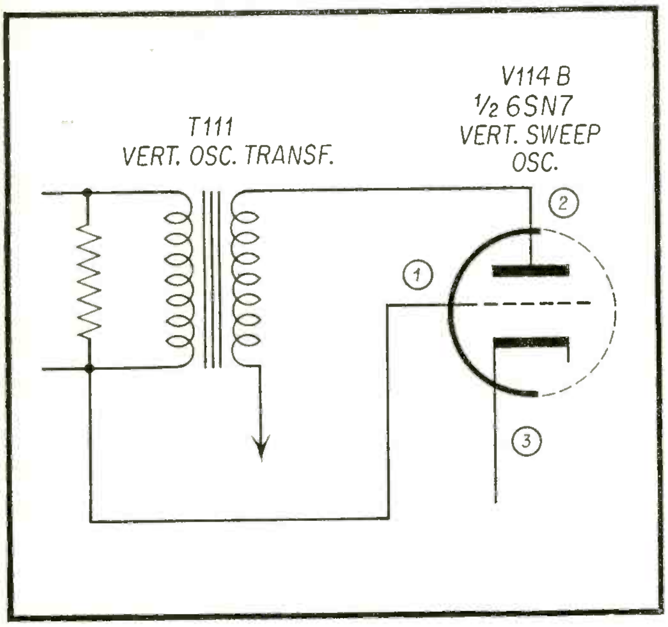
**Symptom:** Sound bars in pix, and sound raspy

**Cause:** Insufficient audio filtering caused by open condenser

**What to Do:**

Replace: *C202C* (10 *uf*).






**Mfr:** RCA **Chassis No.** KCS68C

**Card No:** RC68-10

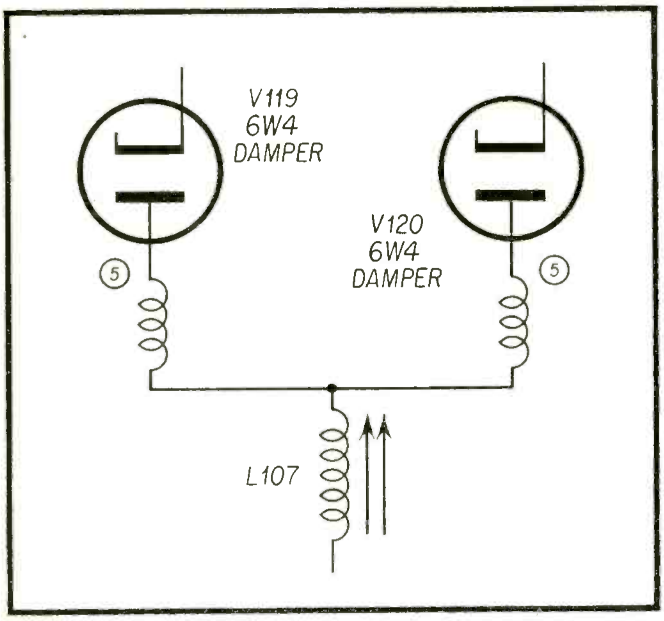
**Section Affected:** Raster

**Symptom:** No vertical sweep

**Cause:** Shorted vertical oscillator transformer

**What to Do:**

Replace: T111 (vertical osc. transformer)—shorted primary to secondary.




**Mfr:** RCA **Chassis No.** KCS68C

**Card No:** RC68-11

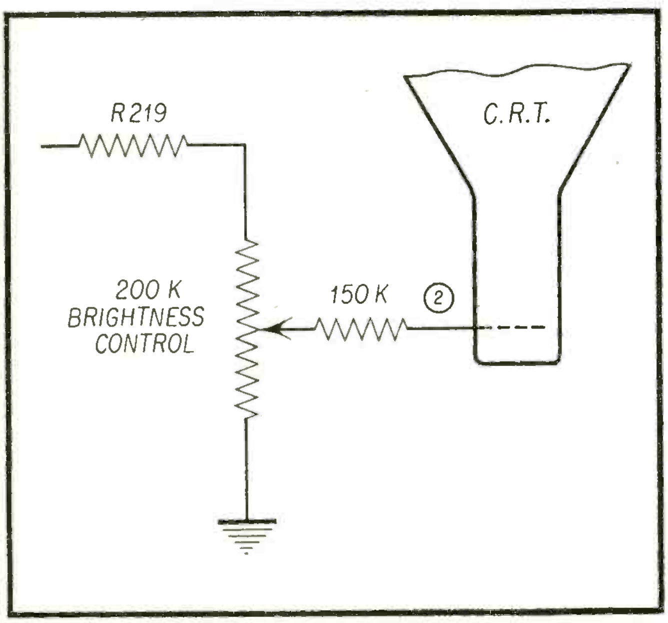
**Section Affected:** Raster

**Symptom:** Not enough width and horizontal linearity control burned

**Cause:** Shorted horizontal linearity control

**What to Do:**

Replace: *L107* (horizontal linearity control).




**Mfr:** RCA **Chassis No.** KCS68C

**Card No:** RC68-12

**Section Affected:** Raster

**Symptom:** Not enough brightness

**Cause:** Resistor *R219* increases in value

**What to Do:**

Replace: *R219* (100K).

# DUMONT

Chassis Numbers
RA-166, RA-167, RA-170, RA-171

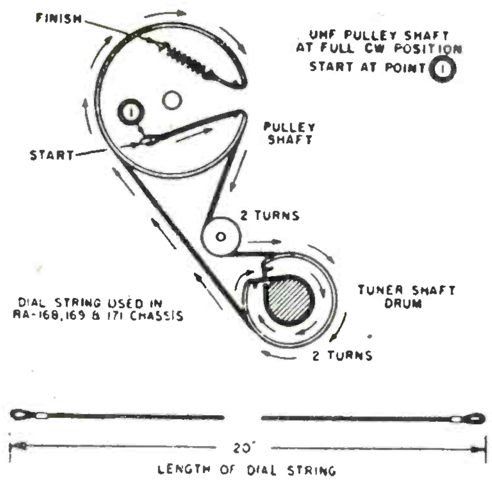
## TUBE LIST

| SYMBOL | TYPE | CIRCUIT FUNCTION |
|---|---|---|
| V101 | 6BK7 | R-F Amp. |
| V102 | 6J6 | R-F Osc. & Mixer |
| V151 | 6J6 | UHF Osc. |
| V201 | 6CB6 | 1st Video I-F |
| V202 | 6CB6 | 2nd Video I-F |
| V203 | 6CB6 | 3rd Video I-F |
| V204 | 6CB6 | 4th Video I-F |
| V205 | 6AL5 | Sound Converter, Video Detector |
| V206 | 6AU6 | Sound I-F |
| V207 | 6AL5 | Ratio Detector |
| V208 | 12AU7 | 1st & 2nd Sync Clipper |
| V209 | 12AT7 | 3rd Sync Clipper, Phase Splitter |
| V210 | 6AL5 | Hor. Phase Detector |
| V211 | 12BY7 | Video Amp. |
| V212 | 6AU6 | AGC Amp. |
| V213 | 6AB4 | Vert. Osc. |
| V214 | 6AT6 | 1st Audio Amp. |
| V215 | 6W6-GT | 2nd Audio Amp. |
| V216 | 6S4 | Vert. Deflection Amp. |
| V217 | 5Y3-GT | Power Rectifier |
| V218 | 5Y3-GT | Power Rectifier |
| V219 | 6SN7-GT | Hor. Osc. |
| V220 | 6BQ6-GT | Hor. Deflection Amp. |
| V221 | 6AX4-GT | Damper |
| V222 | 1B3-GT | H.V. Rectifier |
| V223 | 12AU7 | Noise Inverter, Voltage Regulator |
| V401 | 17HP4; 21FP4A | CRT |

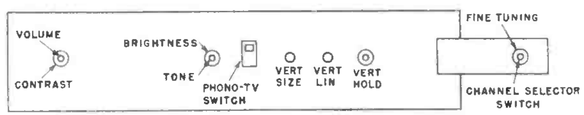
## KEY VOLTAGES

| | |
|---|---|
| B+, plate of damper, V221 pin 5 | 300V DC |
| Boosted B+, cath of damper, V221 pin 3 | 470V DC |
| Plate of Vert. Osc., V213 pin 1 | 110V DC |
| Plate of Vert. Out., V216 pin 9 | 430V DC |
| Plates of Hor. Osc., V219 pin 2 | 210V DC |
| pin 5 | 120V DC |
| Grid of Hor. Out., V220 pin 5 | —16V DC |

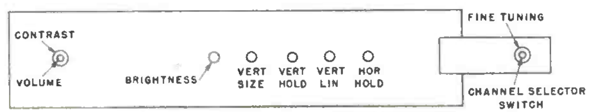
All voltages are measured with a VTVM connected between the tube pins and chassis.



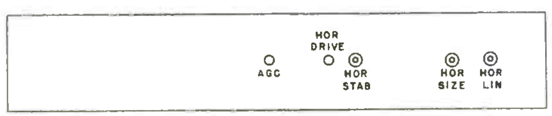

DIAL STRING USED IN RA-168,169 & 171 CHASSIS



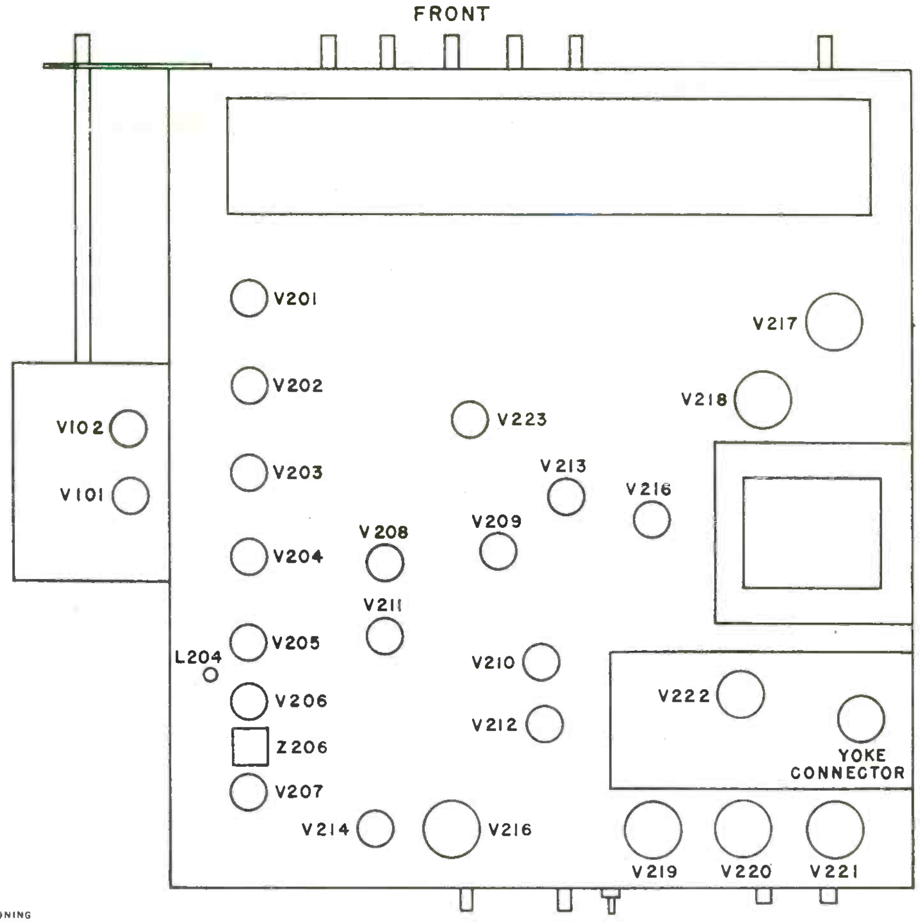

FRONT CONTROL FOR RA170,171




FRONT CONTROL FOR RA 166,167

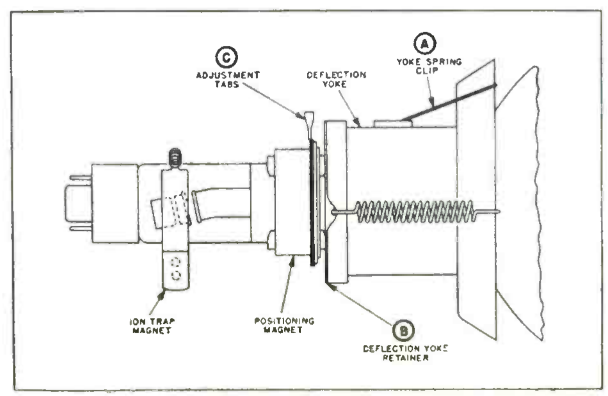



REAR CONTROLS




TUBE LOCATIONS

**TV FIELD SERVICE**
Pre-published from Rider "TV Field Service Manuals"
by Rider & Alsberg

# ADJUSTMENTS

### AGC ADJUSTMENT

The AGC control is adjusted at the factory and normally does not require readjustment in the field. However, in some cases better reception can be obtained by adjusting the control to suit the conditions in your area.

In weak signal areas the AGC control should be adjusted for best contrast and picture stability.

In strong signal areas the control should be set to prevent overloading on the strongest signal received, using the following procedure:

1. Set the front panel Horizontal Hold control for minimum whip (straight vertical wedge on test pattern) at the top of the picture.
2. Adjust the AGC control until no overload is observed.
3. Switch the Station Selector on and off channel. If this causes overload to occur reset the AGC until the overload does not reappear when switching on and off channel.

In areas where both very strong and very weak signals are received the AGC control should always be adjusted to prevent overloading on the strongest signal.

### VHF TUNER OSCILLATOR ADJUSTMENT —

Individual oscillator adjustment slugs are provided in the VHF tuner to permit precise adjustments to suit the receiving condition for each channel in your area. These slugs are set at the factory for average conditions and do not require adjustment when the receiver is installed. However, it is often possible to obtain better reception by readjusting the oscillator slugs to suit the particular conditions at the location where the receiver is installed.

The following procedure should be used:

1. Turn the Station Selector to the channel on which the oscillator is to be adjusted.
2. Remove the Fine Tuning and Station Selector knobs (and the RA-171 UHF channel dial).
3. Set the Fine Tuning control so that the flat on the shaft faces downward. The oscillator slug is accessible through the hole just to the right of the tuning shaft.
4. Using an insulated alignment tool, adjust the slug for best picture and sound.

### POSITIONING ADJUSTMENT

If the picture is not properly positioned, readjust the positioning magnet using the following procedure:

1. Push the positioning magnet assembly forward until it touches the rear of the yoke retainer.
2. Bring the protruding adjustment tabs together.
3. Rotate the entire positioning magnet assembly around the neck of the tube until the picture is properly positioned.
4. If the picture cannot be properly positioned in this manner, separate the tabs slightly and rotate the entire assembly around the tube again. Continue to repeat this step, increasing the separation of the tabs each time, until the picture is properly positioned. When this adjustment has been made, a slight readjustment of the ion-trap magnet may be necessary.

### UHF-VHF ANTENNA CROSSOVER NETWORK

If a combination UHF-VHF antenna having a single transmission line is used with RA-171 chassis, an antenna crossover network is required to terminate the transmission line at the receiver's UHF and VHF antenna terminals. Crossover network. Du Mont Part No. 88 000 681, should be used. This network is available from your Du Mont distributor.

The UHF-VHF transmission line should be connected to the terminals provided on the crossover network and the separate UHF and VHF output leads should be connected to their respective antenna terminals on the receiver.

### REPLACING THE VHF TUNER COIL STRIPS

1. Remove the four screws holding the tuner bottom cover and remove the cover.
2. Using a screw driver, push the spring finger holding the strip toward rear of tuner and lift out strip.
3. To install new strip, insert end having smaller projection into the hole in the detent plate.
4. Pry the spring finger away from the rear of drum and push the strip into place. Let spring finger snap back into place making sure that projection on end of strip seats correctly in hole in spring finger.

### CLEANING THE TUNER CONTACTS

Remove the tuner bottom cover and several of the coil strips as described in the previous paragraph. Rotate the turret so that the wiping contacts are accessible through the opening made by removing the strips. Clean the coil strip and wiping contacts with a soft cloth moistened with "No Noise."

### ADJUSTING THE TENSION OF THE WIPING CONTACTS

Remove the tuner bottom cover and several of the coil strips. Rotate the turret to permit access to the contacts through the opening thus provided. Using a small screw driver bend each contact spring until it extends approximately ⅛ inch inward from the surface of the plastic contact-mounting plate.

# DUMONT TROUBLE SHOOTING CHART

### WEAK SOUND—PIX OK

Tuner fine tuning
Vol. con.
V101, V102, V201, V202, V203, V204, V205
Sound and Vid. IF alignment L-204
Det. alignment Z-206

### NOISY SOUND—PIX OK

Vol. con.
V206, V207, V214, V215
Check sound system for loose connections
Speaker
Sound IF and Det. alignment L-204 and Z-206

### SYNC. BUZZ IN SOUND

Tuner fine tuning
A.G.C. con
V206, V207, V212, V223
Sound IF and Det. alignment

### NO RASTER—SOUND OK

Brightness con.
V211, V219, V220, V221, V222, V401
Ion trap
HV Fuse F201 (0.25 Amps)
HV xformer Hor. yoke CRT connections

### WEAK PIX—SOUND AND RASTER OK

Tuner fine tuning
A.G.C. and Contrast con.
V102, V201, V202, V203, V204, V205, V211, V212, V223

### PIX JITTER SIDEWAYS

Hor. Hold and Stabilizer con.
V209, V210, V219
Check 0.15 mf cap connected to Defl. Yoke plug
Check 12 Ω Res. connected to pin 1 and 2 of V210

### SMEARED PIX

Tuner fine tuning
A.G.C. and Contrast con.
V102, V201, V202, V203, V204, V205, V211, V212, V223
Check Vid. Det. and Amp. peaking coils
IF and RF alignment

### SOUND BARS IN PIX

Tuner fine tuning
Check Sound Trap L-207, connected to pin 7 of V211
V102, V201, V202, V203, V204
IF and RF alignment

### WEAK OR NO PIX—SOUND WEAK—RASTER OK

Tuner fine tuning
A.G.C. con.
V101, V102, V202, V203, V204, V205
RF and IF alignment

### DISTORTED SOUND

Tuner fine tuning
V102, V206, V207, V214, V215
Checked 0.02 mf cap connected to pin 5 of V215
Sound and Vid. IF alignment L-204
Det. alignment Z-206

### INSUFFICIENT RASTER WIDTH

Hor. Drive and Size con.
V217, V218, V220, V221
Check 0.005 mf and 390 mmf caps
Caps connected to pin 5 of V219
Check 0.03 mf cap. connected to terminal 3 of the H.O.T.
Low line voltage
Check 0.1 mf cap. connected to Hor. Lin. Coil

### INSUFFICIENT RASTER HEIGHT

Vertical Size and Lin. con.
V213, V216, V217, V218
Check 0.1 and 0.047 mf caps connected to pin 1 of V213
V.O.T.
Low line voltage

### NO VERT. DEFL.

V213, V216
Check 0.1 and 0.047 mf caps connected to pin 1 of V213
Vert. Defl. yoke
V.O.T.

### NO VERT. SYNC.—HOR. SYNC. OK

Vert. Hold con.
Vert. Int. Network
V208, V213
Check 0.0022 mf cap connected to pin 6 of V213

### ENGRAVED EFFECT IN PIX

Tuner fine tuning
A.G.C. and Contrast con.
V102, V201, V202, V203, V204, V205, V211, V212, V223
Check Vid. Det. and Amp. peaking coils.

# FIRESTONE

Model 13-G-135,
Code 334-3MS39B/5A6A

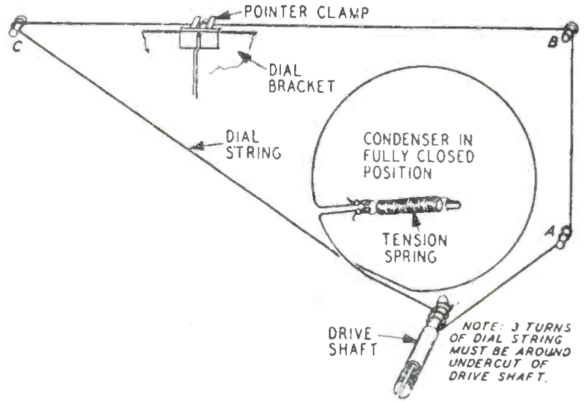
## TUBE LIST

| Symbol | Type | Circuit Function |
|---|---|---|
| | 6AF4 | UHF Osc. |
| | 6BQ7 | RF Ampl. |
| | 6J6 | VHF Osc.-Mixer |
| V1 | 6CB6 | 1st Pix IF Ampl. |
| V2 | 6CB6 | 2nd Pix IF Ampl. |
| V3 | 6CB6 | 3rd Pix IF Ampl. |
| V4 | 6AL5 | Vid. Det. DC Restorer. |
| V5 | 12AT7 | 1st. Vid. Ampl. Sync. Phase Splitter |
| V6 | 6AH6 | Vid. Output |
| V7 | 6BE6 | Sync. Sep. |
| V8 | 6SN7GTA | Vert. Osc.-Vert. Out. |
| V9 | 6AU6 | A.G.C. |
| V10 | 6AU6 | 1st. Audio-IF Ampl. |
| V11 | 6AU6 | 2nd Audio-IF Ampl. |
| V12 | 6AL5 | Rat. Det. |
| V13 | 6AV6 | 1st. Audio Ampl. |
| V14 | 6AQ5 | Audio Output |
| V15 | 6AL5 | Phase Det. |
| V16 | 6SN7GTA | Hor. Osc. |
| V17 | 6BQ7GT | Hor. Out. |
| V18 | 6AX4GT | Damper |
| V19 | 1B3GT | HV Rect. |
| V20 | 5U4 | LV Rect. |
| V21 | 21MP4 | Picture Tube |
| V22 | 5U4 | LV Rect. |

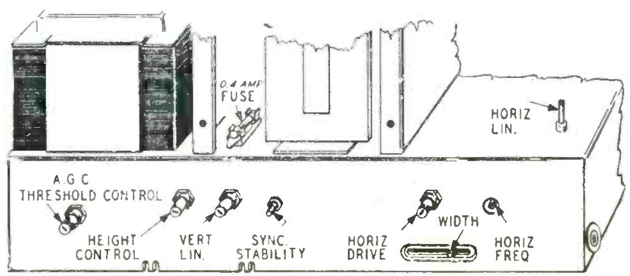
## KEY VOLTAGES

| | |
|---|---|
| B +, plate of damper, V18 pin 5 | 300 Vdc |
| Boosted B +, cath. of damper, V18 pin 3 | 530 " |
| Plate of VERT. OSC., V8 pin 2 | 75 to 200 " |
| Plate of Vert. Out., V8 pin 5 | 500 " |
| Plate(s) of Hor. Osc. V16 pin 2 | 176 to 200 " |
| pin 5 | 260 " |
| Grid of Hor. Out., V17 pin 5 | -26-to-36 " |

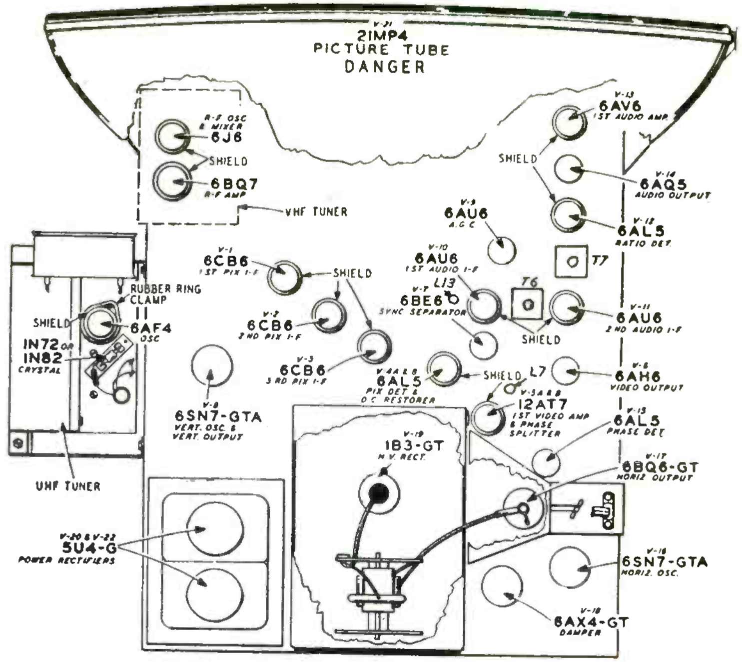
All voltages are measured with a VTVM connected between the tube pins and chassis.



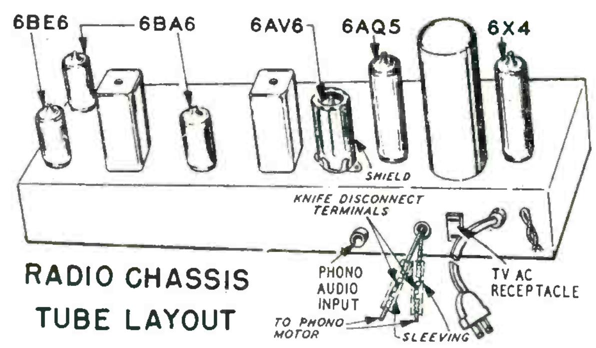

RADIO DIAL STRINGING



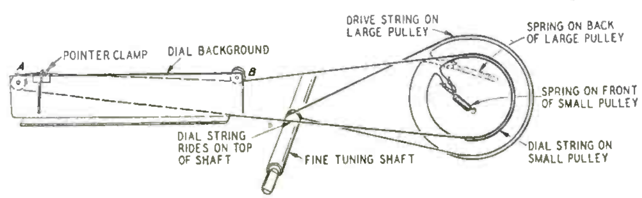

Adjustments Rear of Chassis




Tube Layout.




RADIO CHASSIS TUBE LAYOUT




UHF TUNER DRIVE CORD STRINGING

TV FIELD SERVICE
Pre-published from Rider "TV Field Service Manuals"
by Rider & Alsberg

# ADJUSTMENTS

**CHECK OF R-F OSCILLATOR ADJUSTMENTS**—The oscillator is preset at the factory and normally needs no adjustment. However, if adjustments are required, they can be made without removing the chassis from the cabinet. Remove the channel selector and fine tuning knobs from the tuning shaft.

TEST PROCEDURE:

1. Set channel selector to receive desired station.
2. Set fine tuning control in center of its range.
3. Adjust oscillator slug, with bakelite type screwdriver, for best picture resolution.
4. Repeat steps 1, 2 and 3 on all channels used.

**ADJUSTMENT OF SYNC STABILITY CONTROL**—When receiving strong (500 MV or more) signals, set hold controls so that the picture is locked in. Turn the sync control slowly clockwise until bending occurs at top of picture. Then turn the control a few degrees counter-clockwise until bending disappears. If the control is set incorrectly bending, tearing, etc., will he present and when switching from channel to channel the picture will not lock in quickly.

In weak signal areas the control should be set for maximum picture stability. In general the weaker the signal the more clockwise the control should be turned.

When the sync stability control is correctly adjusted the receiver will hold sync without tearing or rolling under even the most adverse noise conditions.

**ADJUSTMENT OF AGC THRESHOLD CONTROL**—Tune the receiver to the strongest station in the area in which the receiver will be used. While observing the picture and listening to the sound, turn the control clockwise until signs of overloading (buzz in sound, washed-out picture) appear. Then turn the control a few degrees counter-clockwise from the point at which overloading occurs. (The stronger the signal input, the more counter-clockwise this setting will be.) In areas where the strongest signal does not exceed 10,000 uv the setting will usually be maximum clockwise. With the control set correctly, the AGC will automatically adjust the bias on the R.F. and I.F. amplifiers so that the best possible signal to noise ratio (Minimum snow) will he obtained for any signal input to the receiver.

**CHECK OF HORIZONTAL OSCILLATOR ALIGNMENT**—Tune in a station and adjust the horizontal hold control until the picture falls into sync. Momentarily remove the signal by switching off channel and then back. The picture should pull into sync over a range of 90° rotation of the horizontal hold control. If in the above check the receiver fails to hold sync or the pull-in range is at the extreme end of the control, it will be necessary to make the following adjustment.

**HORIZONTAL FREQUENCY ADJUSTMENT**—With the horizontal hold control set to the center of its range of rotation, adjust the horizontal frequency control until the picture pulls into sync. Recheck the "Horizontal Oscillator Alignment."

**WIDTH, DRIVE AND LINEARITY ADJUSTMENTS**—While receiving a signal from a station (with picture locked in sync) turn contrast control fully counter-clockwise, turn the brightness control up so that the picture appears washed out. Adjust width control until the picture fills the mask. Turn the horizontal drive control clockwise until white bars appear in the left center portion of the raster, then turn counter-clockwise until the white bars just disappear. This adjustment will allow the horizontal system to operate at maximum efficiency. Adjust horizontal linearity control for best linearity. If adjustment of the horizontal drive or horizontal linearity is required, it usually will be necessary to recheck the horizontal oscillator alignment. If adjustment of the horizontal linearity control is required, readjustment of the horizontal drive control will be necessary. Adjust the picture centering device to align the picture with the mask.

**CENTERING ADJUSTMENT** — If horizontal or vertical centering is required, adjust each ring in the centering device until proper centering is obtained. If a clamp type centering device is used, rotate the device to the left or right and turn the knob located at the top of the device until the picture is centered correctly.

**ION TRAP MAGNET ADJUSTMENT** — The ion trap magnet should be positioned close to the base of the tube with the magnet of the ion trap on the side where the electron gun is nearest the glass neck of the picture tube. From this position adjust the magnet by moving it back and forth and at the same time rotating it slightly around the neck of the picture tube until the brightest raster is obtained on the picture screen. Reduce the brightness control setting until the raster is slightly above average brilliance. Readjust the ion trap magnet for maximum raster brilliance and best focus. MAXIMUM RASTER BRILLIANCE AND BEST FOCUS OCCUR AT THE SAME POINT. Do not sacrifice brilliance for best focus. The ion trap magnet adjustment is a very critical one especially with the electrostatic type zero focus picture tube. Consequently, great care should be taken to make sure that the ion trap magnet is correctly adjusted.

# FIRESTONE TROUBLE SHOOTING CHART

**NO VERT. DEFL.**
- V8
- Check 0.047 and 0.1 $\mu f$ caps. connected to red lead of Vert. Osc. Trans.
- Vert. Osc. and Out. Trans.
- Vert. Defl. coils (yoke)

**NO VERT. SYNC.—HOR. SYNC. OK**
- Vert. Hold con.
- Vert. Int. network
- V5, V7, V8, V9
- Sync. Stability Con.
- Check 0.0047 $\mu f$ and 4700 $\mu\mu f$ cap. connected to Vert. Osc. Trans.

**NO HOR. OR VERT. SYNC.—PIX SIGNAL OK**
- V5, V7, V9
- Check 0.01 $\mu f$ cap. connected to pin 7 of V7
- AGC Threshold and Sync. Stability Cow.

**NO HOR. SYNC.—VERT. SYNC. OK**
- Hor. Hold and Freq. Con.
- V15, V16, V17
- Check 430 $\mu\mu f$ cap. connected to pin of V16

**DISTORTED SOUND**
- Tuner fine tuning
- Check Tuner Tubes
- V10, V11, V12, V13, V14
- Check printed Circuit connected to pin 7 of V14
- Sound and Vid. IF alignment L13, T6
- Det. Alignment T7

**NO SOUND—PIX OK**
- Tuner fine tuning
- Vol. con.
- V10, V11, V12, V13, V14
- Speaker (open voice coil or defective connection)
- Sound and Vid. IF alignment L13, T6
- Det. alignment T7

**SYNC. BUZZ IN SOUND**
- Tuner fine tuning
- Check Tuner tubes
- V4, V5, V10, V11, V12
- AGC Threshold Con.
- Sound IF and Det. alignment L13, T6 and T7

**ENGRAVED EFFECT IN PIX**
- Tuner fine tuning
- Contrast con.
- Check Tuner tubes
- V1, V2, V3, V4, V5, V6, V9, V21
- Check 0.047 $\mu f$ cap. connected to pin of V6
- Check Vid. Det. and Amp. peaking coils

**VERT. BARS**
- Hor. Drive con.
- V17, V18
- Check 56 $\mu\mu f$ cap. connected to yoke terminals
- Defl. yoke ringing

**PIX BENDING**
- Hor. Hold and Freq. Con.
- V9, V15, V16, V17
- Check 0.01 $\mu f$ cap. and 6.8K$\Omega$ resistor connected to pin of V15
- AGC Threshold Con.
- Sync. Stability Con.

**INSUFFICIENT BRIGHTNESS**
- Ion trap
- Brightness and Hor. Drive con.
- V17, V18, V19, V21
- Low line voltage

**EXCESSIVE RASTER (PIX SIZE)**
- Hor. Drive con.
- Hor. and Vert. Size con.
- V17, V18, V19, V21
- Check 0.047 $\mu f$ and 1000 $\mu\mu f$ caps. and 12K$\Omega$ resistor connected to pin 4 of V17

**RASTER BLOOMING**
- Hor. Drive con.
- V17, V18, V19, V21
- Check HV Filter cap.
- Check 1Meg.$\Omega$ Res. connected to HV Filter cap.

**INSUFFICIENT RASTER WIDTH**
- Hor. Drive and Size con.
- V16, V17, V18, V20, V22
- Check 200 and 330 $\mu\mu f$ caps. connected to pin 2 of V16
- Hor. Out. trans.
- Low line voltage

**POOR HOR. LIN.**
- Hor. Lin. and Drive con.
- V17, V18
- Check 0.047 and 0.1 $\mu f$ caps. connected to Hor. Lin. Coil
- Hor. Out. trans.

**POOR VERT. LIN. (11, 12)**
- Vert. Size and Lin. con.
- V8
- Check 0.047 and 0.1 $\mu f$ caps. connected to red lead of Vert. Osc. Trans.
- Check 100 $\mu f$ Elec. cap. connected to pin 6 of V8
- Vert. Out. trans.

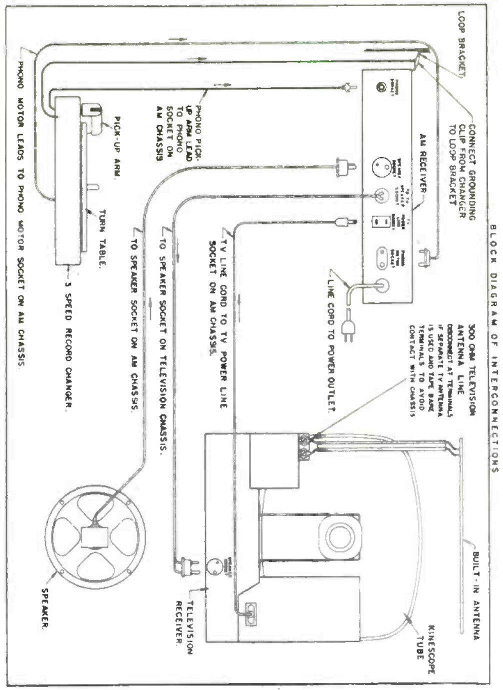
**PIX JITTER SIDEWAYS**
- Hor. Hold and Freq. Con.
- V15, V16, V17
- Check 1000 $\mu\mu f$ cap. connected to pin 2 and 1 of V15

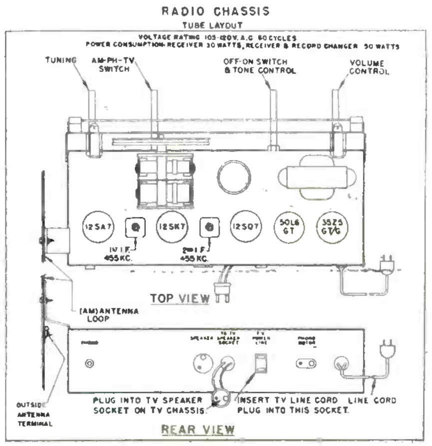
**PIX JITTER UP & DOWN**
- Vert. Hold and Contrast con.
- AGC Threshold Con.
- V8, V9
- Check 0.0047 $\mu f$ and 4700 $\mu\mu f$ cap. connected to Vert. Osc. Trans.

# OLYMPIC
## TM-TN Chassis

### TUBE LIST

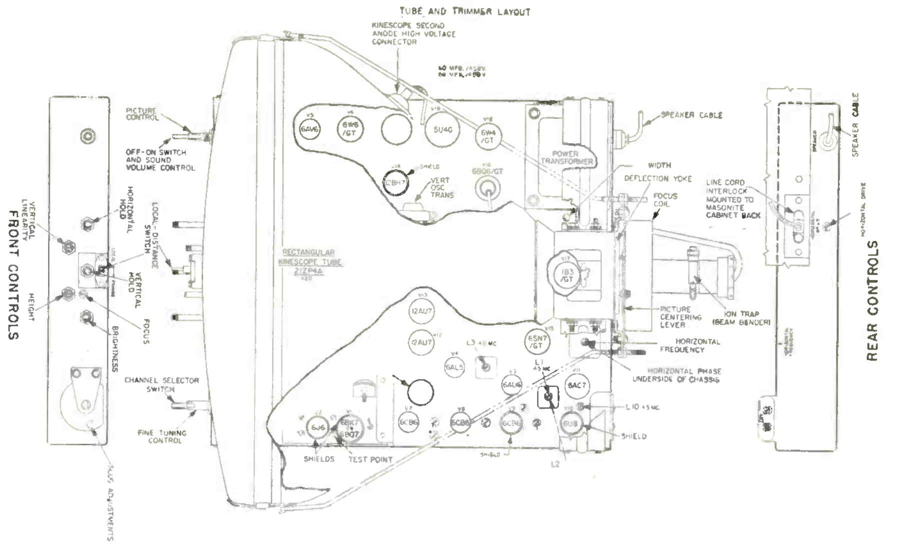
| SYMBOL | TYPE | CIRCUIT FUNCTION |
|---|---|---|
| V1 | 6BK7 or 6BQ7 | RF Amp. |
| V2 | 6J6 | RF Osc. Con. |
| V3 | 6AU6 | 2nd Sound IF Amp. |
| V4 | 6AL5 | Ratio Detector |
| V5 | 6AV6 | Audio Amp. |
| V6 | 6W6/GT | Audio Out. |
| V7 | 6CB6 | 1st Video IF Amp. |
| V8 | 6CB6 | 2nd Video IF Amp. |
| V9 | 6CB6 | 3rd Video IF Amp. |
| V10A-½ | 6Z8 | Video Detector, AGC |
| V10B-½ | 6Z8 | 1st Sound IF Amp. |
| V11 | 6AC7 | Video Amp. |
| V12 | 12AU7 | Sync Separator & Clipper |
| V13 | 12AU7 | Sync Amp., Noise Clipper |
| V14 | 12BH7 | Vert. Osc., Amp. |
| V15 | 6SN7/GT | Hor. Osc. & AFC |
| V16 | 6BQ6/GT | Hor. Out. |
| V17 | 1B3/GT | High Voltage Rect. |
| V18 | 6W4/GT | Damper |
| V19 | 5U4/G | Power Rectifier |
| V20 | 17HP4 | Picture Tube — TM Chassis |
| | 21ZP4A | Picture Tube — TN Chassis |



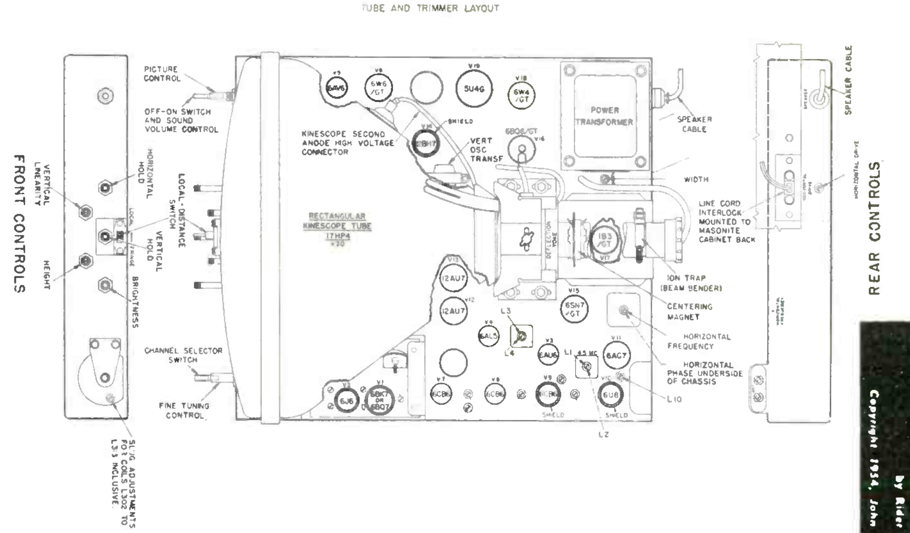




## KEY VOLTAGES

| | |
|---|---|
| B+ plate of damper, V18 pin 5 | 300V DC |
| Boosted B+, cath. of damper, V18 pin 3 | 550V DC |
| Plate of Vert. Osc., V14 pin 6 | 120V DC |
| Plate of Vert. Out., V14 pin 1 | 520V DC |
| Plates of Hor. Osc., V15 pin 2 | 140V DC |
| pin 5 | 250V DC |
| Grid of Hor. Out., V16 pin 5 | —18V DC |




*TN Chassis*




*TM Chassis*

TV FIELD SERVICE
Pre-published from Rider "TV Field Service Manuals"
by Rider & Alsberg

# ADJUSTMENTS

### ADJUSTMENT OF HORIZONTAL OSCILLATOR

Allow set to warm up to operating temperature.

Select station operating normally.

Short out horizontal Phasing Coil Terminals C and D.

Set horizontal hold control at Maximum clockwise rotation.

Adjust horizontal frequency screw until picture falls into sync. Turning the horizontal frequency screw clockwise lowers the frequency (bars sloping downward to left). Turning the screw counter-clockwise increases frequency (bars sloping downward to right).

Turn horizontal hold control through entire range. Picture should fall out of sync at either end of rotation. At full clockwise rotation blanking bar or jitter should be evident. At full counter-clockwise position picture should fall out to 4½ to 5 bars sloping downward to the left. (If picture stays in sync the tuner switch should be rotated to interrupt signal momentarily.)

Caution: It is important that the picture be centered in the mask properly with the horizontal hold control in the mid-position, otherwise the set user may attempt to center the picture by means of the hold control. Under this condition the control may be on "edge" and impulse noise or change of camera will cause the picture to fall out of synchronization. It should also be noted that some manufacturers types of 6SN7GT may perform better than others in the horizontal oscillator socket and excessive drift of the horizontal oscillator circuit may be caused by a weak or defective 6SN7GT **tube.**

### HORIZONTAL WIDTH & DRIVE ADJUSTMENT

The Horizontal Width Control Coil and the Horizontal Drive Trimmer should be adjusted simultaneously. The Horizontal Drive Trimmer should be screwed tight (clockwise) and then back off (counter-clockwise) until Horizontal Drive bars appear. Then turn Drive Trimmer in again (clockwise) until drive bars just disappear. (Note: In some sets no horizontal drive bars will appear regardless of Drive Trimmer adjustment. In these sets the trimmer should be set at 2 turns out (counter-clockwise) from tight.) After the Drive Trimmer has been set, the width coil should be adjusted for proper picture width to fill the mask aperture.

Important: The horizontal oscillator frequency must be checked for proper range of horizontal control after any adjustment of horizontal drive. Any adjustment of the horizontal drive trimmer will usually require resetting of the horizontal frequency adjustment coil.

### CENTERING MAGNET ADJUSTMENT (17"—"TM" ONLY)

The centering magnet consists of two magnetic rings located on the neck of the picture tube. Each ring has a small tab and adjustment is accomplished by rotating these tabs around the neck of the tube. The tab which extends horizontally will affect the vertical position of the picture and the tab which extends vertically will affect the horizontal position of the picture. The two magnetic rings have their maximum affect when they are farthest apart but should never be more than 45° apart to avoid neck shadow.

### CENTERING ADJUSTMENT (21"—"TN"—ONLY)

The 21" receivers are electromagnically focused and centering is accomplished by adjusting an arm which extends vertically from the front of the focus coil. This arm may be rotated, for a limited distance, around the neck of the tube and may also be moved up and down. The physical setting of the focus coil itself in relation to the neck of the tube will also affect picture position. Before the adjustment arm is used, it should be ascertained that (1) the focus coil is at right angles to the neck of the tube (by setting the two nuts which tighten the tube support rods) and (2) that the neck of the tube is directly centered in the focus coil (by loosening the two mounting screws on either side of the focus coil and sliding up or down).

Note: Remove corrugated shipping clip from neck of pix tube before attempting adjustments.

### HEIGHT AND VERTICAL LINEARITY ADJUSTMENTS

For best results it is preferable that these adjustments be made on a transmitted test pattern; although saisfactory results can be obtained from an active picture.

Both controls will affect the height and linearity of the picture and therefore must be adjusted simultaneously. It will be found that the Height Control has a tendency to affect the bottom of the picture more than the top and the linearity control just the reverse.

Note: It is advisable that both height and width of the picture be adjusted to a size slightly larger than the mask opening, so that during periods of low line voltage adequate picture size is maintained.

### ION TRAP MAGNET ADJUSTMENT

Turn the brightness control fully clockwise and the contrast control fully counter-clockwise. Adjust the ion trap magnet by moving it forward or backward and at the same time rotating it slightly around the neck of the kinescope until the raster on the screen is brightest. Of two possible positions, use the one nearest the tube base. Reduce the brightness control setting until the raster is slightly above average brilliance. Adjust focus control until the line structure of the raster is clearly visible (sharp). Readjust the ion trap magnet again for maximum raster brilliance. The final touches on this adjustment should be made with the brightness control at the maximum position with which good line focus can be maintained. Never correct for a shadowed raster with the ion trap.

# OLYMPIC TROUBLE SHOOTING CHART

### NO RASTER—SOUND OK

Brightness control
HV fuse (0.25 Amp.)
Ion trap
V15, V16, V17, V18, V20
HV xformer Hor. yoke CRT connections

### WEAK PIX—SOUND AND RASTER OK

Tuner fine tuning
Contrast control
Local-Distance Switch
V7, V8, V9, V10, V11

### POOR HOR. LIN.

Hor. Drive control
V16, V18
Check 0.1 mf cap. connected to pin 5 of V18
Hor. Out. Trans.

### POOR VERT. LIN.

Vert. Lin. and Height controls
V14
Check 0.25 and 0.05 mf caps. connected to blue lead of Vert. Osc. Trans.
Check 125 mf Elect. cap. connected to pin 3 of V14

### PIX JITTER SIDEWAYS

Hor. Hold, Freq. and Phase controls
V13, V15
Check 2-47 mmf mica caps. connected in series to pin 1 of V15

### SMEARED PIX

Tuner fine tuning
Contrast control
Distance-Local Switch
V2, V7, V8, V9, V10, V11
Check Vid. Det. and Amp. peaking coils
IF and RF alignment

### POOR PIX DETAIL

Tuner fine tuning
Focus control
V7, V8, V9, V10
Local-Distance Switch
IF and RF alignment

### ENGRAVED EFFECT IN PIX

Tuner fine tuning
Contrast control
Local-Distance Switch
V2, V7, V8, V9, V10, V11, V20
Check Vid. Det. and Amp. peaking coils

### VERT. BARS

Hor. Drive control
V16, V18
Check 56 mmf cap. connected to terminal 3 of yoke
Defl. yoke ringing

### PIX BENDING

Hor. Hold, Freq. and Contrast controls
V12, V13, V15
Check 0.02 and 0.05 mf caps. connected to pin 3 of V15

### INSUFFICIENT BRIGHTNESS

Ion trap
Brightness and Hor. Drive controls
V11, V16, V17, V18, V19, V20
Check 0.1 mf cap. connected to yellow lead connected to CRT
Low line voltage

### INSUFFICIENT RASTER WIDTH

Hor. Drive and Width controls
V16, V18, V19
Check 2-0.001 mf caps. connected to terminal "D" of Hor. Osc. Trans.
Check 0.05 mf cap. and 22K Ω res connected to pin 4 of V16
Low line voltage
Hor. Out. Trans.

### INSUFFICIENT RASTER HEIGHT

Vert. Height and Lin. controls
V14, V19
Check 0.25 and 0.05 mf caps. connected to blue lead of Vert. Osc. trans.
Vert. Out. Trans.
Low line voltage

### NO VERT. DEFL.

V14
Check 0.25 and 0.05 mf caps. connected to blue lead of Vert. Osc. Trans.
Vert. Defl. yoke
Vert. Out. Trans. and Vert. Osc. Trans.

### NO VERT. SYNC.—HOR. SYNC. OK

Vert. Hold control
V13, V14
Vert. Int. Network
Check 0.0047 mf cap. connected to pin 7 of V14

### NO HOR. SYNC.—VERT. SYNC. OK

Hor. Hold, Freq. and Phase controls
V15, V16
Check 180 mmf cap. connected to pin 4 of V15

### NO SOUND—PIX OK

Tuner fine tuning
Volume control
V3, V4, V5, V6, V10
Speaker (open voice coil or defective connection)
Sound and Vid. IF alignment L1-L2
Det. alignment L3-L4


Frank J. Moch greets RCA contingent.

Sandy Cowan, RTSD Publisher congratulates Frank Moch.

# 5th NATESA Convention and Exhibition

THE 5th NATESA Convention & Exhibition has taken its place in history. It certainly was a grand success since it did serve the purpose of bringing key service people from across the nation and points beyond the borders.

A number of new Affiliates were officially voted membership. Among them the Television Bureau of Elkhart, Indiana; King County Radio & TV Service Ass'n of Seattle, Wash.; TV Technicians Ass'n of Joplin, Mo.; Massillon & Western Stark County TV Ass'n of Ohio; Radio & TV Technicians of Boise, Idaho; Tulsa TV Service Ass'n of Okla.; TV Service Guild of Dayton, Ohio; and the Radio & TV Technicians Guild of Alabama, and others. Members in Venezuela and Canada were voted in. New officers were voted in and are as follows: Pres. Frank J. Moch, Chicago, Ill.; Eastern V.P. Ferdinand Lynn, Buffalo, N. Y.; East Central V.P. Fred Colton, Columbus, Ohio; West Central V.P. Vincent Lutz, St. Louis, Mo.; Western V.P. Horace Collins, Boise, Idaho; Eastern Sec'y Milton Klarsfeld, Albany, N. Y.; East Central Sec'y Chas. N. Burns, Memphis, Tenn.; West Central Sec'y William Briza, Omaha, Neb.; Western Sec'y Jim Failing, Greeley, Colo.; Secretary General Walt Niswonger, Kansas City, Mo.; Treasurer Bertram Lewis, Rochester, N. Y.

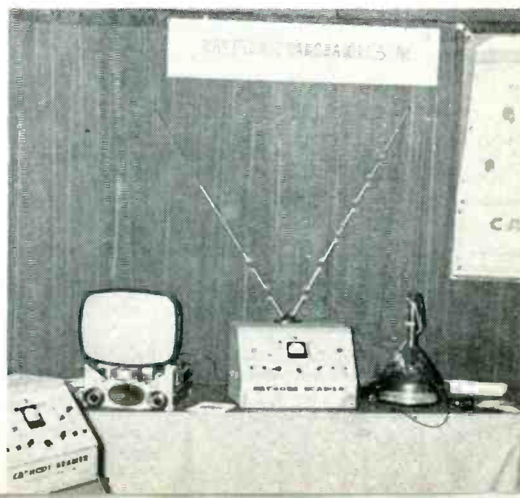
Among business conducted was the furtherance of professional Standard of Classifications; resolutions calling upon set manufacturers to accept the well known fact that independent service is fully qualified to render retail service on all electronic equipment, including color TV, and to refrain from invading this market; resolution calling for recognition of historical patterns of distribution; resolution calling for a reappraisal of the UHF situation and other equally important subjects. These resolutions were reinforced by actions to implement the decision of independent service.

Doug Carpenter, Chief Engineer of JFD talks on antennas.

Above: Jim Early, Field Engineer of Sylvania delivering talk.

Below: Howard Harwood, Adv. Mgr. of Shure line of replacement cartridges greets one of the NATESA members at Shure booth.


Below: Raytronic Laboratories CRT tester and rejuvenator.



# A New Cathode Ray Tube Tester


by
**Morton Greenberg**
*Chief Engineer, Authorized Manufacturers Service Co., Inc.*

**The ease and rapidity of operation which must be inherent in automatic electronic testing devices is reddily apparent in the design of this Authorized CRT Tester.**

THE problem of testing Cathode Ray Tubes, as used in Television receivers, has been resolved in many ways. Essentially, the devices developed have been patterned from the usual field service receiving tube testers.

The instrument to be described is the Model #101 Cathode Ray Tube Tester and is manufactured by Authorized Manufacturers Service Co., Inc., Brooklyn, N. Y. This device is unusual in that it performs a combination of tests simultaneously. All the normal field service test requirements are met rapidly and reliably with a minimum of control settings and a maximum of operational ease and interpretation. Tube troubles are indicated and exactly located immediately without reference to charts, dials or other paraphernalia associated with ordinary tube testers.

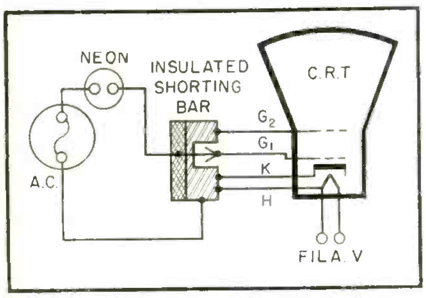



Fig. 1—Elementary short indicator.

Field service tube testers are required to indicate the condition of a tube with regard to shorts, opens, emission, microphonics, gas and intermittents. All these tests, with the exception of emission, gas and some types of intermittents, may be made using a suitable form of neon indicator circuit. An elementary circuit is shown in *Fig. 1*. The switch position compares the element under observation as against all the other elements tied together. A short between any two elements will cause the neon tube to light up when the switch is in either of the positions designated by the shorted elements.

*Figure* 2 shows a simple emission test circuit. The microammeter will indicate the relative cathode emission current with voltages supplied to the electrodes of the tube under test according to the manufacturers' ratings for the tube.

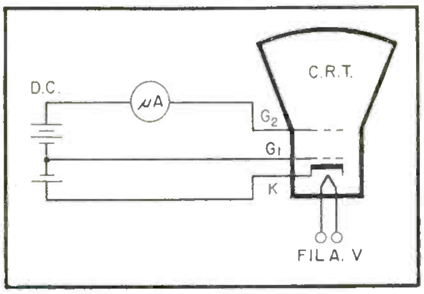



Fig. 2—Simple emission test.

Since an emission test is quantitative and not qualitative, any emission above a certain amount, as specified for the tube type being tested, is an indication that the tube has passed this test. It must not be inferred that, since the tube under test shows a low cathode emission current, although still within the "GOOD" limits, that the tube is going bad. Emission will vary over a large range for good tubes and will properly perform the design function. A "life test" for tubes is not a field service test requirement.

The Model 101 Cathode Ray Tube Tester takes advantage of the properties of neon tubes that allow them to distinguish between *ac* and *dc* voltages. This, plus the rectifying action that takes place between the electrodes of a cathode ray tube with *ac* supplied to them, provides the basis of operation of the Model #101.

*Figure* 3 shows a simplified circuit diagram of the continuity test section. The cathode may be considered at zero *ac* potential. When the *ac* supply voltage on the other electrodes swing positive, the conduction of the electrodes, due to circuit configuration, is such as to produce a *dc* voltage on the grid which is negative with respect to the cathode and a *dc* voltage on the plate which is positive with respect to the grid. This *dc* voltage together with the *ac* voltage across the neons, allows the neons to light as indicated for a good tube. If any of the electrodes were open, the associated indicator would not light. None of the neons would light if there were no cathode emission. In the case of a short between any of the electrodes, the associated neon would light on both its plates.

Different defects in the tube under test will provide various combinations of neon indication, the interpretation of which is listed on the front panel of the Model #101. We therefore have a device which not only indicates opens

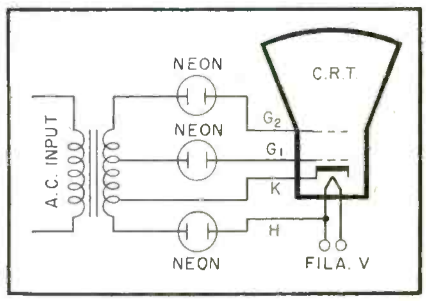



Fig. 3 — Simplified schematic of Model 101 emission test circuit.

and shorts but immediately and specifically pin-points the location and type of trouble in the tube. Since the test also depends on the fact that the tube must emit to give an indication, we also have a rough and rapid check on the emission. By tapping the neck of

[Continued on page 59]

# The Work Bench

by PAUL GOLDBERG

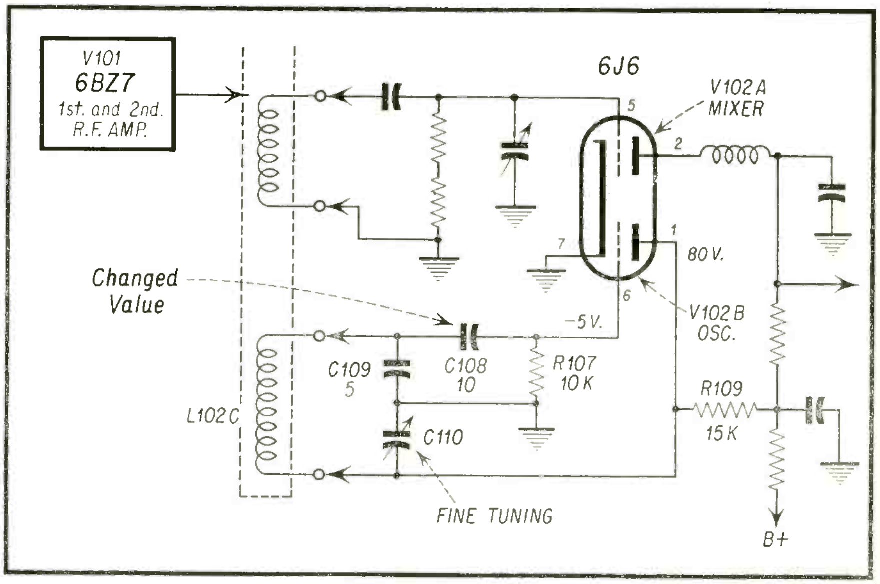
THREE tuner problems have been chosen for this month's installment. Tuner troubles are difficult because of the work entailed in replacing defective components.

### Zenith Chassis 24G26—Low RF Gain

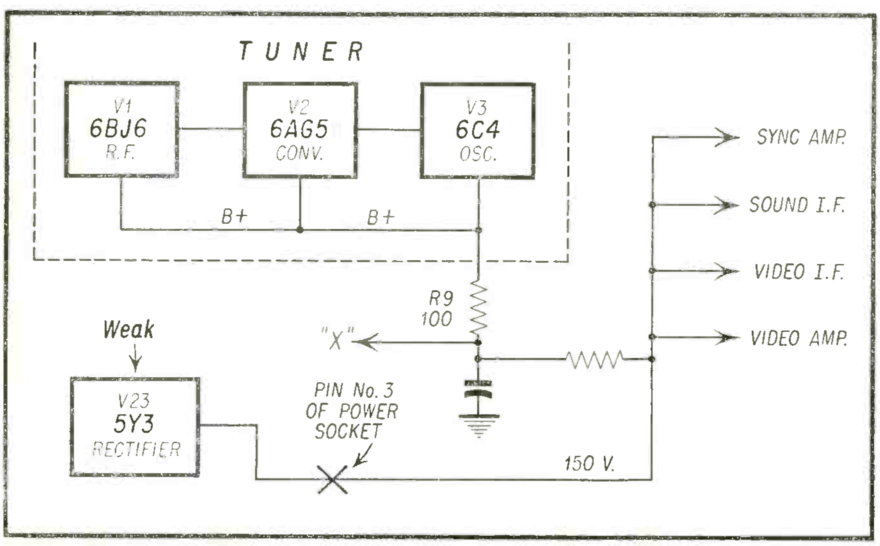
The complaint on this set was that Channel 13 would fade out. It was also pointed out that Channels 7, 9, and 11 were more snowy than they had previously been. The tubes in the tuner had been replaced two or three times but that they did not solve the problem. Recently a new antenna had been installed but the same trouble prevailed.

The receiver was set up on the bench and turned on to Channel #13. It played quite snowy for about three minutes and then disappeared. Checking the other channels it was observed that channels 7, 9, and 11 were quite snowy and that channels 2, 4, and 5 were not snowy but lacked the proper amount of gain. Not taking anything for granted, the tuner tubes, V1, V2, and V3, were replaced individually but without effect. These symptoms are indicative of partial failure of the *rf* oscillator.

One of the first checks in troubles of this sort is the B+ voltage at the tuner. If the B+ is low the *rf* and converter stages will have lower gain and the oscillator might not be able to oscillate up to the frequency of Channel 13. Thus, a voltage check be made at point "X". This is the point at which B+ is fed to the tuner. Our reasoning proved correct. The meter measured 90 volts positive while the diagram called for 150 volts positive. *R9*, 100 ohms, was next clipped open at point "X" in order to disconnct the B supply from the tuner. The B supply voltage now measured about 100 volts positive; still 50 volts low. This proved that the tuner was not causing the reduced B supply voltage. It was next noted that the 150 volts B voltage was supplied by V23, a 5Y3 rectifier. The 5Y3 was immediately replaced. The B voltage was again measured at point "X". It now measured 150 volts. *R9* was resoldered and the receiver was checked. The overall gain was now at its proper amount, the snow was gone from the high channels and Channel #13 now came in properly.




Partial schematic of tuner, Admiral 19B1.

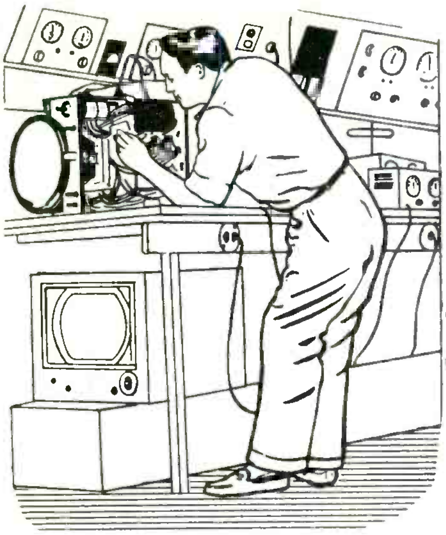



Partial schematic of tuner, Zenith 24G26.

Thus, what seemed like a difficult problem turned out to be quite simple. The point to be remembered is the importance of studying the diagram before attacking a problem of this kind. Referring to *Fig. 1*, you will note that the 150 volt B supply also feeds the video, and sound *if* stages, the sync section, and the video amplifiers. Evidently the voltage however did not drop low enough to produce any noticeable effect to these stages.

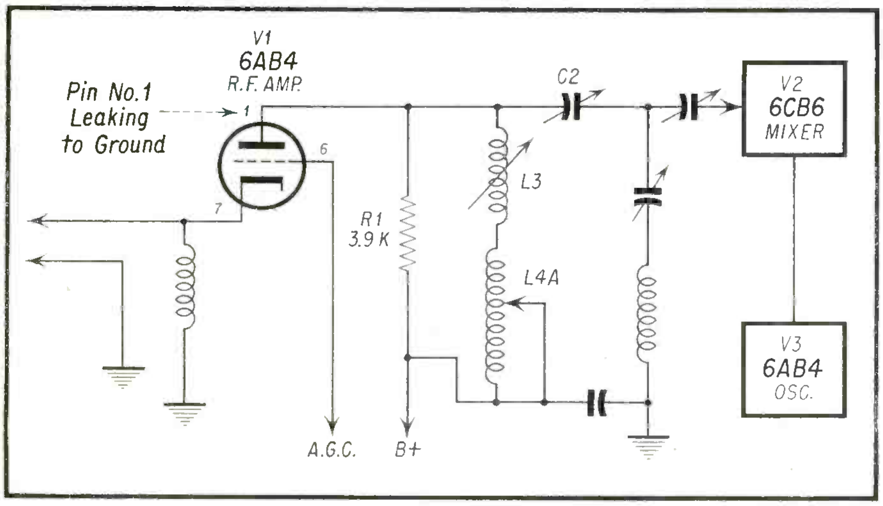
### Admiral 19B1—Shift in Oscillator Frequency

The receiver was turned on and it was found that no station would come in on the indicated channel number. What did happen was that Channel 13



***This Month:***

# TUNER PROBLEMS




Partial schematic of tuner, Crosley 10-428MX.

came in on Channel 12, Channel 11 came in on Channel 10, Channel 9 came in on Channel 8, etc. As this was a cascode type standard tuner, oscillator adjustments could be made on each channel. Adjusting the oscillator slugs, however, failed to bring in the channels on the indicated channel number. The 6J6, the obvious possibility, was replaced and then the 6BZ7, but neither had any effect.

The tuner side cover was then removed allowing meter checks to be made. Inasmuch as there was no snow in the picture, and since this was solely a frequency problem, we assumed that the trouble was in the oscillator circuit. A voltage check at pin #1 of V102B, the oscillator, measured a normal 80 volts. The voltage on pin #2, the plate of V102A, the mixer, was also measured and found to be 85 volts. This too was normal.

*C108,* 10 *mmf,* off pin #6 of V102B was next checked for voltage leakage and *R107,* 10K for resistance. *C108* and *R107* make up the grid leak circuit and have a great effect on frequency. They both tested okay. We then proceeded to test *C109* and *C110,* across the oscillator coil (L102C) which make up the oscillator tank circuit. They both checked okay. The oscillator grid voltage (pin #6 of V102B) was also measured and found to read its normal 5 volts negative.

At this point reference was made to the diagram for consideration of its components. If *C108* were open, the oscillator wouldn't oscillate at all. If *C109* were open there would no longer be a "parallel" oscillator tank circuit. If *C110,* the fine tuner opened, there would be no fine tuning action among other things; but the fine tuner was working and working properly. We decided, therefore, at this point to change components anyway because of the possibility of condensers changing value. *C108,* 10 *mmf* was replaced and immediately the channels came in on their indicated numbers. Evidently *C108* had changed value. The oscillator slugs were next adjusted on each channel and the receiver now functioned properly. Here was a case where checking the voltage leakage charactristics of a condenser was not enough. Undoubtedly a capacitance check would have immediately shown up the trouble. We took the long way but got the same results.

### Crosley Model 10-428 MX—Short in Front End

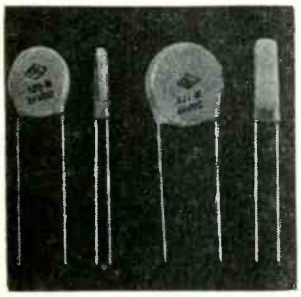
The receiver was turned on and smoke started pouring from the tuner. In order to see the resistors and condensers in the tuner (Mallory type continuous tuner), the cover must be removed. Furthermore, the tuner must be removed from the chassis in order that the cover may be removed. This was done and it was noted immediately that *R1,* 3.9K, off pin #1 of V1, 6AB4, the *rf* amplifier, had burned up. *C2,* the variable plate coupling condenser was next resistance measured for leakage but it checked okay. A resistance measurement was taken from the grid, pin #6 of V1, to ground. It measured open. This is proper with the tuner disconnected from the receiver.

It was assumed at this point that the trouble was caused by a defective 6AB4 (V1). *R1,* 3.9K and the 6AB4 were next replaced. The tuner was put back and the receiver was turned on. Immediately smoke started pouring out of the tuner again. V1, 6AB4, was then pulled out and it stopped smoking. Another 6AB4 was then installed and to our surprise the set played normally.

After about two hours, however, the picture started to become more and more snowy. It was decided at this point to remove the tuner again and examine the 6AB4, *rf* amplifier circuit again. It was seen that *R1,* 3.9K was charred and burned once more. It was decided now to clip *R1* at pin #1 and take a resistance measurement from pin #1 to ground (tuner ground). It measured 2000 ohms. *C2* and *L3* were next clipped from pin #1 of V1 and again the resistance measurement taken read 2000 ohms. With V1 out of the socket however an infinite resistance measure-

*[Continued on page 57]*

# New Products

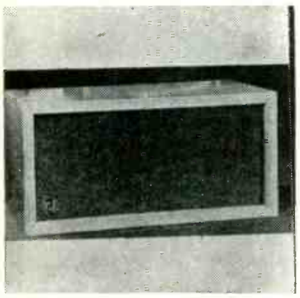


**Centralab Disc Ceramics**

A complete line of 3000 and 6000 VDCW disc capacitors have been added to the **Centralab** Distributor ceramic listing. Designed for use in high voltage circuits and television applications, these capacitors are 100% flash tested at twice rated working voltage for maximum safety factor. The units also can be used for industrial electrical and electronic apparatus such as motor buffers, ignition quieting and computers.

**Davis Distribution Amplifiers**

A new line of Distribution Amplifiers designed to prevent line loss in master TV systems for homes, apartment houses, hotels, motels, and community installations, has been announced by **Davis Electronics**, Burbank, California. According to the manufacturer, the new model features complete electronic isolation of each output. This is accomplished electronically with separate triode amplifiers, giving 40 db isolation between outputs.

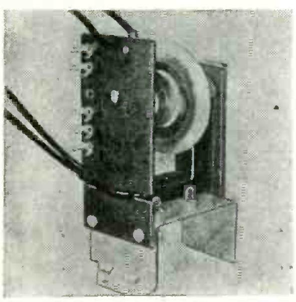


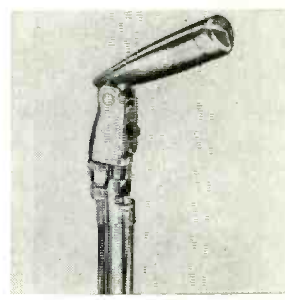
**The R-J "Wharfedale"**

The R-J "Wharfedale," complete with speaker and ready for use, was announced this week by **R-J Audio Products, Inc.**, an affiliate of British Industries Corporation. A most important consideration in the new unit is that it reaches full efficiency at normal room listening levels. Dimension of the new unit: 11 inches high, 10 inches deep and 2: inches long.

**Sylvania Oscilloscope**

A new 7-inch oscilloscope, Model 404, an exceptionally high-gain, wide-band instrument for servicing television receivers, has been announced by **Sylvania Electric Products Inc.** The vertical sensitivity of the new model is 10 millivolts per inch and the vertical response is flat from 10 cycles to 2 mc and is useful to 4 mc. A faithful square wave response is available to 500 kc.



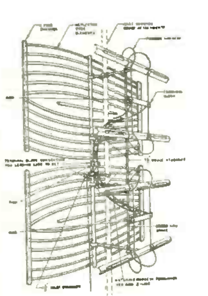


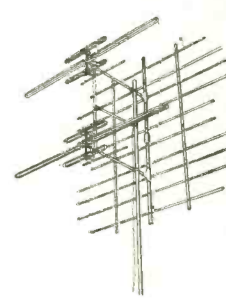
**Stancor Flyback Transformers**

The **Stancor** Division of **Chicago Standard Transformer Corporation** announces the addition of six new flybacks for Muntz, R C A, Airline, and Sentinel. These units are used in over 130 chassis and models. Muntz and RCA applications are listed in bulletin 492. Airline and Sentinel applications are listed in bulletin 493.

**E-V Dynamic Microphone**

**Electro-Voice, Inc.**, Buchanan, Michigan, has introduced a new Model 623 slim-type general-purpose dynamic microphone for public address, paging, home recording and radio amateur communications. This microphone utilizes the exclusive **Electro-Voice** Acoustalloy diaphragm which assures smooth response and is virtually indestructible. The "623" can be used on a stand or in the hand.





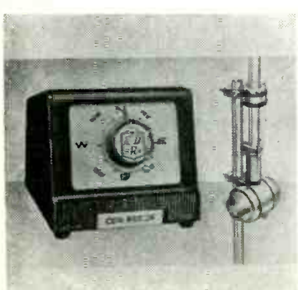
**Antenna Stacking Kit**

A special kit, designed to simplify stacking of two Davis "Super-Vision" antennas in weak-signal areas, has been offered by **Davis Electronics**, Burbank, California. The kit may be used for either horizontal or vertical stacking, and assures proper spacing for greatest possible increase in gain. According to the manufacturer, proper stacking of two Davis "Super-Vision" antennas increases gain approximately 200% on Channel 4, with an increase of 25% or more on all other channels.

**VHF Antennas by R M S**

**R M S** (Radio Merchandise Sales, Inc.) has introduced "The Phantom" line of ghost-reducing vhf antennas.

Engineered so as to bring in optimum gain and ghost free pictures in strong, medium and weak signal areas, these units are single bay, stacked and half-wave stacked arrays, of ⅜" butt seamed aluminum, quick-rigged for jiffy installation. For literature, write to Advertising Manager, **R M S**, 2016 Bronxdale Avenue, New York 62, N. Y.



**CDR Automatic Rotor**

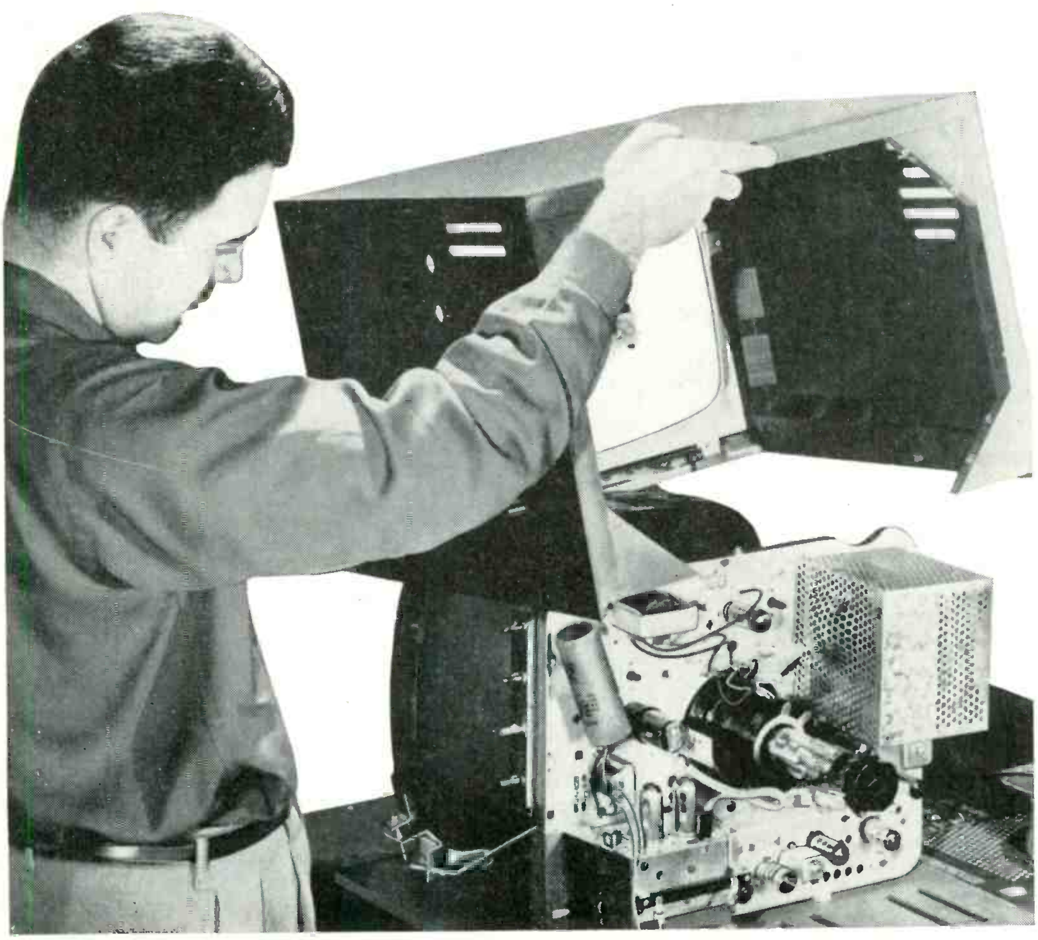
An automatic rotor with very sharp tuning is the newest addition to the line of **CDR** rotors by the **Cornell-Dubilier Electric Corp.** and their subsidiary, the Radiart Corporation. Features include: Mechanical brake that is released magnetically, quick-mounting antenna mast collet, minimum wind resistance through modern design, takes antenna masts up to 1½" O.D., self-centering sawtooth clamps, high strength with low weight, fits standard towers.

**ITI Phantom Feed-Thru**

**Industrial Television's** line of TV accessories now includes the Phantom Feed-Thru, a recently developed device for bringing the TV signal through the glass of a window. Eliminating the work of drilling and the problems of defacing, the Phantom is attached to the glass with a special waterproof adhesive. Careful investigation of possible signal loss resulted in the design of a plate four square inches in area. Consequently, insignificant losses are recordable. *(Continued on page 54)*

# Another break for service men!

# NEW
# CROSLEY SUPER-V
# uses 600 mil tubes



New super-vertical chassis filament circuit—employs 14 new, ruggedized 600 mil tubes . . . provides faster warm-up and far less chance of tube failure than sets using transformers. Parallel tubes and resistors are eliminated.

## 4 other reasons why Super-V is a service man's dream

1. **Fewer components to fail**
2. **All tubes within easy reach by removing back**
3. **Other components readily accessible by sliding chassis** out of console or by lifting off bonnet-type cabinet on table model
4. **Easily portable for repair.** Customers can bring table models in for service.

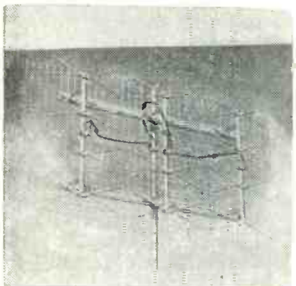
Crosley Division AVCO Cincinnati 25, Ohio

**Crosley gives you <u>more</u> for your money!**

# NEW PRODUCTS [*from page 52*]

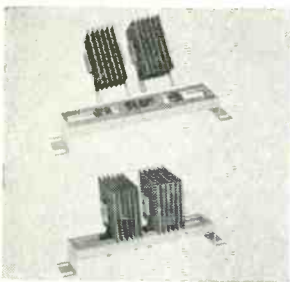
### Transvision Component Tester

Transvision, Division of Sightmaster Corporation, has announced the introduction of the new, 6 in 1, Model 100, Improved TV Component Tester which does the following things: (1) tests flyback transformers and yokes and will detect even one shorted run, (2) tests picture tubes, either in or out of the test for emission, shorts or electrical leakage, (3) checks selenium rectifiers, (4) reactivates picture tubes, renewing the emission of tubes which have lost emission.



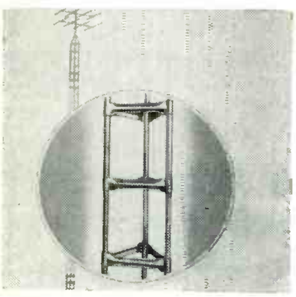
### Taco UHF Antenna

A new uhf antenna providing greater capture area is announced by Technical Appliance Corporation, Sherburne, New York, which comprises twelve open bow tie driven elements plus a large screen reflector. Driven elements are connected in parallel to a common terminal panel, while the individual 4-bay arrays are driven in series-parallel for perfect polarization. The new Taco Super 12 carries the catalog number 3040.



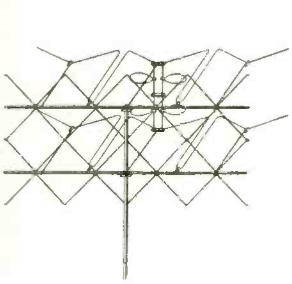
### Rectifier Conversion Chassis

Now available to Authorized Sarkes Tarzian Distributors—a simple conversion chassis, that when incorporated into old television receivers will allow the use of Sarkes Tarzian Plug-In Selenium Rectifiers. This low cost conversion will simplify future replacement of rectifiers and eliminate removing the chassis and soldering. Write for complete information: Sarkes Tarzian, Inc., 415 No. College Ave., Bloomington, Indiana.



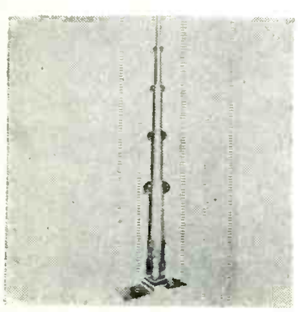
### Rohn No. 6 Tower

Rohn Manufacturing Company, 116 Limestone, Bellevue, Peoria, Illinois, announces a new No. 6 Tower suitable for home TV installation and other communication requirements; it is self-supporting to 50 ft. heights or guyed to 150 ft.; features a 12½" triangular design with heavy-duty corrugated cross bracing which utilizes mass production machinery. The tower is structurally as sturdy as the widely used standard Rohn No. 10 Tower.



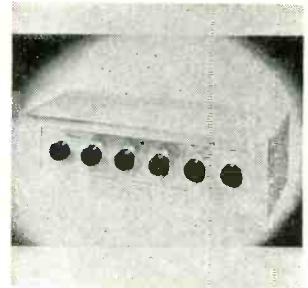
### Fretco Shielded Antenna

Fretco Incorporated, Pittsburgh, Pa. has announced the "Fretaray Spectrum" all channel antenna with a shielded back that needs no assembly. This method of shielding signals from the rear makes the Fretaray Spectrum ideal for primary, near fringe and fringe areas. It is a complete uhf and vhf antenna that receives all channels 2 to 13. Gain Specifications are on an average 13db on channels 2 to 6, and 13.5 on channels 7 to 13.



### JFD Telescoping Masts

JFD Manufacturing Company, 6101-16th Avenue, Brooklyn, New York, announced production of a new telescoping television antenna mast, "Aluzoom," made completely of aluminum. The tensile strength of this new mast is 45,000 pounds per square inch. Top section is 1½" O.D. Wall thickness is .056. Top six inches is swaged to fit all rotators. The "Aluzoom" mast is 1/3 the weight of steel masts, and because it's lighter, time is saved in handling, storing, and installing.

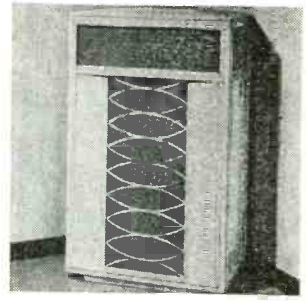


### Regency Pre-Amplifier

A self-contained audio pre-amplifier with good equalization flexibility has been introduced by Regency, a division of I.D.E.A., Inc. of Indianapolis, Ind.

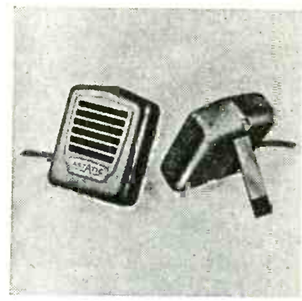
The new unit is housed in a convenient and attractive mahogany or blond cabinet measuring only 16" long, 4¾" high and 7½" wide.

For more information write directly to Regency, 7900 Pendleton Pike, Indianapolis 26, Indiana.



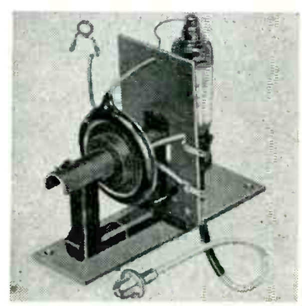
### "Imperial" Reproducer

The Jensen Manufacturing Company of this city has introduced the "Imperial" reproducer, Model PR-100, which consists of the identical components that constitute the Jensen Model RS-100 Laboratory Reference Standard Reproducer, a unit engineered expressly to afford the finest quality of high fidelity reproduction. It differs solely in its cabinetry, being available in selected mahogany and satin korina.



### Astatic Hand Mikes

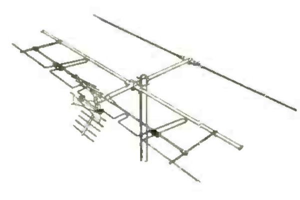
Astatic has announced the new Ceramic Model M101 and Crystal Model M102 hand microphones, compact little units housed in rugged, light tan plastic cases. Output of the crystal M102 is -46 db and that of the ceramic M101 is -53 db. Frequency range of the former is 30 to 10,000 cps, with flat response, while the range of the M101 is 30 to 8,000, with slightly rising characteristics in the high range.



### Halldorson Flyback Replacement

Halldorson Transformer Division, Gramer Transformer Corporation, offers a new specific flyback replacement designed for the vertical chassis 17 TV sets now being built by Crosley and Hallicrafters.

The new unit, Halldorson FB417, is a specific replacement assembly incorporating the H. V. Rectifier socket and mounting to replace Crosley Part No. 15720-5-1 and Hallicrafters Part No. 550251.



### Alliance Triceptor Array

An unusual feature of this antenna is the incorporation of a new idea whereby the gain of the vhf antenna is added to the uhf. Other characteristics cited by the manufacturer include: Pre-assembled, snap-out design for fast, easy installation; Interference minimized or wholly eliminated; High uniform gain is achieved without drop-outs—no channels are sacrificed in order to improve others, and High directivity is assured with a Monolobe pattern.

### Westinghouse Picture Tube

A new 17-inch television picture tube is available from the Westinghouse Electric Corporation. An improved bulb design permits 90-degree deflection and a weight reduction of 5½ pounds with a resulting overall length reduction of approximately three inches, compared to previous 17-inch models. Two new tube types (17ATP4 and 17ATP4-A), are available. Both are electrostatic-focus, directly-viewed picture tubes of rectangular glass construction.

## ANSWER MAN

*[from page 34]*

turbance caused by grounding a grid or touching a plate with a meter lead can be coupled through the B plus or *agc* system to other stages further on causing the erroneous impression to be obtained that the stage being tested is alive and can pass signals.

This problem probably falls into this category. One of the *if* stages is probably not passing the signals with adequate amplification. The result is a very weak picture and weak sound with no accompanying snow. In most receivers, if the signal is weak because of trouble ahead of the mixer circuit, as in the *rf* stage, snow appears on the picture tube

The trouble described above is typical of what can happen when an *if* tube cathode circuit opens for some reason or a coupling condenser opens. In the former case the signal could pass through the capacitance of the tube and circuit capacitances even though the tube is not conducting. This would result in a weak signal arriving at the video detector. In fact, in some receivers the first *if* tube may be removed and a picture, usually weak, may be obtained. This is no hard and fast rule, however, because in many receivers no signals will get through with a tube removed.

Considering this problem from another angle, it has been a practice among TV technicians to substitute different tubes of similar characteristics if the proper tube is not handy. As an example, 12AU7, 12AV7, 12AX7, 12AZ7 and 12AT7 tubes are very often used interchangeably depending upon which tubes are available. In many cases no appreciable difference in receiver operation will be observed. If the switch is made in the tuner oscillator tube, adjustment of the oscillator slugs is almost always required and in certain cases the tuner may not bring in the high channels because of the switch in tube types.

A tube type where switching has become common practice includes the 6AG5, 6BC5 and 6CB6. In an *if* stage these tubes can be used to improve the gain when employed properly. In most cases unless the circuits are critically aligned for the particular tube a noticable difference will not be obtained.

Now, in getting to the question at hand. If the 6CB6 tube is substituted for a 6AG5 or 6BC5 trouble can develop as shown in *Fig.* 3, the tubes concerned are practically the same as far as the electrical connections except for the suppressor screen. Notice that the 6CB6 tube has no internal connection from suppressor screen to cathode as with the 6AG5 and 6BC5.

In the layout of a TV chassis it is often more convenient to use one terminal lug rather than another. Consider the case of *Fig. 3A* and 3*C*, where a resistor may be tied to pin 7 or pin 2 on the assumption that a 6BC5 or 6AG5 tube is used. In both types of chassis wiring the circuits will probably function the same. But one hook-up may be easier to lay out than the other.

However, if a 6CB6 or 6DE6 tube is plugged into the socket, the cathode or suppressor circuit is open depending upon the manner of hookup used in the receiver. The result is that the signal may not be amplified by the tube. There is a strong possibility that this is what has happened in the case under consideration. It has happened to other technicians and has caused much time to be wasted.

What probably brought this about in the first place was a weak 6AG5 tube in the *if* strip and in trying to correct for that trouble a 6CB6 tube or tubes was substituted into the receiver.

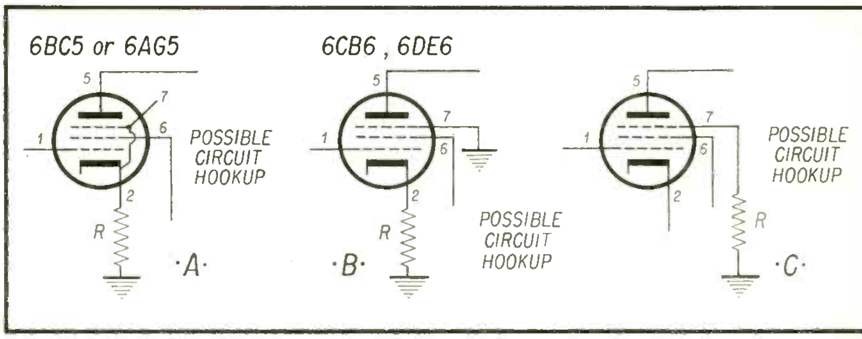



**Fig. 3—Basic tube connections in an *if* stage, and variations which may give rise to substitution problems. In substituting a 6BC6 for a 6AG5 or a 6BC5, trouble can develop through the difference in suppressor screen connections. C illustrates a 6AG5-NBC5 alternate hookup.**

## WORKBENCH

*[from page 51]*

ment was read. Still another 6AB4 had the same effect.

Thus it appeared that pin #1 of the tube socket would short to ground intermittently when the tube was plugged in. There is no job worse than replacing a tube socket in a tuner. Since the tube socket could not be saved, it had to be replaced.

## UNDERSTANDING H.O.T.

*[from page 33]*

Using Table I, we can see that the taps to be used would be 8 and 5. The table also shows that 7 or 9 may be used in place 8, provided they show superior results. The reason for these alternate connections lies in the fact that variations in the plate impedance of the horizontal output tube, together with variations in deflection coil inductance may require a slightly smaller or a slightly larger turns ratio for better matching. Thus, using tap #7 instead of 8 would provide a larger turns ratio. If tap #9 were used, the reverse would be accomplished. Notice also, that the primary is tapped. The tapped primary increases the versatility of this trans-

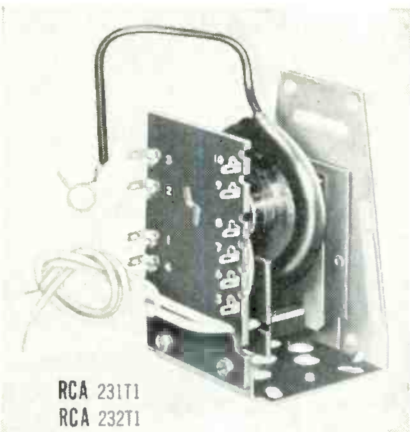



Fig. 6—An H.O.T. with taps and leads clearly shown (see text).

former still further. The plate of the horizontal output tube is connected to either tap #2 or #3, while B+ (boosted B+) is fed in at #1. The horizontal output plate is connected to tap #2 when the B+ supply voltage is under 300 volts while tap #3 is used when the B+ supply is over 300 volts.

Some H.O.T. manufacturers provide catalogs furnishing replacement data on all makes and models of TV

*[Continued on next page]*

*[from preceding page]*
receivers. These will be discussed subsequently.

We might well ask "why are differet taps required for different B+ supply voltages?" The answer here again is impedance matching. The plate impedance of the output tube depends on the voltage applied to its plate. Thus, different turns ratios are required to produce proper matching when the plate voltage on the output tube is appreciably different. By providing these taps the transformer is made more versatile for replacement purposes.

*Figure 6* is a photograph of this transformer which clearly indicates the position of the various taps we have been discussing. The tap of the primary winding going to the plate of the high voltage rectifier is shown in the photograph as the heavily insulated wire terminated in a clip. The two flexible leads shown in the photograph emerging just below terminal #5 are the two remaining unnumbered connections shown in the schematic and are the ends of the filament winding for the high voltage rectifier.

*[To Be Continued]*



## TV INSTRUMENT CLINIC

*[from page 31]*

ent displaces the zero-volt reference line; feedback through the mixer tube grid-plate capacitance from the first i-f stage may appear at the mixer grid out of phase with a portion of the forward sweep voltage, with the result that cross-overs appear in the pattern. Remedy is to use a d-c scope to locate the true zero-volt level, and to follow the receiver manufacturer's instructions concerning disabling of the first i-f stage during front-end alignment procedures.

Q. Why does the horizontal portion of a pattern sometimes appear to be thickened?

A. This situation, illustrated in *Fig. 8*, is caused by the presence of spurious

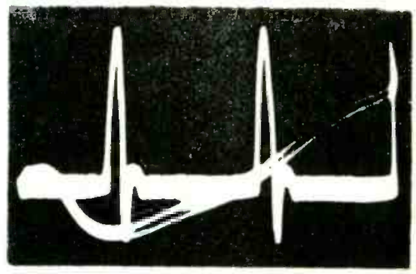


Fig. 8—Presence of spurious voltages thickens horizontal trace.

voltages, or higher-frequency component voltages. The presence of such voltages is often visible in the expanded display provided by the flyback trace, as shown.

Q. What is meant by a "raster" type of sweep expansion on a scope screen?

A. This expedient is illustrated in *Figs. 9* and *10*. In *Fig. 9* is shown a sawtooth wave with a spurious voltage present, due to cross-talk of the horizontal sweep circuit into the vertical sweep circuit.

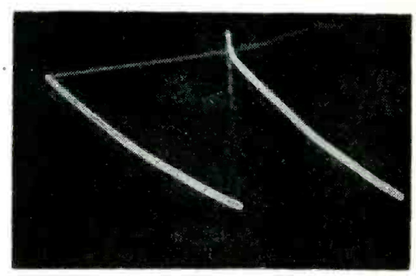


Fig. 9—Spurious voltage present in vertical sweep due to crosstalk.

When the horizontal sweep rate of the scope is increased to several times the rate of the 60-cycle sawtooth waveform, the pattern appears as a raster waveform, with the detail greatly expanded, as

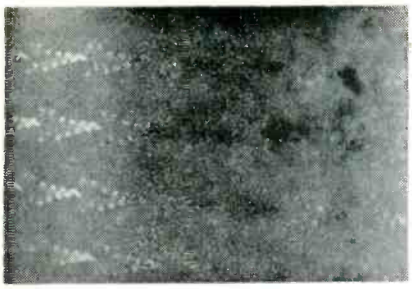


Fig. 10—Shock excitation of vertical sweep yields above "raster."

shown in *Fig. 10*. It is seen that the cross-talk takes the form of damped sine waves superimposed upon the 60-cycle sawtooth. A damped sine wave is initiated in the vertical sweep circuit by shock excitation at the beginning of each horizontal sweep scan.

*Q.* When testing sync circuits it is often noted that the pattern appears at two different levels. What is the reason for this type of display?

*A.* A display of this type is shown in *Fig. 11*. The principal portion of the pattern is a 60-cycle derivative of the vertical sync pulse, which appears

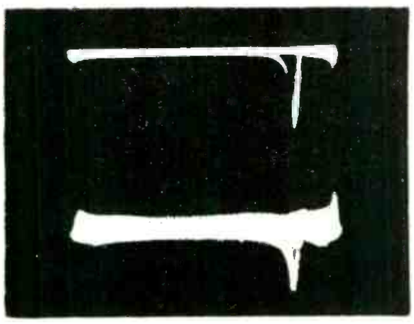


Fig. 11—Horizontal and vertical sync pulse derivative display.

as the lower outline of the pattern. Upon this outline is superimposed a row of 525 pulses derived from the horizontal sync-pulse signal. This row of pulses accordingly reproduces the lower outline of the pattern as a similar upper outline. For this reason, the pattern appears at two different levels on the scope screen.

## CRT TESTER

*[from page 49]*

the tube we may spot microphonics and intermittents and identify the electrode involved by observing which of the neons flickers.

By the use of this instrument, a great deal of the mystery is taken out of the picture tube test, and, since these tubes are expensive, it makes the possible clearance of trouble (e.g. blowing shorts with high *ac* voltage) a rapid and simple determination with almost no thought or chance of error on the part of the operator.

It has been specifically brought to the attention of picture tube distributors by some manufacturers to beware of some types of picture tube testers inasmuch as they apply a positive grid to cathode bias during their testing procedure. This will damage the electrodes of the tube beyond recall in a matter of seconds. The Model #101 applies only a negative grid to cathode bias to the electrodes in all its test functions.

The emission test consists of placing *dc* voltages on the electrode in conformance with manufacturers specifications. The G2 voltage is "SET" to a predetermined base level to provide consistant comparison with standard emission levels. Once the electrode voltages are "SET", the "READ" button is pushed, shorting the grid to the cathode, and the emission is read in terms of "GOOD", "QUESTIONABLE" or "BAD" on the microammeter. Gas in a vacuum tube causes either the cathode current to rise or fall depending on the amount of gas present. In any case, after a tube has heated to its operating

*[Continued on next page]*

*[from preceding page]*

temperature and the electrode voltages are fixed, the emission reading should remain constant. When making the emission test on the Model #101 if the meter reading rises or falls when the "READ" button is depressed, gas is indicated. Even so, the tube may still perform satisfactorily in the receiver although a replacement should be made since any trace of gas in a tube indicates leakage which gets worse and not better.

The front panel of the Model #101 carries on it the neon indications showing all possible *single* troubles which may occur in a picture tube. Sometimes, a tube has two or more defects. These create neon indications not shown on the panel. They are listed in the technical manual but, in any case, if the neons light up in any manner different from that shown for a good tube, the tube is bad and should be replaced.

The ease and rapidity of operation and interpretation plus the portability, dependability and rugged construction of a tube tester makes it an extremely valuable aid anywhere a picture tube may be found. Its use on the counter or in the customer's home makes a sales aid for which there is no peer electronically or psychologically.

## KEY TEST POINTS

*[from page 29]*

cuits such as the picture tube No. 1 anode and the vertical oscillator circuit. This is shown in *Figs.* 5 and 6 where the two most commonly used systems are illustrated with their key test points.

Therefore the test point which will reveal if the horizontal deflection system is functioning is the damper cathode. If the normal boost voltage which has to be higher than the power supply voltage is present the deflection system is operating. However, the presence of boost voltage does not necessarily mean that the high voltage winding on the deflection transformer is O.K. On the other hand if the transformer has any shorted turns the boost voltage will not be normal.

A quick, easy check on the deflection system is the filament light in the high voltage rectifier tube. If the filament is lit the deflection system is delivering deflection voltage to the yoke and a satisfactory deflection magnetic field is being built up in the transformer. This is the only way that sufficient voltage can be available to light up the high voltage rectifier tubes.

Most technicians are familiar with the old check of arcing the high voltage lead to chassis to determine whether the high voltage is present. There are some cautions in regard to this practice. *Do not draw the arc for more than a few* *moments.* It is easy to exceed the wattage rating of the filter resistor in the high voltage rectifier tube circuit and thus damage the resistor. Also, damage to the transformer can be caused by this practice. The arc from the high voltage lead should be stiff and white and not the blue flame type of arc which is present at the high voltage rectifier plates. It is possible to be fooled into thinking that high *rf* arcs from the high voltage lead are *dc* voltage arcs. If the *rf* pulse is at the plate cap of the high voltage rectifier tube an arc of up to ½ inch in length can usually be drawn.

Going back to the horizontal output tube one check at the tube is to draw a spark from the plate cap with an insulated screwdriver by touching the blade to the metal cap and moving the blade slowly away. The spark may not be easily seen but the static noise will be heard in the speaker if there is any doubt of its presence.

If a spark can be obtained from the cap it indicates that the deflection voltages are present at the cap and the horizontal oscillator tube is driving the output stage.

### A Quick Check of the Deflection System

In reference to the horizontal damper stage under discussion previously there is one test point that was discussed and because of its importance is considered again.

Since boost B-plus voltage is used to supply the number one anode of the picture tube, if it can be measured it will indicate quickly whether the damper circuit and deflection system is normal. The boost voltage is supplied to the picture tube socket. It is only necessary to remove the socket from the picture tube and the socket will provide access to the boost voltage at the number 10 pin. For more information concerning this check refer to the previous discussion of the background circuit.

## PRINTED CIRCUITS

*[from page 8]*

freed from the wiring foil as in step (2), apply the soldering iron to the grounding lug on the component side. Grasp the socket and slowly pull the socket away from the board. The socket will free itself from the board when the grounding lug solder has become molten. Remove any thin film of solder that may form across the ground foil connection and any of the socket foil connections.

CAUTION: Ground terminal connections to the tube socket are made underneath the sockets with copper

*[Continued on next page]*

*[from preceding page]*

wiring foil. When removing the tube socket be certain that none of the foil has peeled off between the socket lugs and the center ground connection. An

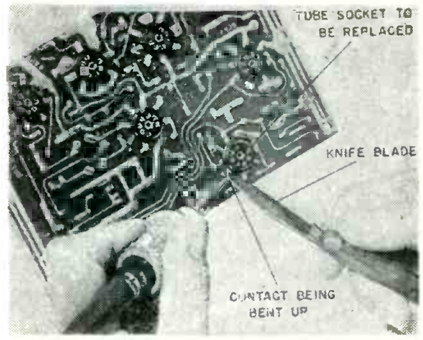



Fig. 9—Removal of tube sockets mounted to wiring side of board by bending up the socket contacts.

indentation or dull section on the board will be apparent if this occurs. See *Fig. 10.*

The portion of the foil most likely to peel and break when removing the socket is the section which is soldered to the grounding lug of the tube socket. If this is overlooked when replacing the tube socket, a mechanical connection may still exist between electrical ground and the socket terminals, but an intermittent connection is very likely to develop later which may be very difficult to locate. Therefore, be certain to replace any missing foil with hook up wire. This wire may be routed underneath the tube socket or a jumper may


Fig. 10—The manner in which the metal grounding foil breaks away because of tube socket removal.

be connected on top of the board to the necessary tube socket terminals. See *Fig. 11.*

4. Clean the board free of stuck solder particles, with a cloth soaked in thinner. Replace the socket.

Cover the finished connections with lacquer or Krylon spray using masking tape as described previously.

### Replacing Tube Sockets Mounted on Component Side of Board

The following procedure is recommended:

1. Apply the soldering iron and

brushing procedure to each socket lug as given in earlier instructions for removing components.

2. Apply the soldering iron to each lug (including grounding lug) and bend the socket lugs upward from the cop-

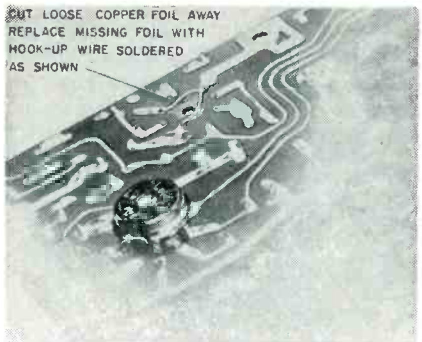



**Fig. 11—A jumper wire may be used to replace the missing metal foil, as illustrated here.**

per foil with a knife. See *Fig. 12.* Note that on some boards, the socket lugs are folded back.

3. Rebrush the connections. This must be done while the solder is molten.

4. Cut the lugs off the socket as close as possible to the board. Rebrush connections if necessary.

5. Apply the soldering iron to the grounding lug (center terminal) and lift socket from the board.

6. Clean the board as described previously.

CAUTION: When installing the new socket, it may be difficult to insert the socket lugs through the holes in the board due to the very close toler-

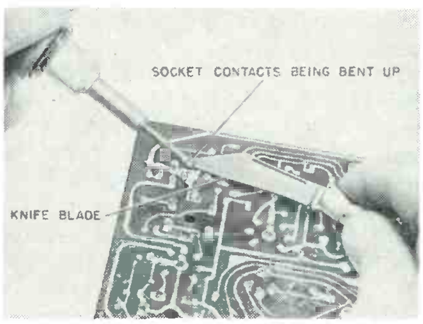



**Fig. 12—Bending up tube socket contacts from the copper foil to permit removal of socket.**

ance. If too much pressure is applied in attempting to force the socket terminals through the holes, the board may break. Therefore, enlarge the holes slightly so that the socket terminals can be inserted without any excessive pressure. A small reamer or penknife can be used for this purpose.

7. Insert new socket, bend over its lugs and solder the connections.

8. Coat the connections with lacquer or Krylon using masking tape as described previously.

"We don't care about the record player . . . make him tell what he did with the JENSEN NEEDLE!"



## ROTATORS

[from page 28]

ities provided by the advertising departments of the manufacturers.

Once prospects have been brought into his salesroom, a dealer can outline the benefits to be derived from a rotator. He must impress the customer with the almost implicit necessity of a rotator for deep fringe reception—in areas where new *vhf-uhf* stations are springing up with regularity in different directions—and in the tuning in of satisfactory color pictures.

Urban area merchants can explain to viewers that daily atmospheric changes, newly built structures, reflecting surfaces of large buildings, parasitic reflections of antennas on crowded rooftops and other variables affect reception adversely. Hence the need of a rotator.

A dealer should remember that *any* viewer who is *not* getting good reception with his present installation — whether he lives in the country—*or* in the city—is a prime prospect for a rotator sale.

### With New Set Sales

Before completing a new set sale, a dealer can demonstrate on his own showroom floor the difference in reception between a television-antenna setup and a rotator-television-antenna setup. Visual proof of such a demonstration can often carry more conviction than words.

### With Older Sets

The users of older installations are prime prospects for rotators, as already mentioned. With the advent of new *vhf* stations in their area—with the advent of color—these viewers can be readily convinced that their receivers need additional tuning sensitivity to meet changing conditions. The sale of a rotator follows easily. It might be noted that many of these prospects can be contacted through the use of direct mail envelope stuffers or self mailers. At the actual sales presentation, point-of-sale material and product literature should be employed.

### Enough for Everyone

The rotator sales potential is limited. It is limited *only* by the amount of television receivers in use—and to be *put* in use! A vast market remains. It need only be mined for results. There's enough potential for everyone—without straining or competition.

It might be stated that to understand and appreciate the value of a rotator is the first step in making customers understand and appreciate the function of rotators.

Such approval leads to sales.

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# Raytheon

## Chassis 17T18, 21T19

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# PARTS LIST

## TUNER

### Resistors

| Ref. No. | Part No. | Description | List Price |
|---|---|---|---|
| R1 | 9B1-20 | 15K ohm, 1/2 watt, 20% | .25 |
| R2 | 9B1-23 | 47K ohm, 1/2 watt, 20% | .25 |
| R3 | 9B1-15 | 2200 ohm, 1/2 watt, 20% | .25 |
| R4 | 9B1-70 | 4700 ohm, 1/2 watt, 10% | .25 |
| R5 | 9B1-13 | 1000 omh, 1/2 watt, 20% | .25 |
| R6 | 9B1-27 | 220K ohm, 1/2 watt, 20% | .25 |
| R7 | 9B1-74 | 10K ohm, 1/2 watt, 10% | .25 |
| R8 | 9B1-20 | 15K ohm, 1/2 watt, 20% | .25 |
| R10 | 9B1-20 | 15K ohm, 1/2 watt, 20% | .25 |

### Capacitors

| Ref. No. | Part No. | Description | List Price |
|---|---|---|---|
| C1 | 31A-079 | 3-8 mmf, trimmer | .75 |
| C2 | 13L8Y102Z | 1000 mmf, GMV | .25 |
| C3 | 31A-056-1 | .5-3 mmf, trimmer | .75 |
| C4 | 13L8T2151K | 150 mmf | .45 |
| C5 | 13L8D121K | 120 mmf | .30 |
| C6 | 31A-056-1 | .5-3 mmf, trimmer | .75 |
| C7 | 13L8C100A | 10 mmf, NPO | .25 |
| C8 | 13L8UA050C | 5 mmf, N900 | .45 |
| C10 | 13L8C100A | 10 mmf, NPO | .30 |
| C14-15-16-17 | 13M102Z02 | 800 mmf, feed thru | — |
| C18 | 13L8D121K | 120 mmf, N750 | .30 |
| C21 | 13L8Y102Z | 1000 mmf, GMV | .25 |

### Coils

| Ref. No. | Part No. | Description | List Price |
|---|---|---|---|
| L1-2 | 31M-012-*H | Antenna coil assembly | — |
| L3-4-5 | 31M-112-*H | RF and oscillator coil assembly | — |
| L6 | 34A-546 | RF Filament choke | 1.55 |
| L8 | 34A-575 | Oscillator filament choke | 09 |
| L10 | 31B-638-1 | Mixer plate choke | .75 |
| L11 | 31B-257-8 | IF coil assembly | .75 |

NOTE: Use VHF-UHF channel number in place of asterisk(*).

## MAIN CHASSIS

### Resistors

| Ref. No. | Part No. | Description | List Price |
|---|---|---|---|
| R100 | 9B1-86 | 100K ohm, 1/2 watt, 10% | .25 |
| R101 | 9B2-80 | 33K ohm, 1 watt, 10% | .30 |
| R102 | 10D-23857 | Buzz control—750 ohm | .40 |
| R103 | 9B1-60 | 680 ohm, 1/2 watt, 10% | .25 |
| R104 | 9B4-77 | 18K ohm, 2 watt, 10% | .35 |
| R105 | 9B1-90 | 220K ohm, 1/2 watt, 10% | .25 |
| R106 | 9B1-92 | 330K ohm, 1/2 watt, 10% | .25 |
| R108 | 9B2-52 | 150 ohm, 1 watt, 10% | .30 |
| R109 | 9B4-29 | 470K ohm, 1/2 watt, 20% | .25 |
| R200 | 9B1-75 | 12K ohm, 1/2 watt, 10% | .25 |
| R201 | 9B1-62 | 1000 ohm 1/2 watt, 10% | .25 |
| R202 | 9B1-46 | 47 ohm, 1/2 watt, 10% | .25 |
| R203 | 9B1-62 | 1000 ohm, 1/2 watt, 10% | .25 |
| R204 | 9B1-77 | 18K ohm, 1/2 watt, 10% | .25 |
| R205 | 9B1-62 | 1000 ohm, 1/2 watt, 10% | .25 |
| R206 | 9B1-130 | 62 ohm, 1/2 watt, 5% | .30 |
| R207 | 9B1-79 | 27K ohm, 1/2 watt, 10% | .25 |
| R208 | 9B1-62 | 1000 ohm, 1/2 watt, 10% | .25 |
| R209 | 9B1-49 | 82 ohm, 1/2 watt, 10% | .25 |
| R210 | 9B1-80 | 33K ohm, 1/2 watt, 10% | .25 |
| R211 | 9B1-62 | 1000 ohm, 1/2 watt, 10% | .25 |
| R212 | 9B1-98 | 1 megohm, 1/2 watt, 10% | .25 |
| R213 | 9B1-46 | 47 ohm, 1/2 watt, 10% | .25 |
| R214 | 9B1-70 | 4700 ohm, 1/2 watt, 10% | .25 |
| R215 | 9B1-152 | 510 ohm, 1/2 watt, 5% | .30 |
| R216A-B | 10A-23714 | Picture control 1000 ohm, volume control 1 megohm | 1.90 |
| R217 | 9B1-98 | 1 megohm, 1/2 watt, 10% | .25 |
| R218 | 9B4-71 | 5600 ohm, 2 watt, 10% | .35 |
| R220 | 10B-23695 | Brightness control, 500K ohm | .55 |
| R221 | 9B1-86 | 100K ohm, 1/2 watt 10% | .25 |
| R222 | 9B1-62 | 1000 ohm, 1/2 watt, 10% | .25 |
| R223 | 9B1-78 | 22K ohm, 1/2 watt, 10% | .25 |
| R224-225 | 9B1-59 | 560 ohm, 1/2 watt, 10% | .25 |
| R300 | 9B1-74 | 10K ohm, 1/2 watt, 10% | .25 |
| R301 | 9B1-94 | 470K ohm, 1/2 watt, 10% | .25 |
| R302 | 9B1-102 | 2.2 megohm, 1/2 watt, 10% | .25 |
| R303 | 9B1-78 | 22K ohm, 1/2 watt, 10% | .25 |
| R304 | 9B1-98 | 1 megohm, 1/2 watt, 10% | .25 |
| R305 | 9B1-95 | 560K ohm, 1/2 watt, 10% | .25 |
| R306 | 9B2-70 | 4700 ohm, 1 watt, 10% | .30 |
| R307 | 9B1-62 | 1000 ohm, 1/2 watt, 10% | .25 |
| R400 | 9B1-86 | 100K ohm, 1/2 watt, 10% | .25 |
| R401 | 9B1-70 | 4700 ohm, 1/2 watt, 10% | .25 |
| R402 | 9B1-85 | 82K ohm, 1/2 watt, 10% | .25 |
| R403 | 10B-23693 | V. Hold control—100K ohm | .55 |
| R404 | 10B-23407 | V. Linearity control—6000 ohm | .65 |
| R405 | 9B1-102 | 2.2 megohm, 1/2 watt, 10 % | .25 |
| R406 | 9B1-86 | 100K ohm, 1/2 watt, 10% | .25 |
| R407 | 9B1-102 | 2.2 megohm, 1/2 watt, 10% | .25 |
| R408 | 10B-23696 | V. Size control—3 megohm | .55 |
| R409 | 9C12-1105 | 3300 ohm, 5 watt, 10% | .35 |
| R410 | 9B1-82 | 47K ohm, 1/2 watt, 10% | .25 |
| R500-501 | 9B1-27 | 220K ohm, 1/2 watt, 20 % | .25 |
| R502 | 9C-23872 | 133 ohm, 15 watt, 10% | .40 |
| R503 | 9B1-27 | 220K ohm, 1/2 watt, 20% | .25 |
| R504 | 9C11-1104 | 2700 ohm, 3 watt, 10% | 35 |
| R505 | 9C-24033 | 2500 ohm, 5 watt, 10 % | — |
| R506 | 46M-23018 | Fusible resistor | .45 |
| R600 | 9B1-92 | 330K ohm, 1/2 watt, 10% | .25 |
| R601 | 9B1-97 | 820K ohm, 1/2 watt, 10% | .25 |
| R602 | 9B1-86 | 100K ohm, 1/2 watt, 10% | .25 |
| R603 | 9B1-85 | 82K ohm, 1/2 watt, 10% | .25 |
| R604 | 9B1-88 | 150K ohm, 1/2 watt, 10% | .25 |
| R605 | 9B1-69 | 3900 ohm, 1/2 watt, 10% | .25 |
| R606 | 10B-23694 | H. Hold control—50K ohm | .55 |
| R607 | 9B1-88 | 150K ohm, 1/2 watt, 10% | .25 |
| R608 | 9B1-82 | 47K ohm, 1/2 watt, 10 % | .25 |
| R609 | 9B1-73 | 8200 ohm, 1/2 watt, 10% | .25 |
| R610 | 9B1-50 | 100 ohm, 1/2 watt, 10% | .25 |
| R611 | 9B1-94 | 470K ohm, 1/2 watt, 10% | .25 |
| R612 | 9B4-73 | 8200 ohm, 2 watt, 10% | .35 |
| R613 | 9C1-1065 | 1.5 ohm, 1/2 watt, 10% | .25 |
| R614 | 10B-23858 | Coarse H. Hold control—250K ohm | .55 |
| R615 | 9B1-86 | 100K ohm 1/2 watt, 10% | .25 |
| R616 | 9B1-80 | 33K ohm, 1/2 watt, 10% | .25 |

### Capacitors

| Ref. No. | Part No. | Description | List Price |
|---|---|---|---|
| C100 | 8G-20269 | 10K mmf, 500 volt, ceramc disk | .25 |
| C101 | 8F2-121 | 470 mmf, 300 volt, mica | .25 |
| C102 | 8G-11789 | 10 mmf, 500 volt ceramic | .25 |
| C103-104 | 8G-20269 | 10K mmf, 500 volt, ceramic disk | .25 |
| C105 | 8G-13201 | 1000 mmf, 500 volt, ceramic | .25 |
| C106 | 8G-20269 | 10K mmf, 500 volt, ceramic disk | .25 |
| C107 | 8K-23091 | .01 mfd, 400 volt, molded | .25 |
| C108 | 8K-23102 | .01 mfd, 600 volt, molded | .25 |
| C109 | 14B-23772 | 30 mmf, shielded wire | — |
| C200 | 8G-13201 | 1000 mmf, 500 volt, ceramic | .25 |
| C201 | 8G-19522 | 2000 mmf, 500 volt, ceramic | .25 |
| C202 | 8G-12166 | 5 mmf, 500 volt, ceramic | .25 |
| C203 | 8G-19731 | 47 mmf, 500 volt, ceramic | .25 |
| C204 | 8G-13962 | 5000 mmf, 500 volt, ceramic | .25 |
| C205-206 | 8G-13201 | 1000 mmf, 500 volt, ceramic | .25 |
| C207 | 8G-21105 | 680 mmf, 500 volt, ceramic | .25 |
| C208 | 8G-13962 | 5000 mmf, 500 volt, ceramic | 25 |
| C209 | 8F2-241 | 470 mmf, 300 volt, mica | .55 |
| C210 | 8G-19731 | 47 mmf, 500 volt, ceramic | .25 |
| C211 | 8G-13962 | 5000 mmf, 500 volt, ceramic | .25 |
| C212 | 8G-13201 | 1000 mmf, 500 volt, ceramic | .25 |
| C213 | 8G-13962 | 5000 mmf, 500 volt, ceramic | .25 |
| C214 | 8K-23086 | .22 mfd, 200 volt, molded | .35 |
| C216-217 | 8G-12166 | 5 mmf, 500 volt, ceramic | .25 |
| C218 | 8K-23084 | .1 mfd, 200 volt, molded | .25 |
| C219A-B-C-D | 8C-23689 | 10 mfd, 300 volt, 60 mfd, 50 volt, 25 mfd, 450 volt—100 mfd, 300 volt, lytic | 4.35 |
| C220 | 8G-23793 | 51 mmf, 500 volt, ceramic | .25 |
| C221 | 8G-19503 | 33 mmf, 500 volt, ceramc | .25 |
| C222 | 8L-23551 | 3.3 500 volt | .25 |
| C223 | 8G-13201 | 1000 mmf, 500 volt, ceramic | .25 |
| C225 | 8K-23093 | .022 mfd, 400 volt, molded | .25 |
| C226 | 8K-23095 | .1 mfd, 400 volt, molded | .30 |
| C227 | 8K-23082 | .022 mfd, 200 volt, molded | .25 |
| C228 | 8G-23645 | 47 mmf, 2KV, ceramic | .35 |
| C229 | 8G-13962 | 5000 mmf, 500 volt, ceramic | .25 |
| C230 | 8G-24026 | 47 mmf, 3KV, ceramic | .35 |
| C300 | 8G-19865 | 220 mmf, 500 volt, ceramic | .25 |
| C301 | 8G-13962 | 5000 mmf, 500 volt, ceramic | .25 |
| C302 | 8K-23083 | .047 mfd, 200 volt, molded | .25 |
| C305 | 17A-22376 | Printed circuit | .75 |
| C400 | 8G-19522 | 2000 mmf, 500 volt, ceramic | .25 |
| C401 | 8K-23084 | .1 mfd, 200 volt, molded | .25 |
| C402 | 8K-23816 | .033 mfd, 400 volt, molded | .25 |
| C403 | 8K-23084 | .1 mfd, 200 volt, molded | .25 |
| C404 | 8K-23095 | .1 mfd, 400 volt, molded | .30 |
| C405 | 8G-23781 | 1000 mmf, 1500 volt, ceramic | .25 |
| C500-501 | 8F3-121 | 470 mmf, 500 volt, mica | .25 |
| C502-503 | 8G-23790 | 5000 mmf, 500 volt, dual ceramic | .30 |
| C504 | 8C-22463 | 150 mfd, 150 volt, lytic | 1.75 |
| C505 | 8C-22464 | 150 mfd, 150 volt, lytic | 1.80 |
| C506 | 8G-13962 | 5000 mmf, 600 volt, ceramic | .25 |
| C600 | 8F3-117 | 220 mmf, 500 volt, mica | .25 |
| C601 | 8F3-112 | 82 mmf, 500 volt, mica | .25 |
| C602 | 8K-23083 | .047 mfd, 200 volt, molded | .25 |
| C603 | 8K-23082 | .022 mfd, 200 volt, molded | .25 |
| C604 | 8K-23087 | .47 mfd, 200 volt, molded | .50 |
| C605 | 8K-23094 | .047 mfd, 400 volt molded | .25 |
| C606 | 8M-24087 | .0068 mfd, 600 volt | .30 |
| C607 | 8F5-119 | 330 mmf, 500 volt, mica | .30 |
| C608 | 8D-23779 | 470 mmf, 500 volt, ceramic | .35 |
| C609 | 8K-23099 | .001 mfd, 600 volt, molded | .25 |
| C610 | 8K-23094 | .047 mfd, 400 volt, molded | .25 |
| C611 | 8K-23095 | .1 mfd, 400 volt, molded | .30 |
| C612 | 8F3-112 | 82 mmf 500 volt, mica | .25 |
| C613 | 8K-23085 | .15 mfd, 200 volt, molded | .30 |
| C614 | 8G-23953 | 220 mmf, 3000 volt, ceramic | .35 |
| C615 | 8E-18511 | 80-480 mmf, trimmer | — |

### Transformers and Coils

| Ref. No. | Part No. | Description | List Price |
|---|---|---|---|
| L100 | 201-23727 | Quadrature coil assembly | .60 |
| T100 | 201-23873 | 4.5 MC interstage transformer | .75 |
| T101 | 12C-23704 | Audio output transformer | 1.40 |
| L200 | 201-23829 | IF coil assembly | .70 |
| L201 | 16A-18676 | RF choke—2.2 UH | .20 |
| L202 | 201-24043 | IF coil assembly | 1.45 |
| L203 | 201-20265 | Peaking coil—35.2 UH | .20 |
| L205 | 16A-22923 | Peaking coil—22 UH | .20 |
| L206 | 16A-19365 | Peaking coil—410 UH | .25 |
| L207 | 16A-21391 | Peaking coil—305 UH | .25 |
| L208 | 16A-20970 | Peaking coil—270 UH | .30 |
| L209 | 16A-22923 | Peaking coil—22 UH | .20 |
| L210 | 16A-24090 | Choke coil assembly | — |
| T200 | 13B-23887 | Output IF coil assembly | .65 |
| T201 | 201-23729 | Sound trap & pick-off transformer | 1.85 |
| T202 | 201-23744 | Deflection yoke assembly | 9.35 |
| T400 | 12E-23726 | Vertical output transformer | 3.00 |
| L500 | 16A-23889 | Filter choke—.51H | 1.50 |
| T500 | 12D-23699 | Filament transformer | 4.15 |
| L600 | 13M-24085 | Stabilizer coil assembly | .95 |
| L601 | 13M-24086 | H. Blocking osc. coil | .75 |
| L602 | 16A-21701 | RF choke—8 UH | .20 |
| T600 | 12E-23939 | H. V. deflection transformer | 5.70 |
| | 201-23744 | Deflection yoke assembly, (includes 3 items below) | 9.35 |
| | 13M-23755 | Deflection yoke | 8.50 |
| | 18A-21216 | 5" PM speaker | 3.75 |
| | 18A-23735 | 4" PM speaker | 3.25 |

## MODEL IDENTIFICATION CHART

| MODEL | CHASSIS | CABINET | TYPE |
|---|---|---|---|
| M-1750A | 17T18 | Mantel | Autumn Brown - Metal |
| M-1750C | 17T18 | Mantel | Charcoal Black - Metal |
| M-1750G | 17T18 | Mantel | Seamist Green - Metal |
| M-1750K | 17T18 | Mantel | Gold - Metal |
| M-1751D | 17T18 | Mantel | Grey - Leatherette |
| M-1751F | 17T18 | Mantel | Mahogany - Leatherette |
| M-1752E | 17T18 | Mantel | Black Stag - Leatherette |
| M-1752L | 17T18 | Mantel | Leopard Skin - Leatherette |
| M-2160A | 21T19 | Mantel | Autumn Brown - Metal |
| M-2160C | 21T19 | Mantel | Charcoal Black - Metal |
| M-2160G | 21T19 | Mantel | Seamist Green - Metal |
| M-2160K | 21T19 | Mantel | Gold - Metal |
| M-2161D | 21T19 | Mantel | Grey - Leatherette |
| M-2161F | 21T19 | Mantel | Mahogany - Leatherette |
| M-2162E | 21T19 | Mantel | Black Stag - Leatherette |
| M-2162L | 21T19 | Mantel | Leopard Skin - Leatherette |

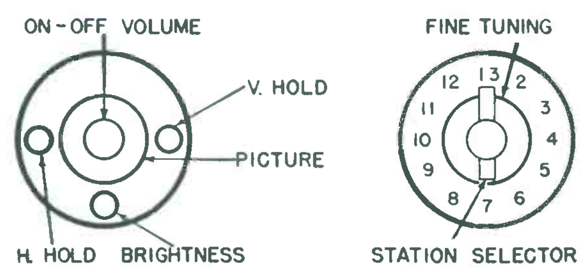


Figure 1. Top Controls

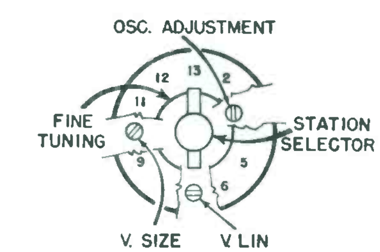


Figure 2. Service Controls

# Raytheon

Chassis 17T18, 21T19

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## INSTRUCTIONS FOR REMOVING CHASSIS FROM CABINET

1. Remove volume, picture, horizontal hold, brightness, vertical hold, station selector, and fine tuning knobs by pulling straight up from shaft.
2. Remove 4 screws securing cabinet back in place.
3. Place cabinet with back side up on any soft surface that will not mar safety glass.
4. Remove antenna and safety interlock bracket by removing two mounting screws at bottom rear of cabinet.
5. Disconnect speaker from cabinet by removing two screws and nuts.
6. Remove six screws around front of cabinet.
7. Remove four screws at top and bottom of cabinet. Top screws are within indicator disks and accessible after removing knobs.
8. Lift cabinet straight up.

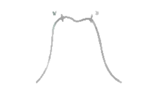
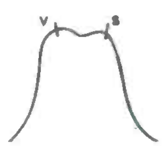
## TUNER ALIGNMENT

NOTE: I F Amplifiers must be correctly aligned before attempting tuner alignment.

Tuner must be in chassis and properly connected.

CONNECT -1.5 VOLTS BIAS TO TUNER A.G.C. SET FINE-TUNING CONTROL TO MID-RANGE.

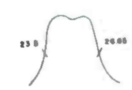
V-Video
S-Sound

| Step No. | Signal Generator Freq. (mc.) | Sweep Generator Freq. (mc.) | Signal Input Point | Output Point | Remarks | Adjust | Response |
|---|---|---|---|---|---|---|---|
| 1 | V-193.25 S-197.75 | Channel 10 | Antenna Terminals | Scope at R. F. Test Point | Adjust for maximum response with markers as shown and less than 30% difference between valley and peaks | C-1 C-3 C-6 |  |
| 2 | V-67.25 S-71.75 | Channel 4 | Antenna Terminals | Scope at R.F. Test Point | Adjust for maximum response with markers as shown and less than 30% difference between valley and peaks | C-1 C-3 C-6 |  |
| 3 | V-211.25 S-215.75<br>V-205.25 S-209.75<br>V-199.25 S-203.75<br>V-187.25 S-191.75<br>V-181.25 S-185.75<br>V-175.25 S-179.75<br>V-83.25 S-87.75<br>V-77.25 S-81.75<br>V-61.25 S-65.75<br>V-55.25 S-59.75 | Channel 13<br>Channel 12<br>Channel 11<br>Channel 9<br>Channel 8<br>Channel 7<br>Channel 6<br>Channel 5<br>Channel 3<br>Channel 2 | Antenna Terminals | Scope at R. F. Test Point | Set Tuner to various channels. Response curve and markers should be as indicated. Response curve tilt of not more than 30% is permissible. (If not, repeat step 1). | Check Points Only |  |
| 4 | V-193.25 | Channel 10 | Antenna Terminals | Scope at Pin 8 of V-6A | Adjust until marker is 50% down on low frequency slope. | Oscillator Slug |  |
| 5 | REPEAT STEP 4 FOR EACH CHANNEL | | | | | | |

## PRE-ALIGNMENT PRECAUTIONS

1. If sweep generator does not have a balanced output, connect a 150 ohm resistor in series with the ground lead and 150 ohms minus the internal resistance of the generator in series with the hot lead.
2. Connect a 1000 mmf capacitor across scope terminals and a 10K ohm resistor in series with hot lead as close to test point as possible.
3. Connect signal generator through a 1000 mmf capacitor.
4. When aligning the IF Amplifier be sure tuner is set to channel 10.

## VIDEO IF ALIGNMENT

| Step No. | Signal Generator Freq. (mc.) | Sweep Generator Freq (mc.) | Signal Input Point | Output Point | Remarks | Adjust | Response |
|---|---|---|---|---|---|---|---|
| 1 | 23.9<br>26.3 | 25 | Pin 8 of V-5A | Scope at IF detector output | Connect short between pin 5 and 6 of V-4 | T200 pri. (top) T200 sec. (bot.) Coupling rod |  |
| 2 | Markers should fall 10% down. If response curve is not as shown, readjust coupling rod (bottom T200) for proper bandwidth and T200 primary and secondary for flat response and maximum gain. | | | | | | |
| 3 | 21.3 | —— | Converter grid | VTVM at Pin 8 of V-6A | Remove short. Adjust generator for output of approx. 2 volts DC on VTVM | L202B (bottom core) | Maximum reading |
| 4 | 26.5 | —— | Converter grid | VTVM at Pin 8 of V-6A | Adjust generator for output of approx. 2 volts DC on VTVM | L202A (top core) | Maximum reading |
| 5 | 21.3 | —— | Converter grid | VTVM at Pin 8 of V-6A | Adjust generator for output of approx. 2 volts DC on VTVM | L202B (bottom core) | Maximum reading |
| 6 | 24.0 | —— | Converter grid | VTVM at Pin 8 of V-6A | Adjust generator for output of approx. 2 volts DC on VTVM | L200 | Maximum reading |
| 7 | 25.0 | —— | Converter grid | VTVM at Pin 8 of V-6A | Adjust generator for output of approx. 2 volts DC on VTVM | L11 | Maximum reading |
| 8 | —— | 25 | Converter grid | Scope at Pin 8 of V-6A | —— | L11 | Rock for flat response. |
| 9 | 23.8<br>26.65 | 25 | Converter grid | Scope at Pin 8 of V-6A | Markers should be 50% down and response curve should be as shown. If not, repeat alignment | Check point only |  |

Picture IF frequency 26.75 MC — Sound IF frequency 22.25MC.
NOTE: A very short lead from the generator must be used to prevent regeneration.

## SOUND IF ALIGNMENT

Sound Alignment can be performed without test equipment and without removing the picture tube from the chassis.

1. Tune in a TV station and adjust fine tuning until sound bars just appear.
2. Turn T201 primary (furthest from chassis pan) slug all the way out (counter-clockwise).
3. Turn same T201 slug in (clockwise) until the horizontal scanning lines are smooth and continuous.
4. Readjust fine tuning for best picture with adequate sound.
5. Reduce signal strength at antenna terminals by use of an attenuator or similar device until a "hiss" accompanies the sound.
6. Adjust sound pick-off transformer (T201 secondary), interstage transformer (T100), quadrature coil (L-100) and buzz control (R102) for maximum clear sound and minimum buzz.
7. If "hiss" disappears during step 3, further reduce signal strength.

RADIO-TELEVISION SERVICE DEALER
COMPLETE TV SERVICE INFORMATION SHEETS

# Raytheon

Chassis 17T18, 21T19

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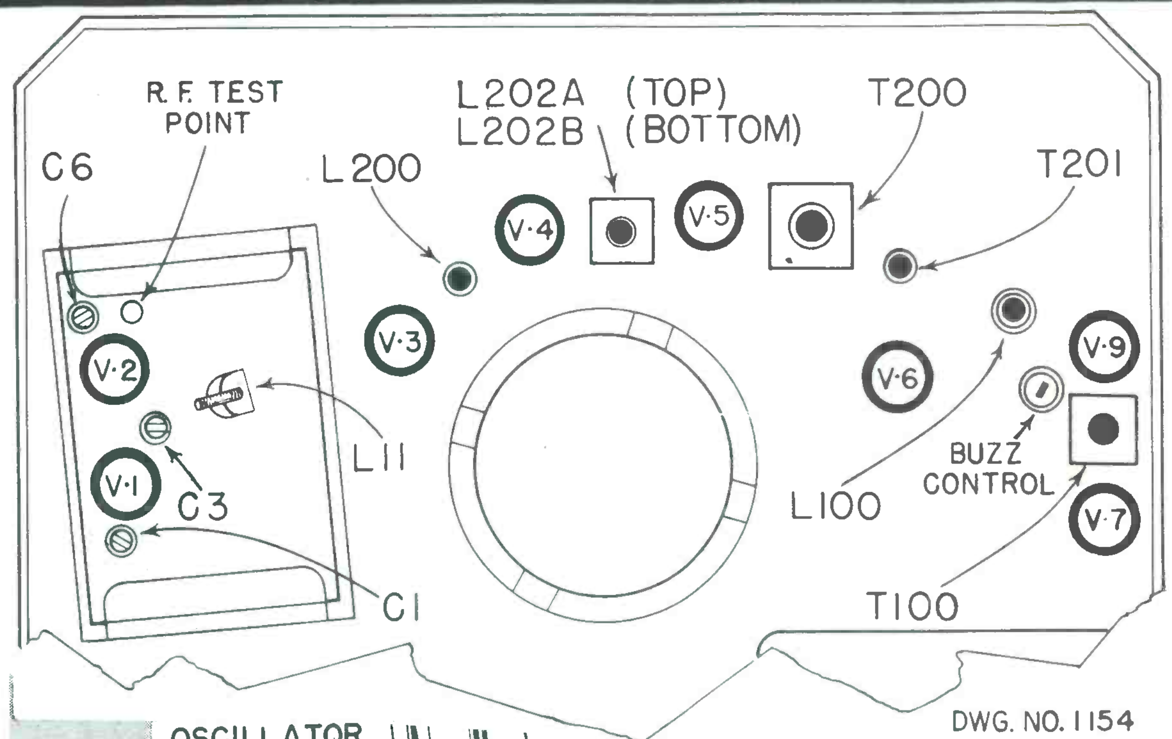


**Figure 3. Top Chassis View**

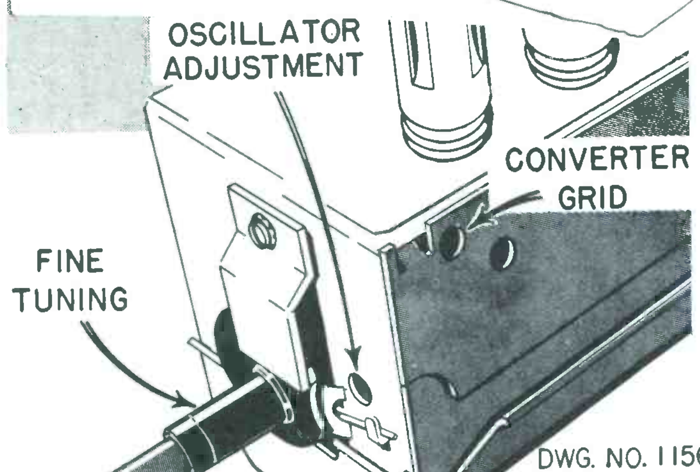


**Figure 4. VHF Tuner View**

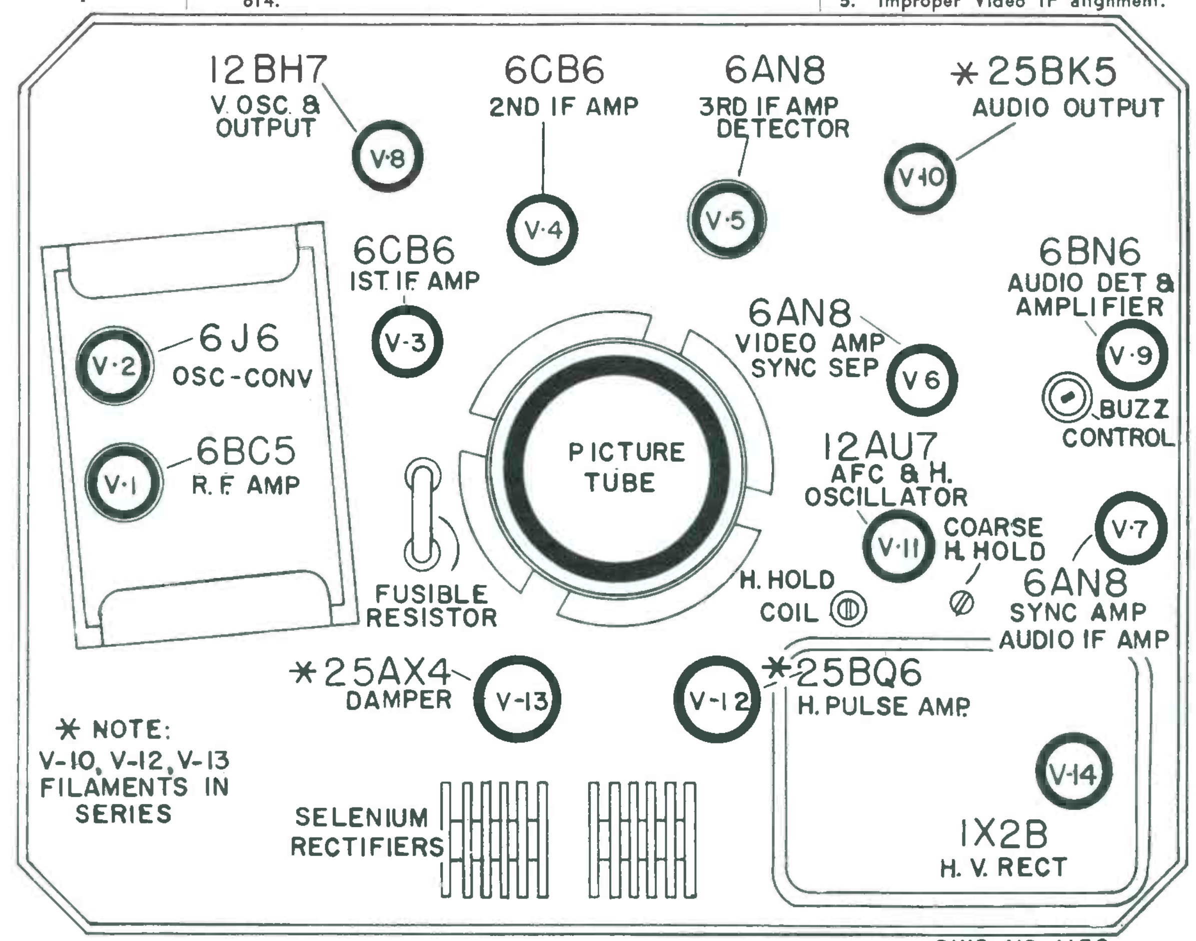


**Figure 6. Tube Layout**

# TROUBLE-SHOOTING

| Trouble | Probable Location |
|---|---|
| No Raster No Sound | 1. Defective tubes V10-12-13.<br>2. Defective selenium rectifers<br>3. Defective resistors R502 thru R506<br>4. Defective capacitors C504-505-219-506.<br>5. Defective transformer T500 or choke L500.<br>6. Defective safety interlock or on-off switch. |
| No Raster Sound Normal | 1. Insufficient or no high voltage, (refer to "No High Voltage section).<br>2. Defective picture tube.<br>3. Second anode lead disconnected.<br>4. Ion trap magnet misadjusted.<br>5. Defective C.R.T socket. |
| No High Voltage | 1. Defective tubes V11-12-13-14.<br>2. Defective transformer T600, yoke T202 or coil L600-601-602.<br>3. Defective capacitors C604-605-607-609-610-611-613.<br>4. Defective resistors R604-606-607-610-612-613-615-616. |
| No Picture No Sound Raster Normal | 1. Defective antenna or lead-in.<br>2. Defective tubes V1-2-3-4-5-6.<br>3. Improper voltages or resistances at sockets of tubes V1-2-3-4-5-6.<br>4 Improper alignment. |
| No Sound Picture Normal | 1. Defective tubes V7-9-10.<br>2. Improper voltages or resistances at socket of tubes V7-9-10.<br>3. Defective speaker or leads broken or not in place.<br>4. Defective transformer T100-101 or coil L100.<br>5. Improper sound alignment. |
| No Sync | 1. Defective tubes V6-7.<br>2. Defective capacitors C301-302.<br>3. Defective resistors R300 thru R307. |
| Insufficient or no Vertical Sweep | 1. Defective tube V8.<br>2. Defective transformer T400 or yoke T202.<br>3. Defective capacitor C401-402-403-404-405-219.<br>4. Defective resistor R401-404-405-406-407-408-409-410. |
| Picture cannot be Centered | 1 Defective picture tube.<br>2. Defective centering control.<br>3. Defective ion trap magnet. |
| Poor Focus | 1. Improper adjustment on ion trap.<br>2. Defective picture tube. |
| Poor Horizontal Linearity | 1. Defective tubes V12-13.<br>2. Defective capacitors C228-230-611-613 614.<br>3. Defective transformer T202-600 or coil L602. |
| Snow or Poor Picture | 1. Insufficient signal input.<br>2. Defective antenna or lead-in.<br>3. Weak tubes V1-2-3-4-5-6.<br>4. Improper video IF alignment. |
| Lack of Contrast | 1. Defective tubes V4-5-6.<br>2. Defective resistors R203-208-211-214.<br>3. Defective capacitors C218-226<br>4. Defective coils L205-206-209. |
| Washed Out or Picture Smear | 1. Gassy tubes V1-2-3-4-5-6.<br>2. Defective resistors R212-214-216-217-218.<br>3. Defective capacitors C214-218-226.<br>4. Defective coils L205 thru L209 and transformer T201.<br>5. Improper Video IF alignment. |

# TUBE COMPLEMENT

| Schematic Ref. No. | RTMA TYPE | TUBE FUNCTION |
|---|---|---|
| V-1 | 6BC5 | RF Amplifier |
| V-2 | 6J6 | Oscillator-Converter |
| V-3-4 | 6CB6 | IF Amplifier |
| V-5 | 6AN8 | 3rd IF Amp., Detector and A.G.C. |
| V-6 | 6AN8 | Video Amplifier and Sync Sep. |
| V-7 | 6AN8 | Sync. Amp. and Audio IF Amp. |
| V-8 | 12BH7 | Vertical Osc. and Output |
| V-9 | 6BN6 | Audio Detector and Amplifier |
| V-10 | 25BK5 | Audio Output |
| V-11 | 12AU7 | AFC and Horizontal Osc. |
| V-12 | 25BQ6 | Horizontal Pulse Amplifier |
| V-13 | 25AX4 | Damper |
| V-14 | 1X2B | H. V. Rectifier |
| V-15 | 17HP4 | 17" Picture Tube |
| V-15 | 21YP4 | 21" Picture Tube |

# Raytheon

## Chassis 17T18, 21T19

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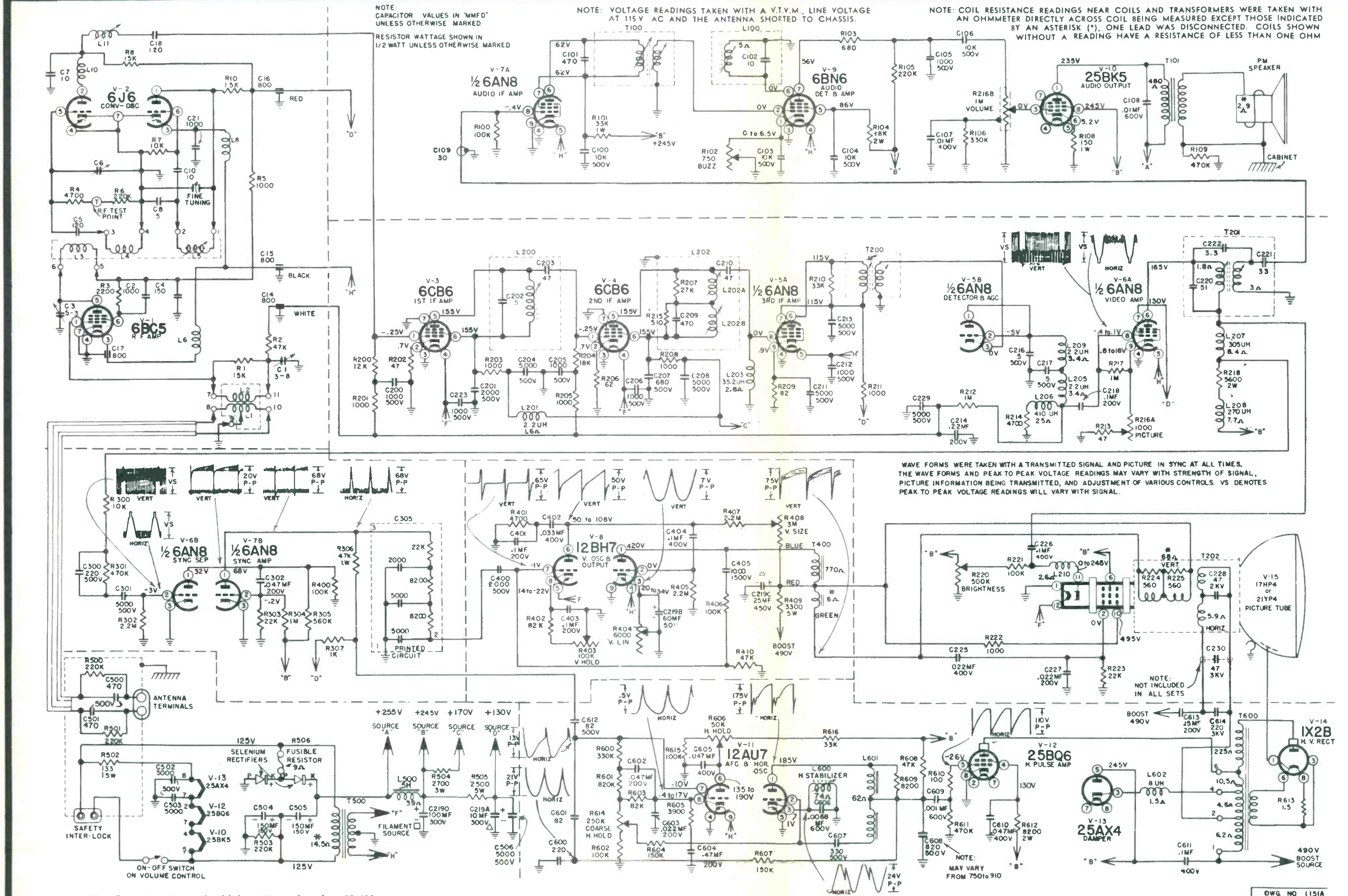
NOTE: CAPACITOR VALUES IN "MMFD" UNLESS OTHERWISE MARKED. RESISTOR WATTAGE SHOWN IN 1/2 WATT UNLESS OTHERWISE MARKED

NOTE: VOLTAGE READINGS TAKEN WITH A V.T.V.M., LINE VOLTAGE AT 115 V AC AND THE ANTENNA SHORTED TO CHASSIS.

NOTE: COIL RESISTANCE READINGS NEAR COILS AND TRANSFORMERS WERE TAKEN WITH AN OHMMETER DIRECTLY ACROSS COIL BEING MEASURED EXCEPT THOSE INDICATED BY AN ASTERISK (*), ONE LEAD WAS DISCONNECTED. COILS SHOWN WITHOUT A READING HAVE A RESISTANCE OF LESS THAN ONE OHM

WAVE FORMS WERE TAKEN WITH A TRANSMITTED SIGNAL AND PICTURE IN SYNC AT ALL TIMES. THE WAVE FORMS AND PEAK TO PEAK VOLTAGE READINGS MAY VARY WITH STRENGTH OF SIGNAL, PICTURE INFORMATION BEING TRANSMITTED, AND ADJUSTMENT OF VARIOUS CONTROLS. VS DENOTES PEAK TO PEAK VOLTAGE READINGS WILL VARY WITH SIGNAL.




NOTE: Capacitor C608 should be 470 mmf and a 80-480 mmf trimmer is connected in parallel with C608.

17T18, 21T19 TELEVISION SCHEMATIC DIAGRAM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