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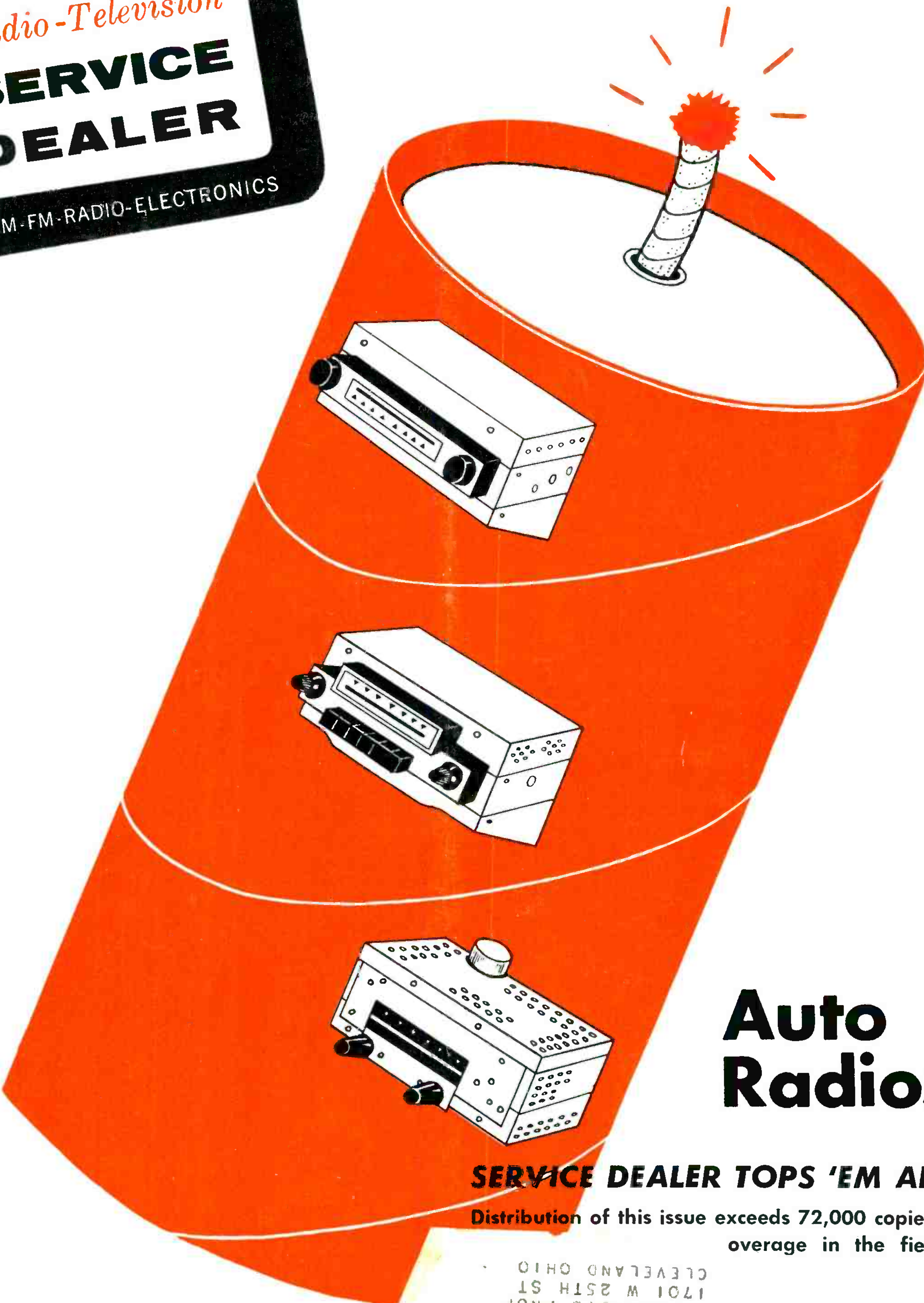
JULY 1955



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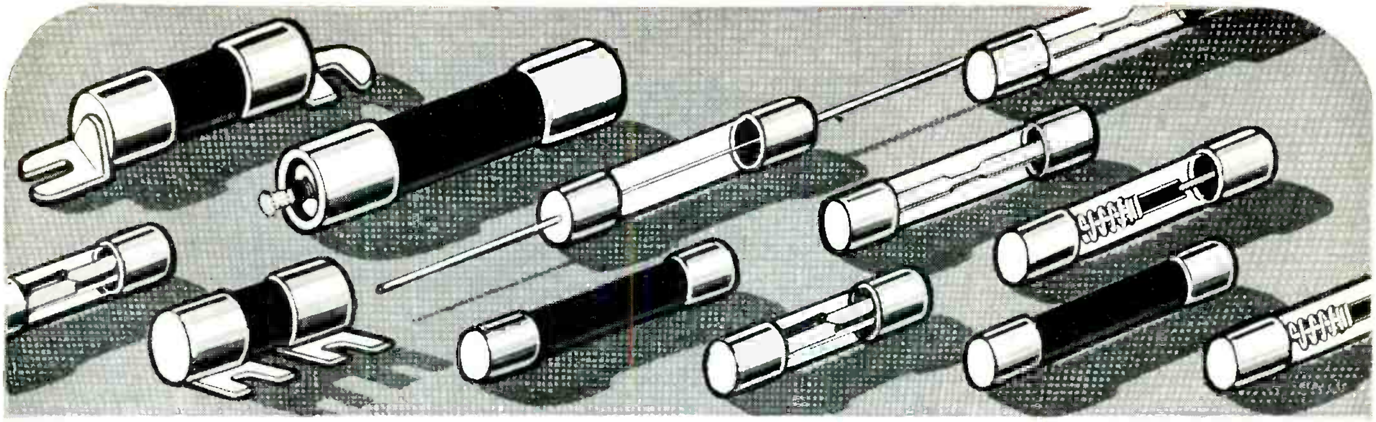

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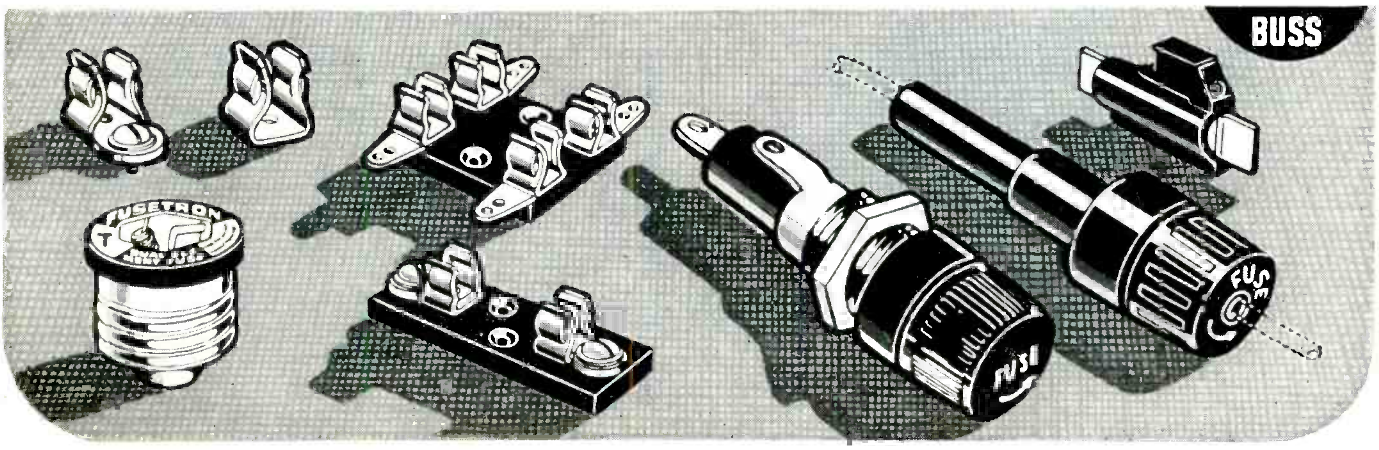

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COWAN PUBLISHING CORP., 67 West 44th Street, New York 36, N. Y.

VOL. 16, NO. 7 JULY, 1955

FEATURE ARTICLES

CIRCUIT AND SERVICE FORUM

DEPARTMENTS

RADIO-TELEVISION SERVICE DEALER is published monthly by Cowan Pub. Corp., 67 West 44th St., New York 36, N. Y. Subscription price: $1.00 per year in the United States, & U.S. Poss. Elsewhere $1 per year additional. Single Copies 25c. Second Class mail privileges authorized at New York, N.Y. Copyright 1955, Cowan Publishing Corp.

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OUR COVER

July is the month when the vacation season starts off with a bang. For many millions of Americans a vacation is generally associated with an automobile trip of some sort, and associated with every auto is the indispensable auto radio. Auto radio sales and repair are big business today and offer a welcome fill-in to the seasonal slack in home radio sales and repairs.

EDITORIAL...

by S. R. COWAN
PUBLISHER

A Paradox

The vowels EIU when properly combined with the consonants DNT spell the word "UNITED." If changed around they also spell the word "UNTIED." "UNITED" and "UNTIED" are 180° out of phase. This paradox struck me today as I read in the newspaper that United Automobile Workers representatives are about to negotiate new contracts with Ford and General Motors.

Because the union members are united whereas Ford and G.M. are untied impels me to guess that the unions will win most of their objectives. And that fact, if borne out, is worth thinking about if you earn your living or a part of it as a radio-TV serviceman or service dealer.

Our Field Needs to be United

I honestly believe that no other group or class of businessmen are as completely disorganized and un-united as those who make up the radio-TV servicing profession. Although there are many servicemen's associations, many dealers associations and even a few State Federations of service associations—in the main, none of these groups represents a high percentage of the total potential within their respective boundaries. (There are slightly over 10,000 service firm owners and upwards of 40,000 employed technicians in N. Y. state and yet total association memberships combined is less than 4,000). Talk about disunity—in metropolitan New York alone there are more than six servicemen's associations having a total membership of less than 1,000 and yet there are close to 5,000 service shops, many having more than 30 employees.

Delving further into the matter, all through the country the various groups or associations vie with each other, only a handful collaborate, and even the State Federations show but passing interest in the activities of similar groups located in adjacent states. Certainly, in plain English, there is but minimum effectiveness being derived from the status quo and servicers as a whole enjoy no recognition from anyone on a national basis. Let's change that!

Editorially time and time again I have said that every individual who derives a part or all of his income from radio-appliance-TV sales or servicing should be affiliated with some association. I have stressed that the smaller independent associations should be affiliated with State Federations and finally I have urged that such Federations should collaborate with each other to form, what in the final analysis, might be called a "Congress of Service-Dealers and Technicians." Imagine the benefits that would result to all—the public and those who earn their living from selling-servicing—if there were such a Congress made up by representatives from all 48 states and the District of Columbia. I'd need a book to recount them all. In a word —instead of servicemen being looked upon by manufacturers, distributors and the public as whipping dogs, members of the servicing profession, whether big or small operators, could be raised to the status of highly regarded, skilled professional men who have a dignified and proper place in the nation's economy, i.e., maintaining in good order upwards of 4 billions of dollars worth of sundry electronics apparatus. In spite of the fact that electronics ranks as a leader in American industry, by no stretch of the imagination are electronics technicians considered in a comparable position among service personnel.

Why is there such disunity and why are servicemen so "untied" instead of being "united?" Lack of far-sightedness is, in my opinion, the basic reason. In the past, when forming associations, independent servicemen and shop owners preferred to exclude from their midst their employed technicians, saying "Capital and Labor can't mix." How trite! Technicians, on the other hand, were reluctant to affiliate with associations made up primarily of shop owners—and pure service shop owners tried to exclude or discriminate when it came to associations with a retailer or dealer who also did service work. Finally, many dealer associations excluded from membership any independent servicemen or even service firm. Yes, history proves our various groups have been dis-united in every possible manner. And now disunity is working a hardship on all. But it is not too late to readjust and correct this situation.

Correcting The Fault

NARDA—the National Appliance & Radio-TV Dealers Association—is the largest group of its kind. The association's general manager, Al Bernsohn, has a lot "on the ball." Recently he wrote me saying, "We're getting more and more service representation in NARDA . . . with Servicemen's

[*Continued on page 41*]

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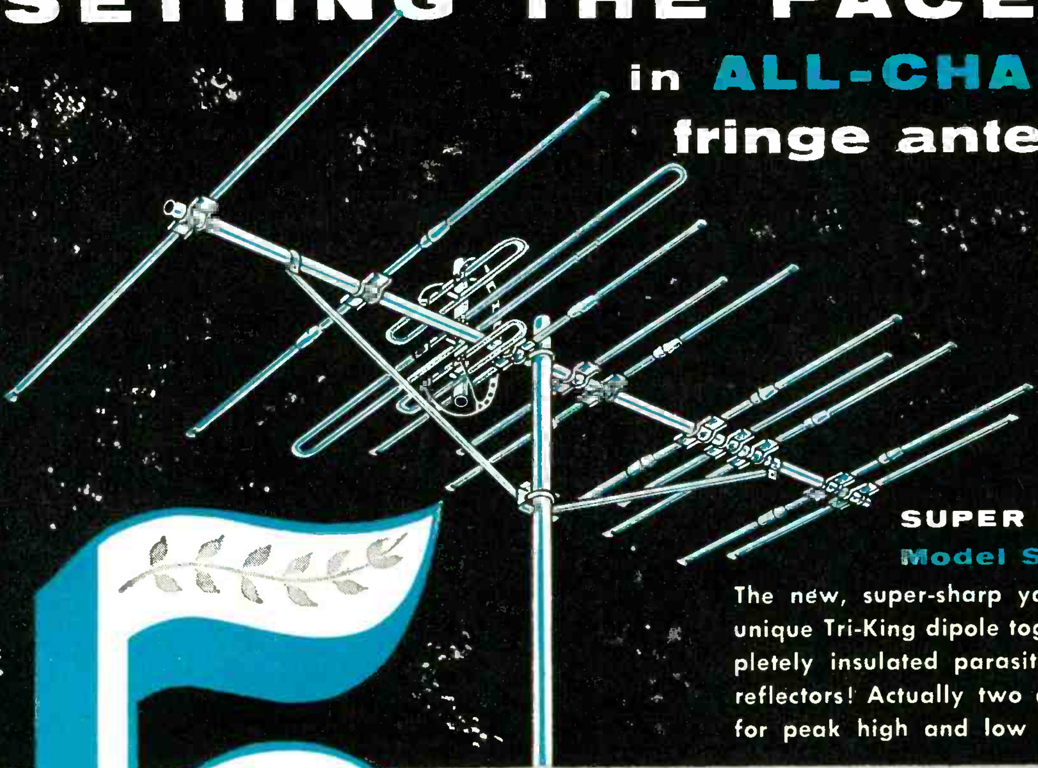

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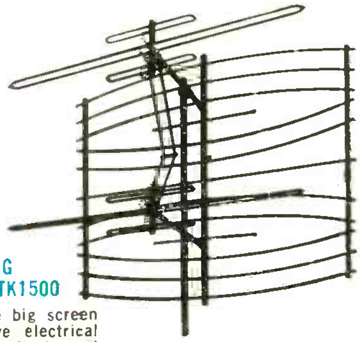

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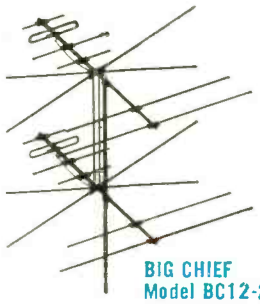

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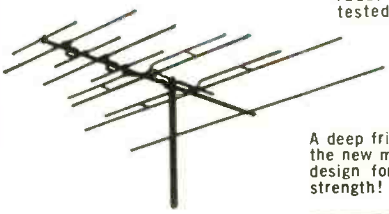

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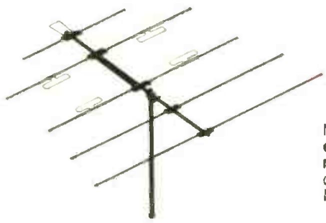

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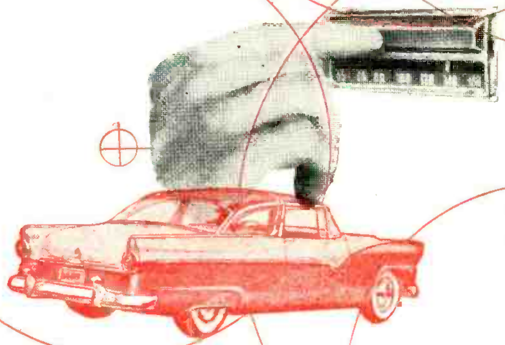
SIGNAL SEEKING in auto radios

by **Steve Travis**

Description of the electron circuits involved in a typical "Signal Seeking" auto radio. These units are enjoying increasing popularity and will require servicing.



A SYSTEM of tuning and selecting stations on auto radios that is becoming very popular is called "Signal Seeking" or "Search Tuning." This is a method whereby a bar on the front of the radio or a foot tread is pressed and the radio automatically changes to the next station. If a station further along the dial is desired the bar or foot tread is held depressed until the station is approached by the dial indicator and then released and the station is automatically tuned.

Signal seeking is *generally* incorporated in deluxe radios installed in the more expensive cars, an excellent example of which are the Mopar models 902 and 903, manufactured by Philco and employed in the Chrysler cars. In these models tuning of the radio station can be accomplished by means of any of three methods: manually, with push buttons, or by means of the signal seeking feature.

The search tuning system makes use of an electric motor to move the tuning mechanism. The motor operates until a station is tuned in at which time it automatically stops. The direction of action is from the low frequency end of the broadcast band towards the high frequency end. When the extreme end of the band has been reached the dial indicator and the tuning mechanism is rapidly moved back to the low frequency end where the signal searching is continued.

As has been previously mentioned the station seeking function is put into operation by pressing a bar on the radio. If it is desired a foot pedal can be installed thus making it possible to change stations without making it necessary to remove the hand from the steering wheel.

An additional control employed in the system is the sensitivity selector. This is a four position switch which permits the signal seeking system to function on the strong stations only, or on three other levels of sensitivity to the point where even weak broadcast stations can automatically be tuned in. This added feature of search tuning is built into a conventional eight tube auto radio, uses only one extra tube, a 6CS6, and is accomplished by means of three functions:

1. Switching and relay circuits
2. Motor driving mechanism
3. Phase comparing and control circuit

The operational sequence occurs in the following manner. First, an examination of *Fig. 1* will reveal that when either the foot tread or the tuning bar is momentarily depressed current flows through the relay to B plus. This current causes the relay to be closed and the following switch contacts are made:

1. The clutch solenoid is put into operation changing the tuning from manual to motor operation.

2. The motor is made active.

3. Muting of the audio system is accomplished by grounding the grid of the audio phase inverter.

4. The sensitivity switch is caused to take control by the removal of the ground connection for the *rf* and *if* cathode circuits.

5. A 20 $\mu\mu$f condenser is placed across the secondary of the 2nd *if* transformer. At the same time this contact completes the grid and cathode circuits of the 12AU7 relay control tube. Thus, the tube is permitted to conduct, thereby maintaining current flow through the relay and *holding* it in position to maintain the relay switch contacts closed.

All connections of the switch are maintained in this position until a negative pulse is supplied by the phase detector tube to cut off the relay tube current. This allows the relay to be released thereby removing power to the clutch solenoid and driving motor, removing the muting ground, breaking the connection for the phasing condenser and relay cathode and grid circuits and finally removing the biasing resistors of the sensitivity control from the *rf* and *if* amplifiers to permit the receiver to operate at normal gain.

As can be noted in *Fig. 1*, the sensitivity switch has four positions. In the ordinary operation of the radio the relay switch completes the *rf* and *if* amplifier tube cathode circuits ground connections permitting the receiver to function normally and achieve maximum sensitivity. However, in the search position the sensitivity control resistors are placed in the cathode return leads and the gain is then a function of the sensitivity switch position.

The search tuning operation is designed to function in one direction only. That is, from the low frequency end of the dial towards the high frequency end. At the end of the travel of the tuning carriage a latch mechanism is opened and the tuning carriage is returned rapidly to the low frequency end. At this end the search operation is caused to continue because of an extension on the tuning bar which forces it to be depressed, contact being made in this extreme position. Thus, if a pulse occurs, during the retrace of the broadcast band, which triggers the relay tube and blocks it, the system is placed in operation again so that the searching is continued.

The Electronic Control Circuit

The phase detector circuit with its phase shifting condenser constitutes the electronic means of bringing to a stop the signal seeking operation when a station has been reached. The search operation must be stopped accurately so that the station is properly tuned. In a mechanism such as this there will be a certain amount of delay in opening the relay and switches. Also, because of the inherent momentum that exists it is necessary to cause the stopping action to be triggered previous to the proper tuning point.

The triggering pulse is accomplished in the 6CS6 phase detector plate circuit shown in *Fig. 1*. The 2nd *if* stage, besides feeding the detector for the recovery of the amplitude modulation, supplies the 6CS6 phase detector circuit with two signals. The plate circuit side of the *if* transformer couples a signal to grid #3 while the secondary of the transformer supplies the same signal to grid #1. These two signals are 90° out of phase with each other, a condition which is obtained between primary and secondary in a double-tuned *rf* transformer at resonance.

As tuning occurs, the *if* beat signal (which is the difference between the local oscillator and the incoming *rf* signal) is fed through the *if* circuitry which has sufficient bandwidth to pass 10 *kc* on either side of the center resonance frequency of 265 *kc*. The beat difference signal will at first be less than the center *if* frequency as tuning brings it toward the exact *if* frequency for the station being received. It then increases until 265 *kc* is reached, at which time tuning will have ceased. If tuning were allowed to continue the frequency would increase higher than the *if* frequency of 265 *kc*. These changing frequencies are the signals supplied to the phase detector during the signal seeking process. Actually, only the frequencies *below* the center *if* frequency of 265 *kc* are of interest, because the relay tube triggering can be approached from one direction only.

The *if* signal voltages coupled to grid #1 cause it to function as a self biasing circuit and grid #1 controls the electron flow through the tube with electrons

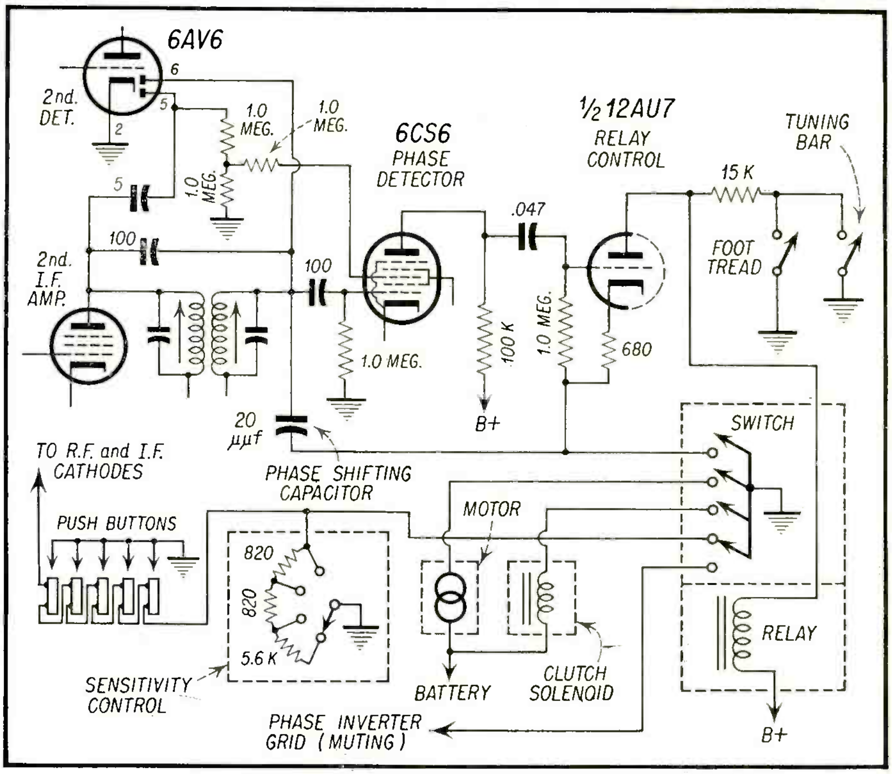


Fig. 1—Simplified schematic of Mopar Models 902 and 903 "Signal Seeking" circuitry.

passing only during the positive portion of the applied signals. When the polarity of the signal swings negative the electron flow is cut off. As has been pointed out the same signal is fed to grid #3 of the 6CS6 tube. The application of this signal likewise acts upon the electron flow through the tube in conjunction with additional biasing provided by a separate diode in the 6AV6 circuit. This provides a smoother control of the signal seeking action.

The relative phase relation of these two signals determines the extent of the current flow through the tube; that is, whether it will increase or decrease as the *if* beat frequency is changing. It

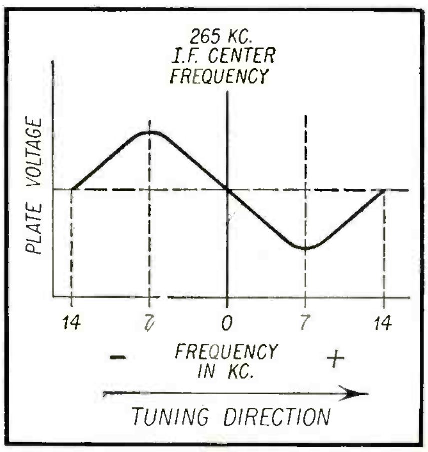


Fig. 2—Theoretical plate voltage changes of phase detector tube as a broadcast signal is tuned in by mechanism.

will be recalled that when current through a tube decreases the plate voltage rises and vice versa. The change in phase of the two signals applied to the separate grids as the center *if* frequency is approached causes a change in plate current and opposite change in plate voltage. From the plate of the phase detector circuit we can obtain an "S" curve somewhat similar to that of a frequency swept FM detector as shown in *Fig. 2*. Subsequently, we will show how this curve is modified to obtain the desired curve necessary to operate the relay tube.

At this point in our discussion it must be emphasized again that the momentum of the tuning mechanism necessitates that the movement be stopped and the switch contacts be open 4 *kc* ahead of the center frequency. The momentum will then carry the mechanism to the center *if* frequency of the broadcast station. The stopping of the motor or, in other words, the opening of the relay can only be caused by the blocking of the flow of current through the relay control tube since the tuning bar or foot tread is only momentarily depressed to activate the relay and, being spring loaded, breaks contact once released. A negative pulse must be supplied to the grid of the relay control tube to cut off the tube current. This negative triggering signal is produced in the phase detector plate circuit 4 *kc* ahead of the center *if* frequency for the station.

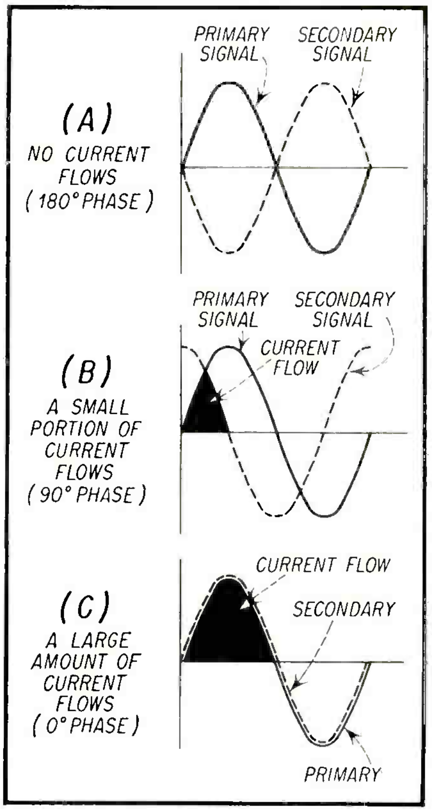


Fig. 3—Current and phase relationships occurring in phase detector of "Signal Seeking" portion of circuit as a signal is tuned in by mechanism.

As mentioned previously, the electron conduction in the phase detector is dependent on the phase of two signals applied to grids #1 and #3. That is, the phase of the signal applied from the transformer secondary to grid #1 with respect to the signal applied from the primary of the transformer to grid #3. The voltage that appears at the plate is a result of the phase relationship of the two signals and their resultant current flow. Consider the signal in the primary of the transformer as a signal with a fixed reference phase. This same signal is shifted in phase, in passing through the tuned circuits of the transformer secondary, the amount of phase shift depending on its frequency. Phase shift takes place in resonant circuits when the incoming signals deviate somewhat from resonance. At frequencies lower than the resonant frequency of the tuned secondary circuit the phase shift is such that the two signals can be 180° degrees out of phase as shown in *A* of *Fig.* 3. In this case both grids are not positive going at the same time as is required for electrons to flow. This reduces the current flow through the phase detector tube, and the plate voltage will rise as indicated at the upper left bend in the curve of *Fig.* 2. As the two signals approach the resonance frequency of the tuned circuits the phase difference is reduced allowing more current to flow as shown in *B* of *Fig.* 3. These conditions apply where the primary and secondary transformer circuits resonate at the same frequency. As mentioned previously at resonance, the relationship is a 90 degree phase difference permitting current to flow as indicated by the shaded portion between the two signals.

When the two signals are in exact phase which occurs at a point higher in frequency than the resonant point of the primary and secondary of the 2nd *if* transformer, maximum current flows and the negative knee of the curve of *Fig.* 2 is obtained. This point in the curve is as shown in *C* of *Fig.* 3.

The curve of *Fig.* 2 would not provide the desired control as the trigger pulse would be generated somewhere around 5 *kc* previous to the center frequency when it is necessary to have the relay triggered by a signal at about 4 *kc*. Therefore, it is necessary to modify the curve and the phase relationship somewhat.

The change in the curve is brought about by altering the phase of the signal obtained from the secondary of the transformer. A 20 $\mu\mu f$ condenser is connected across the secondary of the 2nd *if* transformer when the relay switch is activated for searching purposes, and can be noted in *Fig. 1*. When the condenser is shunted across the secondary it causes the circuit to resonate at a point lower in frequency. The plate voltage curve is shifted a fixed amount to the left of the center *if* frequency due to an advancing of the phase of the signal brought about by the detuning action. The resultant plate signal is thus steepened so that a sharp triggering voltage is obtained as shown in *Fig. 4*.

It can also be noted that the curve is flat on top. The phase detector tube is operated near plate current cutoff by the cathode biasing arrangement. Therefore current cutoff is easily reached, causing the upper portion of the curve to be flattened. A low plate voltage is also employed for this tube allowing the saturation point to be readily attained at the bottom of the curve. These two circuit developments combine to bring about a desired distortion in the curve so that it goes negative rapidly. A sharp negative going pulse is produced 4 *kc* ahead of the center *if* frequency of the broadcast station being automatically tuned, this pulse being of the proper amplitude to trigger the relay control tube.

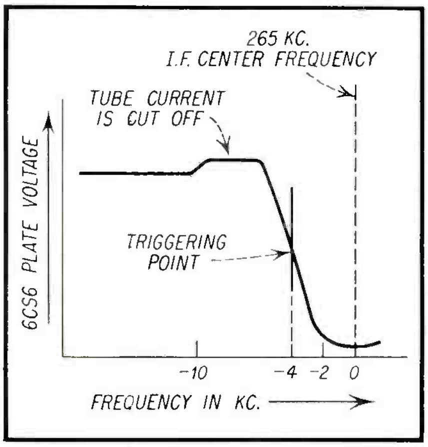


Fig. 4—Graph of signal developed at plate of phase detector as a result of signal phase relationships.

The negative plate pulse is coupled to the grid of the relay control tube through a .047 μf condenser where it drives the grid sufficiently negative to cut off the tube current. As a result the relay opens up and the relay switch circuits are broken causing the search operation to cease.

Although the signal search unit removes the need for a means of manually tuning the radio, manual tuning is made available in these Mopar models. Push button operation is also accomplished electronically by making use of the signal search system. A mechanical connection between the push buttons and the start switch causes the signal searching to be placed in operation when any button is pushed. However, there is one big difference in the manner in which the system functions when the push buttons are made use of. The *rf* and *if* amplifier cathode circuits are opened by the act of pushing a button so that no signals can pass through the radio. When a particular button is depressed it also grounds a contact for that button. There is a contact finger for each button that rides with the tuning carriage which is adjustable to any station. The contact fingers move in conjunction with the search operation and when the finger touches the contact that has been grounded by pushing in the button it provides a connection for the *rf* and *if* amplifier cathode circuits. Signals are then permitted to pass through these amplifiers. The first signal to pass through the radio is that for which the button has been set, with the result that the triggering action developed at the phase detector causes the relay tube to cease the searching operation.

This article has dealt with the knowhow and operation of a signal seeking radio. Due to space limitations adjustments of the push buttons has not been touched upon. It is a relatively simple process and is thoroughly explained in the manufacturer's service manual. Concerning alignment of the *rf* and *if* stages, this procedure is not affected by the inclusion of the signal seeking feature in the receiver just discussed.

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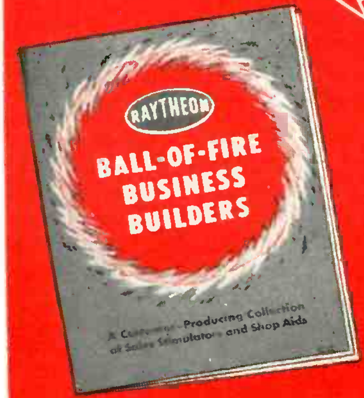

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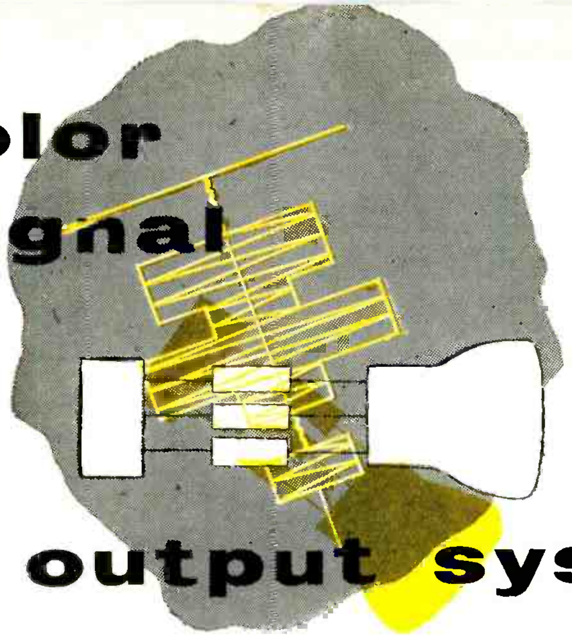

color signal output systems

Part 2

**by Bob Dargan
and Sam Marshall**

from a forthcoming book entitled "Fundamentals of Color Television"

Correct rendition of a black and white signal in a color receiver requires a set of adjustments in the color video output stages often referred to as, "High and Low Level Gray Scale Adjustments." These are discussed below.

IN general, control of the color video output signal to produce a correct black and white image on the picture tube involves certain adjustments of the red, green and blue video output circuits to give us a certain ratio of beam currents. This ratio is necessary for a correct black and white picture. These adjustments involve the:

1. signal drive
2. screen grid (G2) voltages on the picture tube
3. control grid (G1) voltages on the picture tube.

With close control of tolerances only two of the above sets of adjustments may be all that would be necessary to produce the required beam ratio for a correct black and white picture. However, recourse to a third set of adjustments is usually necessary to compensate for production tolerances in the picture tube.

In our previous discussions we intimated that to obtain a white picture the light output of the individual red, green, and blue phosphors should be equal. We also assumed that equal grid drive voltages were used to produce equal light outputs from the red, green, and blue phosphors. However, in practice we are confronted with phosphors of unequal light level efficiencies, so that adjustment of the control grid, screen grid, and signal drive voltages on the picture tube becomes necessary in order to take into consideration these inequalities.

Equal and Unequal Video Drive Systems

There are two fundamental approaches to the solution of the problem of unequal phosphor efficiencies. One is to adjust the individual G1 and G2 voltages so that identical gun characteristics are obtained without the applied signal. Following this, unequal video voltage drives are applied to the three guns so as to obtain the greatest beam current on the red gun, a lesser beam current on the green gun, and the smallest beam current on the blue gun. The second technique is to use equal video voltage drives and to adjust the gun characteristics by varying the G1 and G2 potentials of the guns to such an extent that the individual beam currents will be unequal in a manner similar to the results obtained in the first method.

Adjustment of Typical Unequal Drive System

The following procedure and discussion of a typical "unequal drive" system is presented to acquaint the reader with the *why* as well as the *how* of the various adjustments made in calibrating an I/Q color receiver for correct black and white reception. This procedure is performed in three distinct steps, these being:

1. adjustment of the picture tube screen grid controls
2. adjustment of the green and blue amplifier gain controls
3. adjustment of the green and blue background controls.

Throughout this discussion it must be borne in mind that our initial purpose is to obtain *untinted* black and white pictures for any setting of the contrast and master background (brightness) controls during these adjustments. To prevent possible contamination of the signal from spurious signals in the chrominance and demodulator sections, the chroma control is turned completely counter-clockwise.

Screen Grid Adjustments

A simplified schematic of the screen grid and control grid voltage supply of a typical I/Q receiver is shown in *Fig. 1*. Here we observe that the red, green, and blue screen grid voltages are obtained from individual potentiometers which form part of the voltage divider system between the 400V B+ line and ground. When the master background control is advanced completely in a clockwise direction all grids receive a negative bias of 60 volts with respect to cathode. The purpose of adjusting the bias on the grids to —60 volt (or any other predetermined value) is to establish an identical cutoff point on all three control grids. This characteristic requires previous adjustment of the individual G2 potentials.

The procedure in making the screen grid (G2) adjustments is as follows:

1. Turn the contrast control down for no signal input (counterclockwise).
2. Turn the master background (brightness) control on full (clockwise).
3. Turn the red, green, and blue screen grid controls completely off (counterclockwise).
4. Advance the red screen grid control until a faint red raster is visible.

Correction:
In *Fig. 1* of the preceding installment, RTSD June, 1955, page 6, the symbols G and B above the cathodes of the color tube symbols should be interchanged in parts (B) and (C) of the figure to correspond with the correct position of the color guns shown in (A).

5. Advance the green screen control until the raster turns yellow.

6. Advance the blue screen grid control until a neutral gray shade is obtained.

An analysis of the above adjustments points up the following significant fact. When the R, G and B screen controls are turned down for a barely visible raster, and the master background or brightness control is at its full or clockwise position the beam current in the color tube is just about at cutoff. This condition is shown in (A) in *Fig.* 2. This means that the normal appearance of the raster under no-signal conditions is a dull gray. The injection of a signal under these vertical cut-off conditions then drives the color grids in a positive direction thereby lighting up the various phosphors.

Color Amplifier Gain Adjustments

Having adjusted the beam currents of the R, B and G guns under no-signal conditions, we are now ready to provide the correct beam current ratios for a black and white picture. These beam current ratios may be obtained by providing a larger red grid signal than both the green and blue; and a larger green signal than the blue. The controls for these adjustments are shown in the equivalent simplified circuit diagram illustrated in *Fig.* 3. Inasmuch as the red phosphor has the weakest light energy output the full red signal is applied to the input of the adder tube. Thus, only two adjustments preceding the blue and green adders are used to adjust the video signals in the green and blue amplifiers against the video signal in the red amplifier.

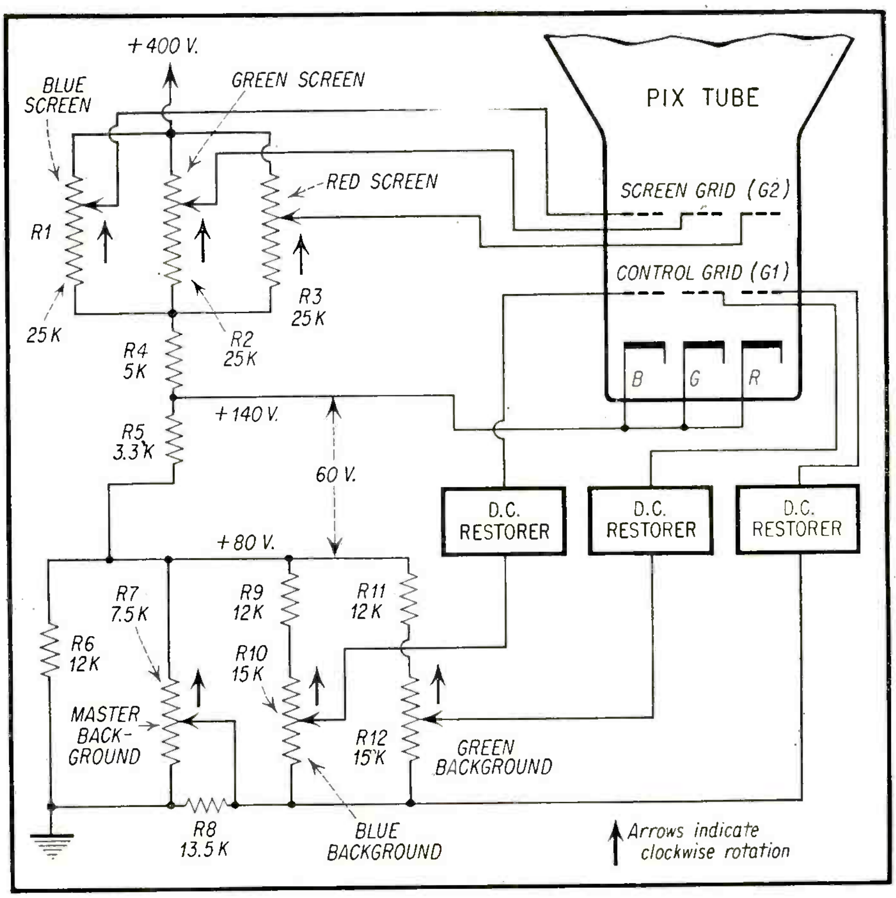

Fig. 1—Simplified screen grid and control grid voltage supply of a typical I/Q receiver.

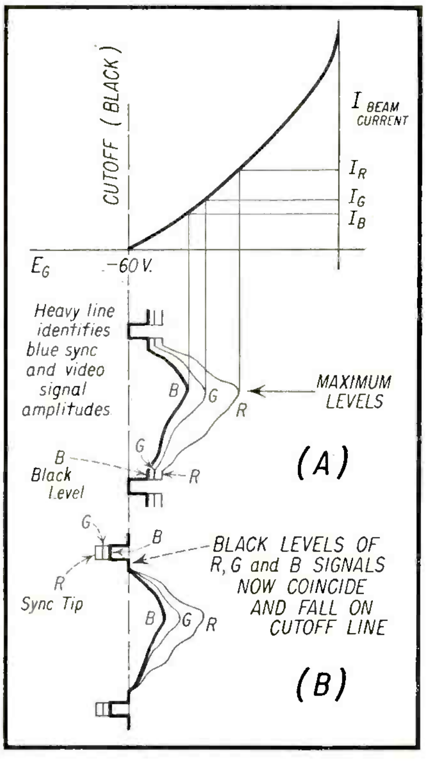

Fig. 2—How beam currents vary with grid voltage. Beam current ratio (I_R: I_G: I_B) should remain constant for various settings of master background control. Heavy lines identify blue color signal for clarity, and show how its position is shifted with reference to cutoff.

The manner in which the red, green and blue beam currents assume their correct ratios for a given set of video signals at the picture tube grids is illustrated in the different I beam current values shown in *Fig.* 2 (B). Here we have taken the maximum levels of the respective signals at the red, green and blue grids to illustrate our point. It will be shortly shown that the same ratios of I beam currents are maintained throughout the entire range of video signal amplitudes.

The procedure in adjusting the blue and green gain controls is as follows:

1. Advance the contrast control clockwise until a picture is obtained.

2. Adjust the blue and green gain controls until the highlight areas have no color tinting and are an acceptable white. This procedure involves possible readjustments of the blue and green gain controls for optimum results. The manner in which the ratio of beam currents remains the same for all values of contrast control settings is referred to as "tracking."

Background Control Adjustments

It will be recalled that the initial screen grid black and white adjustments occur normally at cutoff (see *Fig.* 2). Under these conditions the *sync tip* is now sitting on the black cutoff level of the picture tube and not the blacker than black level where it should be. It becomes necessary, therefore, to increase the negative bias of each gun by means of the background controls so that the various cutoff biases correspond to the black level of the signal. This will bring the sync pulses into the blacker than black region where they belong as shown in *Fig.* 2 (B).

A little reflection on what is taking place is now in order. First the *dc* restorers clamp the sync tips of the individual color signals at cutoff. Therefore, the video signal proceeds to the right of the sync tips as a reference. Notice that all sync tips coincide with each other and fall on the cutoff line. Because of the different red, green and blue signal values their respective black levels do not coincide as shown in *Fig.* 2 (*A*). However, proper rendition of picture contrast requires that the black levels of all three signals should corres-

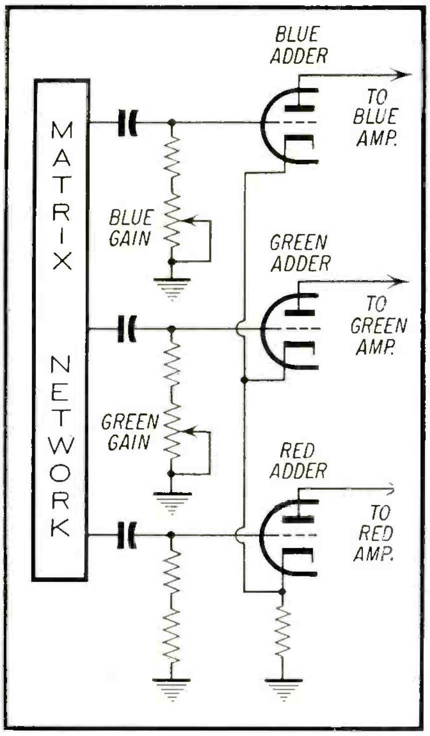

Fig. 3—Simplified schematic of Adder circuit in an I/Q receiver showing connections of Blue Gain and Green Gain controls in circuit. Notice that the full red signal is applied to the input of the Red Adder tube. Under these conditions the signals applied to the Blue and Green Adder tubes are adjusted for lower input levels compared to Red.

pond to cutoff for each gun. This condition is shown in *Fig. 2 (B)* which illustrates the same signals of *Fig. 2 (A)*, brought over to the left so that the black levels fall on the cutoff line and the sync tips lie along different values in blacker-than-black region.

To make all black levels coincide as in *Fig. 2 (B)* would seem to dictate the need for three separate grid bias controls, these controls requiring continuous adjustment as the contrast control is varied. However, by the ingenious circuit arrangement shown in *Fig. 1*, once *R10* and *R12* (G and B Background Controls) are adjusted in conjunction with *R7* (Master Background Control), the black levels of all three color signals will always coincide for any setting of the Master Background Control. The adjustment of these controls is as follows:

1. Turn the Master Background (brightness) control counter clockwise until the picture has a low light output. The picture will probably show color tinting indicating that *R10* and *R11* are in need of adjustment. Now turn the blue and green background controls until a neutral gray picture is obtained. As before, this procedure may involve readjustment of these controls until the picture is absolutely without tint.

It should be obvious that if no change in color tinting occurs as the Master Background and Contrast controls are rotated, tracking has been accomplished between the various bias levels and the corresponding video signal amplitudes.

Background Circuit Analysis

The background circuit in *Fig. 1* insures a constant resistance voltage divider network. A study of this circuit will reveal that for any setting of *R7*, the background control, the resistance of the network is constant. As an example, let us assume two extreme cases, one with *R7* turned completely clockwise, and the other with *R7* turned down (counter clockwise). We will observe that with *R7* turned clockwise the equivalent resistance of the network is:

$$R = \frac{7.5K \times 13.5K}{21K} = 4.81K$$

Notice that when *R7* is in this position, *R9, R10, R11*, and *R12* are shorted out. At a counter clockwise setting of *R7* the equivalent resistance of the network is as follows:

1. The parallel combination of *R9, R10, R11*, and *R12* is equal to 13.5K.

2. *R8* (13.5K) is now shorted out; however, the parallel combination of *R9, R10, R11*, and *R12* takes its place, so that the equivalent resistance of the network remains the same. The reader is advised to note that in practice *R8* is 12K because 13.5K resistors are not readily available. However, the error involved is negligible.

To summarize the material discussed in this installment, we must first recall that because of unequal phosphor efficiencies, adjustments of the screen grid, signal drive, and control grid voltages must be made for various operating conditions to provide suitable beam currents to balance out the phosphor inequalities. Finally, to summarize gray scale adjustment the procedure is as follows:

1. Adjust the screen grid controls at zero signal and the background control clockwise to obtain a dim gray raster at nominal cutoff.

2. Adjust the green and blue amplifier controls on a B&W signal to obtain the proper highlight white.

3. Adjust the green and blue background controls so that the bias ratios track with the video signal amplitudes at all settings of the master background control.

In this manner the unequal phosphor efficiencies of the red, green, and blue, phosphors will be compensated for at any setting of the master background or contrast control.

[*To Be Continued*]

TRADE FLASHES

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Items from RETMA . . . During the nine year period 1946 through 1954, nearly 36 million TV receivers were shipped to dealers. . . . Production of radio and TV receivers declined seasonally in April from the March level but remained considerably above the output level of April 1954. . . . Pointing out that the servicing of radio and TV receivers has become big business, a RETMA executive noted that the 12-month period from June 1954 marks the first time that the TV-radio industry has seen the gross income from the servicing of receivers equal or exceed the income from retail sales of receivers. . . . The week-long observance of National Radio and Television week, which will be highlighted by displays of new lines of radios, TV sets and phonographs in retail stores throughout the country, will start Sept. 18, and will be initiated by regional dinners throughout the country. Promotional material will be supplied to participants prior to this date. Life Magazine and the Saturday Evening Post will spearhead the promotional campaign.

Harold J. Schulman has been named Assistant to the President, for CBS-Columbia, in charge of coordinating all company plans and activities. One of the most versatile executives in the electronics field, he has been Director of Product Service for this firm with supervision of all service and field engineering activities. He is also Chairman of the RETMA Service Committee.

The United Motors Service Division of General Motors has mailed seven new Delco electronics parts bulletins to their distributors and their dealers. The seven green and yellow bulletins will permit easier and quicker reference to the company's aerials; capacitors and resistors; vibrators; transformers; speakers; hardware and suppression material; and auto radio controls.

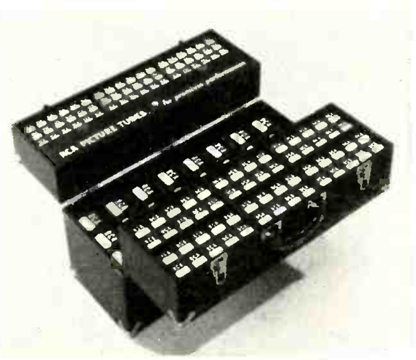
Year-end sales and profits are expected to exceed 1954, H. Leslie Hoffman, president and chairman of the board, told stockholders at the annual meeting of Hoffman Electronics Corporation today. Hoffman said the company is currently producing 21-inch color television sets but anticipates it will be 1956 before the company ob-

tains sizeable volume in color receivers. Representative of some of the developments now under way in their engineering research sections is this small, completely transistorized portable radio, with high output and very low power drain. Hoffman Laboratories is also nearing completion on a second Geiger counter for the low-cost market, as well as a sensitive scintillation counter.

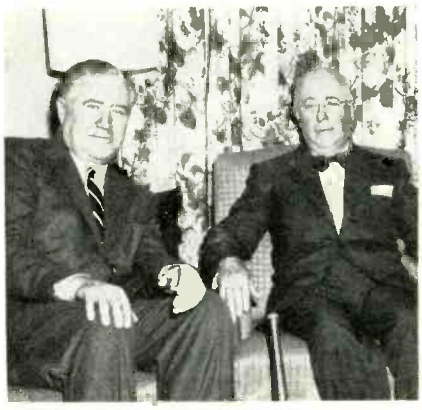
The Winegard Co. of Burlington, Iowa has introduced a new line of Antennas, L-4DA and S.L.-4DA which are processed in Alumalite and can be produced in as many fabulous colors as aluminum drinking glasses or today's automobiles. Mr. Winegard describes Alumalite as an anodizing process which puts a metallic coating on his antennas that approaches the hardness of a diamond, and is impervious to the effects of pitting and rusting in seaboard areas where salt air is so damaging to unprotected metals.

A new portable Appliance Tester, Model 5100, has been introduced by Philco Corporation. It is designed for servicing of refrigerators, freezers, air conditioners, ranges, radio sets and television receivers as well as checking other household appliances and many types of industrial equipment. In one unit, the Model 5100 Appliance Tester provides an accurate measurement of power, voltage, current, temperature and resistance, permitting the user to quickly localize electrical or temperature difficulties within the appliance.

A new carrying case for electron tubes, the "Treasure Chest," is being made available to the radio-TV serviceman through RCA distributors. It has space for 54 miniature, 56 GT, and at least 24 larger tubes. A compart-



ment is also provided for the small tools most frequently needed in home service calls. These units are obtainable by turning in twenty RCA "Treasure Notes" which are awarded to dealers upon purchases of RCA tubes.



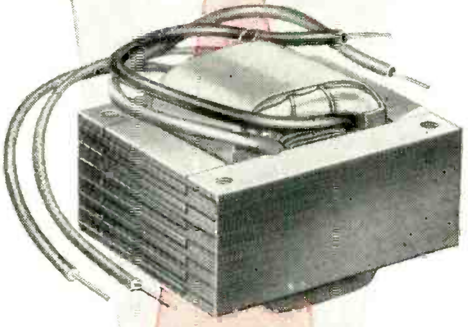
Louis Rieben (right), President of Tung-Sol Electric Inc., being interviewed by Quentin Reynolds on the WRCA-TV show, "Operation Success." Mr. Rieben predicted the early arrival of the push-button home, and to meet the increased need for electronic products he foresaw the doubling of the size of Tung-Sol within ten years. Its seven plants now employ 5,500 people.

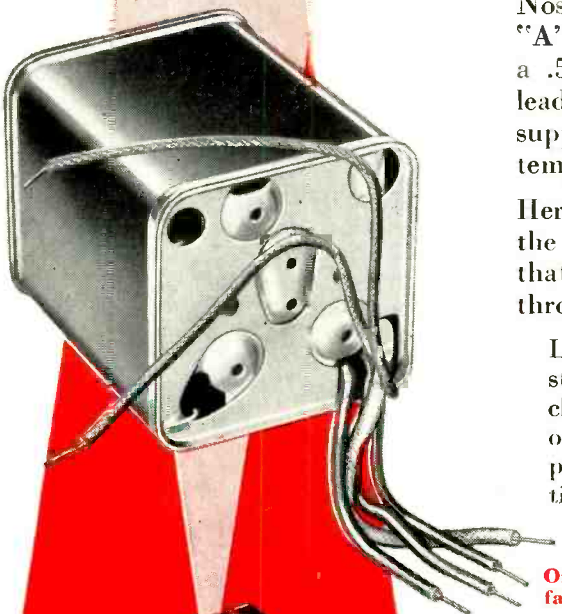
To augment new product development and to facilitate an aggressive advertising and merchandising program for the Chase line, a new business affiliation making Walsco Electronics Corporation the exclusive distributor for Chase Manufacturing Company was jointly announced here by officials of both firms. Under the agreement, Walsco will stock and act as sales rep-

[*Continued on page 40*]

from DELCO RADIO...

High-Quality
POWER TRANSFORMERS
for Car Radios





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BELOW, CASED MODEL 6C60.

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Three—Model Nos. 6055, 6065 and 6067—are *uncased* and *do not* include a filter network. Three others—Model Nos. 6060, 6064 and 6066—*are cased* and *do include* an "A" line filter network consisting of an "A" choke and a .5 mfd. capacitor. All six models have long-enough leads for universal application, and cased models are supplied with three self-tapping screws and a drilling template for easy mounting.

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Laminated core inserts stamped out of low-loss silicon steel and heat-treated so magnetic properties will not change • Primary and secondary coils wound by skilled operators using special machines • Hot asphalt compound poured into cased models to hold components in position, transfer heat and protect quality and performance.

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Circuit Analysis

by Radio Television Service Dealer Technical Staff

This Month's Circuit—
Noise Control Circuit: Emerson Ch. 120174B (Cont.) Also Motorola Volumatic

A NOISE cancellation circuit used in the Emerson 120174B chassis was the subject of our analysis in the previous issue (June 1955). Before continuing with this discussion, it is suggested that the reader review this material. Let us continue then, with the detailed circuit analysis of the two remaining stages, namely the sync clamper and the sync clipper. *Fig. 1* is the schematic of the circuit under discussion.

It was pointed out previously that since the strength of the signal picked up at the antenna may vary over wide limits, there is a distinct possibility that the sync pulses might rise above the cut off level of the noise inverter, V17B. Conduction would then occur on the sync pulses, resulting in an amplified negative sync pulse at the output of the noise inverter. This negative sync pulse would be fed into the sync clipper stage along with the positive going sync pulse from the sync amplifier and cancellation would take place by the same process previously described in detail for the noise pulse. Obviously, cancellation of the sync pulse would cause complete loss of synchronization. It is to avoid this occurrence that the sync clamping circuit is included.

In *Fig. 1,* V17A is the sync clamper. *Fig. 2* shows only the portion concerned with sync clamping and is redrawn for ease of explanation. A composite video signal in the positive phase appears at plate of V11A. The tube plate load consists of *R53* and *R54* in series. This forms a voltage divider, allowing a portion of the signal to be tapped off at point "A." This changing positive voltage at "A" is coupled to the plate of V17A by *C68* causing a current to flow which charges *C68*. The charging path

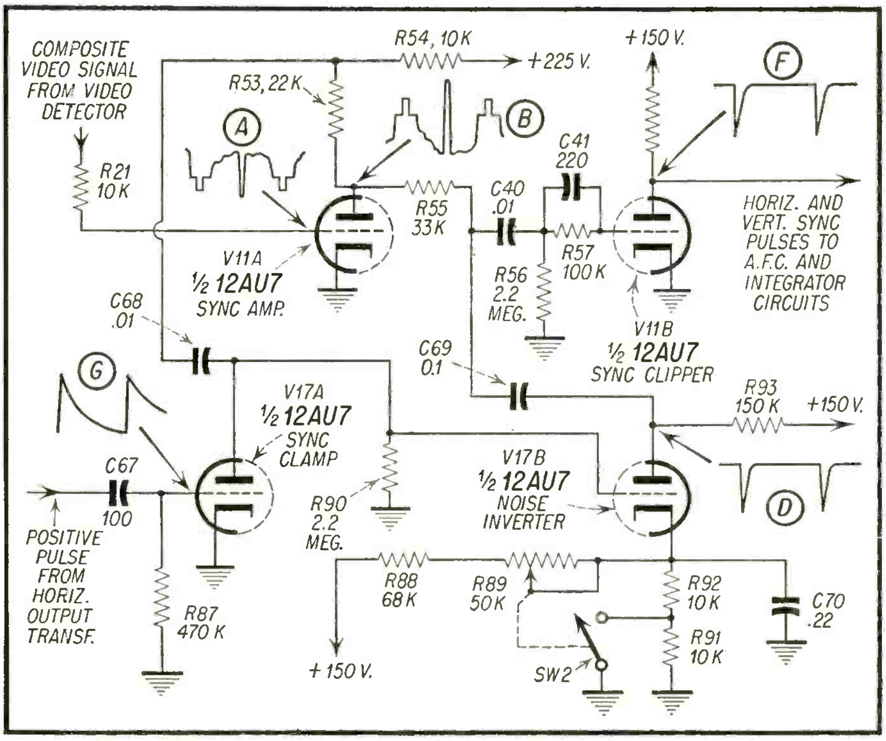

Fig. 1—Partial schematic of Emerson Chassis 120174 B illustrating Noise Cancellation Circuit. Waveforms are shown for each signal.

is indicated by the heavy arrows in *Fig. 2.* This path consists of *R54* and the cathode to plate path within V17A. (*R90* offers a parallel charging path, but since it has such a high resistance, the charging current through it may be neglected.) Since this charge path has a low time constant, *C68* quickly charges to the highest voltage which appears at point "A." At this point it is most important to note that the charging of *C68* in this manner can take place only if V17A is conducting. A keying pulse of positive voltage from the horizontal output transformer allows V17A to conduct only at the time of the sync pulse. It is cut off at all other times. This action will be discussed later. Since V17A is keyed in this way, only the sync pulses can produce the action described above. The noise pulse, shown at "n" in the wave form at the plate of V11A would be ineffective since V17A is cut off at this time.

Thus we see that *C68* is charged to the peak value of the sync pulse with the polarity as shown. Immediately after the sync pulse, *C68* will begin to discharge since the voltage at "A" has become lower. It will tend to discharge

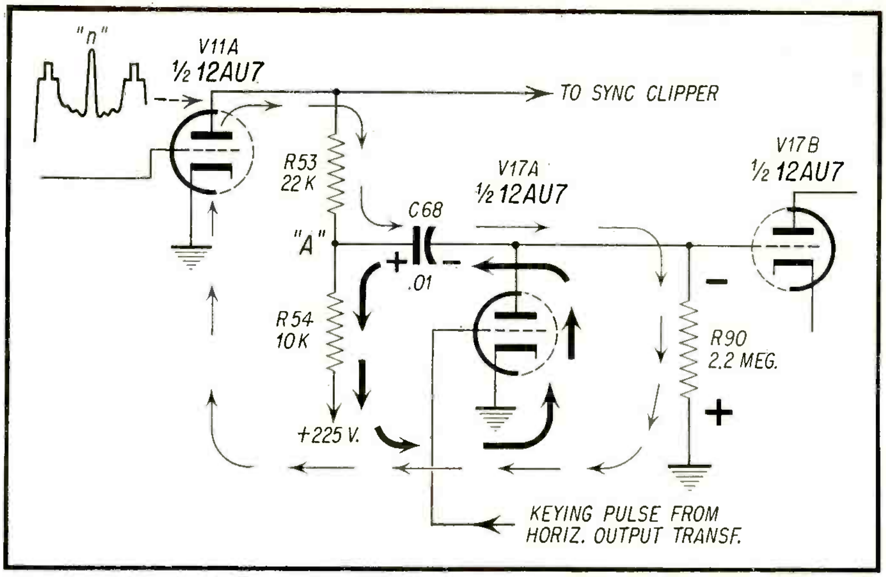

Fig. 2—Partial schematic of sync clipper—Emerson Ch. 120174B.

to this lower value of voltage. The path of discharge is shown by the light arrows in *Fig.* 2. As can be seen, this path consists of *R90*, cathode to plate of V11A, and *R53*. *R90*, a 2.2 meg resistor, is by far the largest resistance in the path. Because of this, practically the entire voltage across *C68* appears across this resistor. Note also that the voltage developed across *R90* is applied to the input of the noise inverter, making the grid negative with respect to the cathode.

Because of the large value of *R90*, *C68* discharges very slowly and the bias developed across *R90* maintains a value very close to the peak of the sync pulse, until the next sync pulse comes along and recharges *C68* once more, close to the peak value. In this way a bias voltage is developed across *R90* which automatically adjusts itself to a value which is slightly less than the peak of the incoming sync pulses.

A numerical illustration may help to make this clearer. Suppose for example the amplitude of the incoming sync pulse is 10 volts. The bias developed across *R90* would then be slightly less than 10 volts, or about 9.9 volts negative. The net grid voltage would then be plus 0.1 volts. Now suppose the signal strength drops so that the sync pulse peak falls to plus 5 volts. *C68* then discharges to slightly less than 5 volts, resulting in a negative bias across *R90*, for example, of 4.9 volts. The net grid to cathode voltage is again plus 0.1 volts. In this way then, the signal produces a bias across *R90* which automatically varies in such a way that when it combines with the signal, the net voltage applied to the grid with respect to ground is always just slightly above zero at the sync pulse tips.

In order to prevent conduction at the time of sync pulses, all that is necessary now is to adjust the cathode bias on V17B to a value slightly beyond cut off. This is done by adjusting *R89* as described in the previous issue.

The noise pulses, being larger in amplitude than the sync pulses, rise above cut off, and therefore cause conduction in V17B. This then produces the desired noise cancellation as previously described, without the possibility of sync pulses working their way through the noise inverter stage.

The Sync Clipper

The negative going noise pulses at the output of V17B are coupled to the input of the sync clipper, V11B, by means of *C69* and *C40* in *Fig. 1*. At the junction of these two condensers, the inverted and amplified noise pulse combines with the original composite video signal. Since the negative noise pulse from V17B occurs at precisely the same time as the positive noise pulse in the composite video signal, cancellation of the noise pulse takes place. In this way the operation of the sync clipper is unaffected by the noise pulse.

Motorola Volumatic

THE Motorola Volumatic which was featured in the 1954 line of auto radios, provides an electronic control of the audio or listening level of the program. In the past, automatic control of gain based on the variations in strength control, rather than the common designation of *avc* or automatic volume control, as now employed in the trade. Now, Motorola in the Volumatic makes available combined gain and volume control, resulting in practically flat level of output at any desired listening volume selected by the listener.

To achieve this control of the audio level electronically where signal strengths vary considerably with stations and with locations, tube engineers in cooperation with Motorola radio engi-

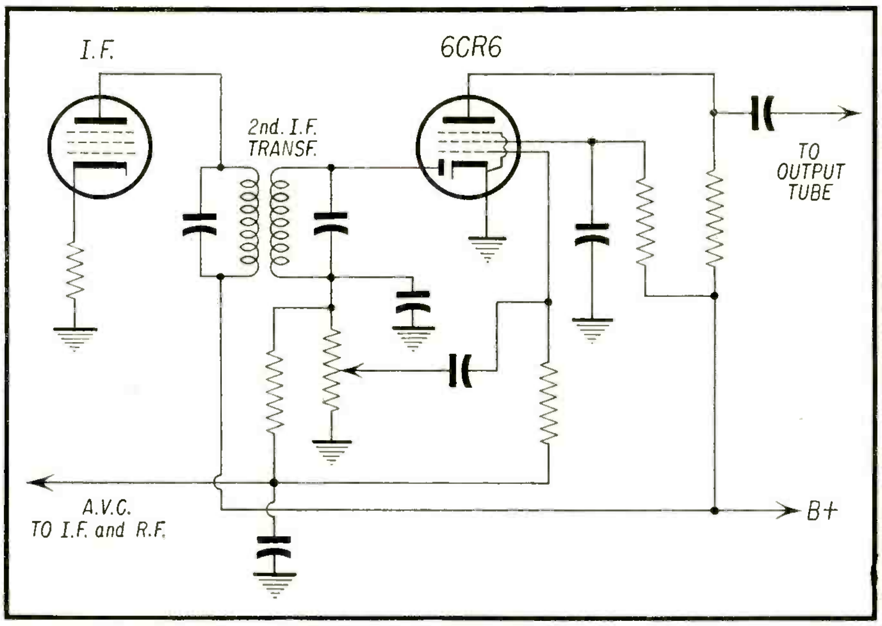

Fig. 3—Partial schematic—Motorola Volumatic.

of the received signal, has been applied to the radio frequency portions of the radio circuit only, and any resulting control of the audio level has been only partial. This type of automatic control would best be termed automatic gain

neers designed and developed a miniature variable mu pentode. This tube, used in the driver stage of the audio amplifier, has a variable bias supplied to the grid varying the gain or ampli-

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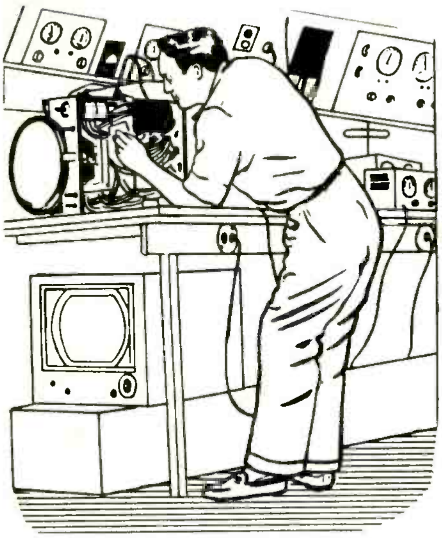


The Work Bench

by **PAUL GOLDBERG**

This Month:

"BUTCHERED" RECEIVERS

PROBLEMS concerning "butchered receivers" have been chosen for this installment. When a TV receiver is butchered, we mean some individual has attempted to repair a receiver and instead creates the need for further and more extensive repair.

Westinghouse H-649T17

The receiver was turned on and a hum was heard from the speaker but as the volume control was turned toward maximum the hum disappeared. In order to isolate the circuit causing the hum the volume control was set to minimum, (maximum hum) and the vertical hold was varied. No change in hum pitch was heard. Thus the hum was not caused by the vertical section. Next the contrast control was varied but it also had practically no effect on the hum. (*See Fig. 1.*)

Because an increase in volume meant a decrease in hum, it seemed that audio pick up might be the cause of the trouble. If filters were the cause, an increase in volume would not cause the hum to disappear. The 6T8, first audio, was next removed from its socket in order to further isolate the trouble. As soon as this was done, the hum disappeared. The 6T8 tube was then replaced but had no effect on the trouble. The 6AU6, second sound *if*, was next removed from its socket. The hum remained. Thus the trouble was isolated in the 6T8 circuit. The 6T8 audio circuit was next closely examined, and it was noted that a new volume control had recently been installed. A resistance check of the volume control was made but it checked correctly at 500K. We next studied the wiring against the diagram. A close examination of the volume control wiring proved to be worthwhile. *C209*, .01 μf, instead of being connected to the center arm of the volume control, was connected to the ungrounded arm; while *C222*, .02 μf, was connected to the center arm instead of the ungrounded arm. The two condensers were next resoldered correctly and now the receiver functioned properly without any hum. Referring to the diagram in *Fig. 1*, it can be seen that with the incorrect connections, the 6T8 control grid through *C209* has 500K to ground. When the volume control is set at minimum the full 500K is left open for the hum pick up.

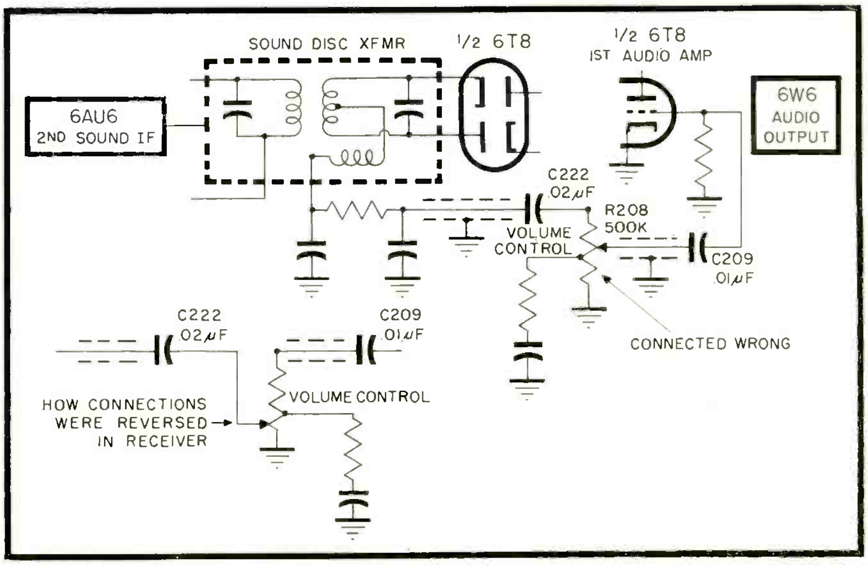


Fig. 1—Partial schematic of sound section—Westinghouse H-649T17.

As a positive check the customer was called to determine whether anyone had serviced the receiver recently. The customer replied that his cousin (not a legitimate serviceman) had serviced the set recently. He stated that since his cousin had serviced the receiver, he had the hum in the set.

Admiral 22E2

The receiver was turned on and blooming was noted when the brightness control was turned up. However, at normal settings of the brightness and contrast controls, the picture was satisfactory. Turning the brightness control to maximum caused the raster to disappear. (As the control grid of a picture tube is made more positive with respect to its cathode, the second anode voltage decreases; this action causes blooming). In other words, because of poor regulation on the part of the high voltage supply, the high voltage will decrease as the brightness control is turned up.

The high voltage circuit was therefore checked first. As the width, height, and linearity of the raster seemed satisfactory the 6CD6 and 6W4 (*Fig. 2*) tubes were not replaced. The 1B3 however, was replaced, but did not solve the problem. An arc was then drawn with a screw driver from the 1B3 filaments to ground. A very tiny arc was drawn with the brightness control at maximum while a healthy arc was drawn at a

[*Continued on page 45*]

STEP	AM-GENERATOR INPUT POINT	AM-GENERATOR FREQUENCY	ADJUST	REMARKS
1	Plate of conv. tube thru .001cap. to ungnd. tube shield **	47.25 mc 41.25 mc	L151) L152) for minimum	Connect scope to Test Point V; maximum vertical gain may be required.
2		39.25 mc	L153 for maximum	
3	Test Point IV (Diode Load).	4.5 mc	L156	Connect detector network between oscilloscope input & receiver Test Point V as shown in Figures 8 & 11

**See Fig. 2C

I-F SYSTEM, SWEEP ALIGNMENT

Now that the traps have been set at their proper frequencies, the i-f curve may be shaped.

PRE-PEAKING:
Should difficulty be experienced in obtaining the proper video i-f response as may be experienced when the set is far out of alignment, the tuning of the individual coils may be checked.

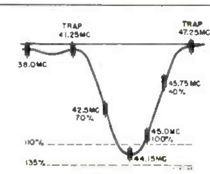
If each coil is peaked at the respentive frequency specified below with an AM signal as prescribed for setting traps, an overall i-f response curve which closely approximates the proper curve will be achieved. After this is done, the sweep method may be used to thus permit proper final curve shaping. This peaking may be done by using an AM signal as prescribed for setting the traps, or the sweep method may be used by adjusting the coils for maximum amplitude at the desired marker points.

Since it may be possible to obtain two peaks through the coil adjustment range, make certain the coil is aligned for the first peak (slug starting from out position).

Begin alignment of Peaking Frequencies with T153.
T153 -44.15 mc T151 -44.8 mc
L150 -44.15 mc T152 -42.9 mc
L153 -43.0 mc

NOTES:
1. Turn picture contrast control to minimum.
2. Observe sweep waveform at Test Point III through a 10,000-ohm resistor. Oscilloscope should be calibrated so that 5 volt signal will provide 2-inch vertical deflection.
3. Apply a negative 4 1/2 volt battery bias voltage to Test Point VI. Connect positive lead of battery to chassis.
4. Note that the following procedure uses 45.0 mc as the 100% reference point. Maintain the sweep generator output level so that the baseline-to-45 mc marker amplitude equals two inches.

VIDEO I-F ALIGNMENT CHART

CONNECT SWEEP GENERATOR	ADJUST	DESIRED RESPONSE	REMARKS
To ungrounded tube shield, Fig. 2C through .001 capacitor center sweep frequency approximately 44 mc Sweep width approximately 10 mc.	T153 for max. at 44.15 mc. T152 to set 42.5 mc marker at 70% T151 to set 45.75 mc marker at 40% L135)See Remarks L150)Column		L135 & L150 should be adjusted to shape peak region of curve for symmetrical response consistent with proper 45.75 mc marker placement. Peak of curve may fall between the limits of 110% and 135% of 45 mc 100% reference point.

AUDIO I-F ALIGNMENT

NOTES:

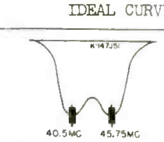
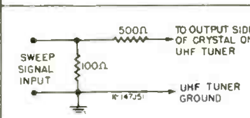
1. Tune in a television signal. This will provide a 4.5 mc signal source for audio i-f alignment. Keep the volume control turned down unless the speaker is connected.
2. Step 3 below requires a meter connection to the electrical midpoint of the ratio detector load circuit. To do this, connect two 100,000-ohm resistors in series between V117 (6T8) pin 2 and chassis. These two 100,000-ohm resistors should be chosen as accurately as possible, for equal resistance.

AUDIO I-F ALIGNMENT CHART

STEP	CONNECT VTVM OR 20,000 OHMS/VOLT METER	ADJUST	METER INDICATION	REMARKS
1	To Test Point IX and chassis	T301	Adjust for maximum deflection.	Voltage to be read is negative with respect to chassis
2	V117 pin 2 and chassis	T302 primary (bottom core)		
3	Between Test Point X and center of two 100,000 ohm resistors.	T302 secondary (top core)	Adjust for zero volts d-c output.	Repeat steps 1, 2 and 3 to assure proper final adjustment.

ALIGNMENT OF 40 MC CHANNEL IN VHF TUNER
(UHF POSITION)

1. Apply -3 volt bias to tuner AGC line.
2. Disconnect I-F output link from converter plate coil. (Remove L135 shield can).
3. Place oscilloscope through a 10,000 ohm resistor on Test Point I of VHF tuner.
4. Through resistor network as shown insert sweep signal to the output side of UHF crystal.
5. Set VHF tuner to UHF position; tune UHF for minimum tilt over center tuning area (approx. 620 mc).

TUNE	TO SET	IDEAL CURVE	REMARKS	RESISTOR NETWORK
L128 L113 T101	40.5 mc for maximum 45.75 mc for maximum For maximum gain and zero tilt		Spacing between coils varies bandwidth. Do not allow coils to touch. Disregard possibility of notch caused by I-F trap L100.	

ALIGNMENT OF L100 I-F TRAP

The trap, L100, Figure 3 is for the purpose of removing any frequency in the i-f range which may cause interference. It is normally aligned at the factory to 43.5 mc.

The trap may be aligned by tuning for minimum I-F channel interference pattern on the screen. If the interference frequency is known, the trap may also be aligned for minimum interference as outline below.

1. Connect 3 volts bias from the AGC line to B-. Connect the positive of bias battery to B-.

2. Use an accurate marker generator to furnish marker of the same frequency as the interfering frequency.

Connect the scope to view the response curve at the output of the video detector, Test Point III.

Use a sweep generator with its center frequency set approximately at the interference frequency.

3. Do not tune L100 so it will attenuate Channel No. 2.

4. Use the GE ST-8A balanced adapter and a 3-foot piece of 300-ohm transmission line to couple the r-f sweep to the antenna terminals of the receiver to properly match the input impedance of this receiver.

If the shape of the response curve changes when you grasp the 300-ohm transmission line, a resistor pad, as shown in Figure 2A, should be inserted at the head-end antenna terminals.

L100 ALIGNMENT CHART

MARKER FREQUENCY	SWEEP FREQUENCIES & INPUT POINTS	CONNECT OSCILLOSCOPE BETWEEN CHASSIS AND -	CHANNEL SWITCH SETTING	ADJUST	SEE NOTE
Interference frequency	40 to 50 mc to antenna terminals.	Test Point III	2	Core of L100 for minimum amplitude of curve at marker.	3

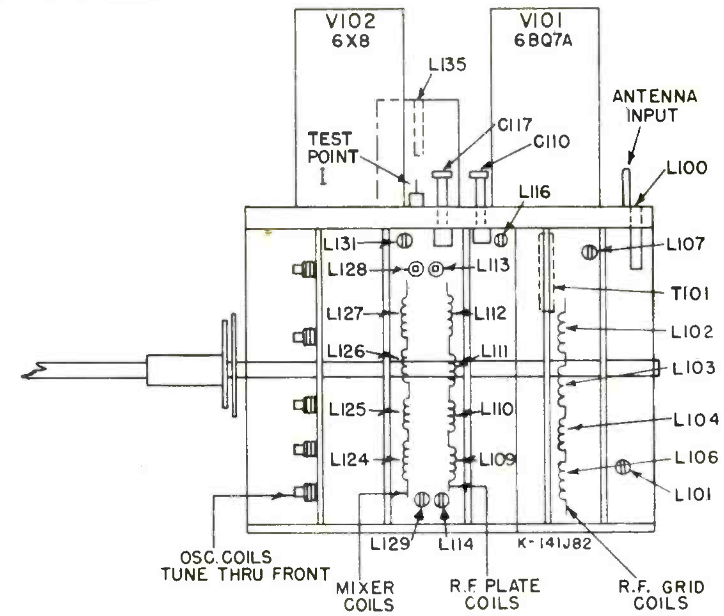
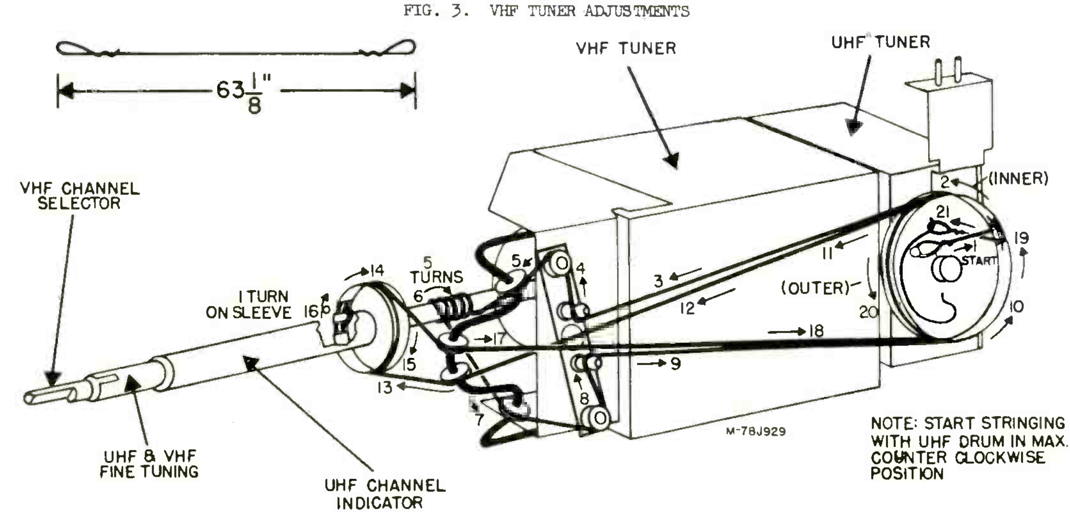


FIG. 3. VHF TUNER ADJUSTMENTS



DIAL STRINGING

General Electric

Models 21C40, -C41, -C130, -C131, -C151, -C152, -C156, -C157, "O" Line

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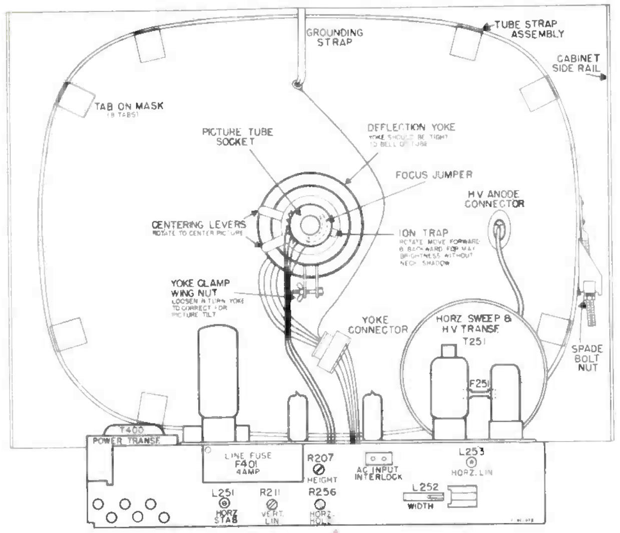

FIG. 1. PICTURE TUBE ADJUSTMENTS (REAR VIEW)

INSTALLATION ADJUSTMENTS

GENERAL: These receivers are shipped from the factory with the picture tube installed and all controls pre-adjusted for normal operation. It is necessary, therefore, to merely plug in the receiver and, where required, connect it to a suitable antenna system. The various operating controls should then be checked for proper operation.

On the rear of the receiver immediately below the antenna terminals is located a local-distant switch. This switch is normally left in the distant position except in cases of severe cross modulation caused by one or more strong stations interfering with the signal received. It may be necessary, therefore, to switch from distant to local in these areas.

If it becomes evident that one or more of preset controls are out of adjustment due to handling, adjust the necessary controls according to the following information.

ELECTRICAL INSTALLATION ADJUSTMENTS

It is recommended that the receiver be permitted to operate for at least 15 minutes before the final raster adjustments are made.

Height & Vertical Linearity: These controls (R207 and R211), See Fig. 1, should be adjusted simultaneously to provide proper picture height consistent with good vertical linearity. The final adjustment should extend the picture approximately 1/8 inch beyond the mask limits.

Horizontal Size (Width) & Horizontal Linearity: These controls (L252 and L253) should be adjusted to provide proper picture width simultaneously with good horizontal linearity. The adjustments, when completed should extend the picture approximately 1/4 inch beyond the mask limits.

HORIZONTAL STABILIZER COIL:

This control is factory pre-set and should only require adjustment if the horizontal oscillator tube has been changed, or if horizontal instability becomes apparent in noisy signal areas.

1. With a signal turned in, adjust the stabilizer coil, (L251) until the picture locks in place.
2. Connect a VTVM between Test Point XI and ground.
3. Re-adjust the stabilizer coil so that +5 volts appears at Test Point XI.

NOTE: If horizontal instability persists in noisy areas, observe picture and tune coil for best horizontal stability.

CAUTION NOTE:

A) DO NOT REMOVE THE 12AT7 HORIZONTAL OSCILLATOR WHILE POWER IS ON AS DAMAGE TO THE HORIZONTAL SWEEP OUTPUT TUBE (6BQ6-GA) WILL RESULT.

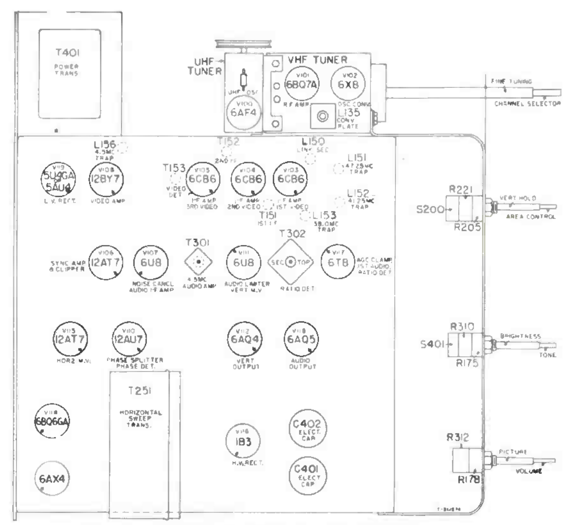

FIG. 2. LOCATION OF TUBES AND ADJUSTMENTS

B) BEFORE INSTALLING A NEW 6BQ6-GA HORIZONTAL SWEEP OUTPUT - BE SURE TO CHECK THE HORIZONTAL OSCILLATOR (12AT7), OTHERWISE THE NEW 6BQ6-GA MAY BE DAMAGED.

PICTURE TUBE ADJUSTMENTS

ION TRAP -Power should not be applied to the receiver for any great length of time without the ion trap being properly adjusted. Rotate and slide the ion trap on the tube neck for position of maximum picture brightness consistent without tube neck shadow. As maximum brightness with trap is approached, readjust the rear apron brightness control as required to keep picture brightness moderate during trap adjustment.

YOKE POSITION (Picture Tilt) -Loosen yoke clamp wing nut and push deflection yoke to seat firmly against bell of picture tube. Rotate yoke and clamp to correct picture tilt (squaring of picture within picture mask). Tighten wing nut after adjustment.

PICTURE CENTERING: -A lever and ring assembly used for picture centering clamps over the deflection yoke. Move the levers toward or away from each other until picture is centered within picture mask.

FOCUS: On the base of the picture tube is located a focus jumper. This jumper is so designed that ut may be placed either between pin six and two, (focus effectively at ground potential) or pin six and pin ten (focus at B+ boost potential).

REMOVAL OF THE PICTURE TUBE FROM THE CABINET

If it becomes necessary to remove the picture tube and/or mask, the following procedure should be observed.

1. Disconnect all electrical connections between the picture tube and yoke and the main chassis.
2. Remove the ion trap, centering rings and yoke from the neck of the tube.
3. Remove the four (4) small screws from the top glass retainer at the front of the cabinet, tilt the glass forward at the top and remove safety glass.
4. Remove the six screws (three on each side), fastening the mask to the cabinet side rails.
5. Remove the mask and picture tube assembly from the front of the cabinet.
6. Loosen the spade bolt nut and remove the tube strap assembly. The picture tube may now be lifted from the mask.

PICTURE TUBE INSTALLATION

To reinstall a picture tube, the removal-instruction procedure may be applied in reverse. Additional items of note are, however, given as follows:

1. When replacing the tube in the mask be sure the anode connection is at the right of the mask as viewed from the rear.
2. Replace the strap assembly as to position the spade bolt and clamp at the side.
3. Slide deflection yoke over the neck of the tube and be sure it rests firmly against the bell of the tube. Tighten yoke clamp wing nut.
4. Replace remaining items on neck of tube, centering ring first and then ion trap.
5. Be sure ground wire eyelet is clipped to ground strap at the top of the tube.

SPECIFICATIONS

POWER INPUT RATING:	Frequency . . . . 60 cycles Voltage . . . . 117 volts Wattage . . . . 225 watts
R-F FREQUENCY RANGE:	Channels . . . . No. 2 thru No. 13 Frequencies . . 54-88 mc, 174-216mmc For receivers with UHF Tuners - UHF Channels 14 thru 83: Frequencies . . . . . 470-890 mc
OPERATIONAL FREQUENCIES:	Picture I-F Carrier. . 45.75 mc Adjacent channel audio trap 47.25 mc Sound I-F Carrier . . 41.25 mc Intercarrier sound take-off 4.5 mc

PICTURE TUBE

Type	21ACP4A
Size	21 inches
Construction	Glass, rectangular, aluminized
Deflection Angle	90 degrees
Focus	Electrostatic
Mask	Rectangular, elliptical sides
Picture Size	14-7/16 inches high 18-9/16 inches wide

CAUTION NOTICE

The Regular B+ voltages are dangerous and precaution should be taken when the chassis is removed from the cabinet for service. The high-voltage supply (17,000 volts) at the picture tube anode will give an unpleasant shock but does not supply enough current to give a fatal burn or shock. However, secondary human reactions to otherwise harmless shocks have been known to cause injury. Always discharge the picture tube anode to the receiver chassis before handling the tube. Since the high voltage is obtained fromthe B+ voltage, certain portions of the high-voltage generating circuit are dangerous and extreme caution should be observed.

The picture tube is highly evacuated and, if broken, glass fragments will be violently expelled. When handling the picture tube, always wear goggles.

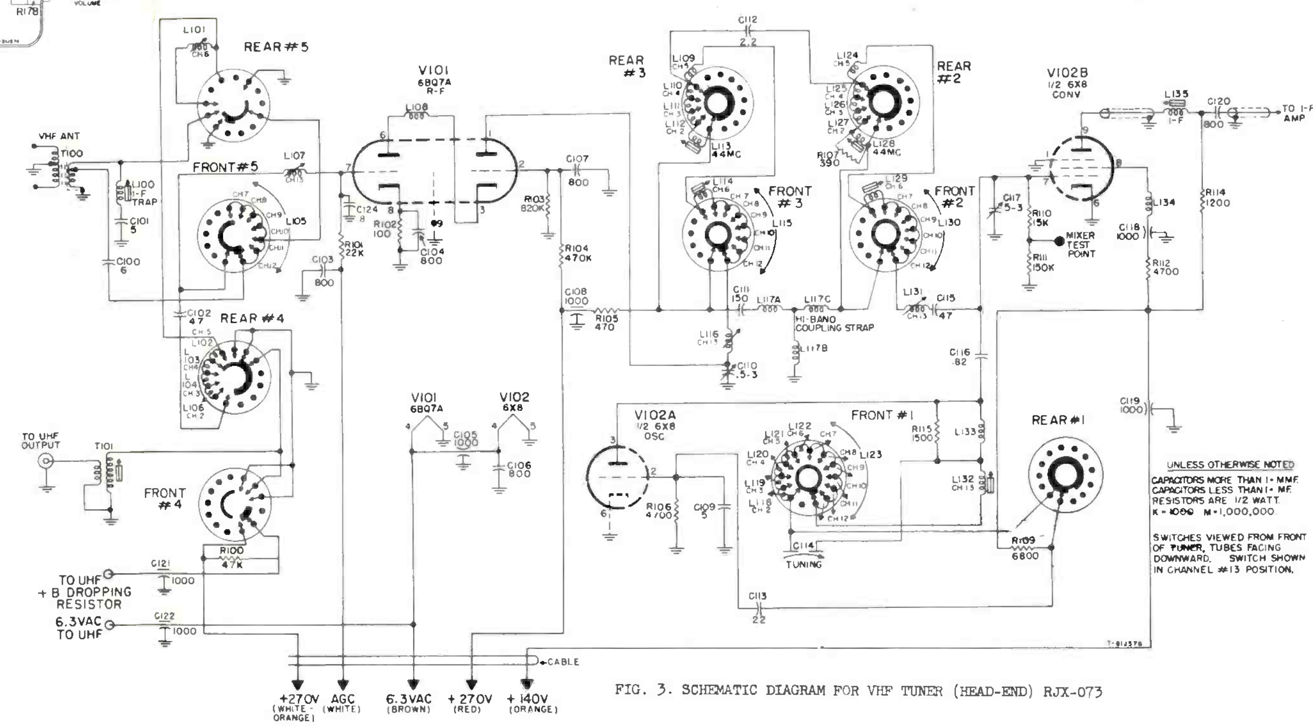

FIG. 3. SCHEMATIC DIAGRAM FOR VHF TUNER (HEAD-END) RJX-073

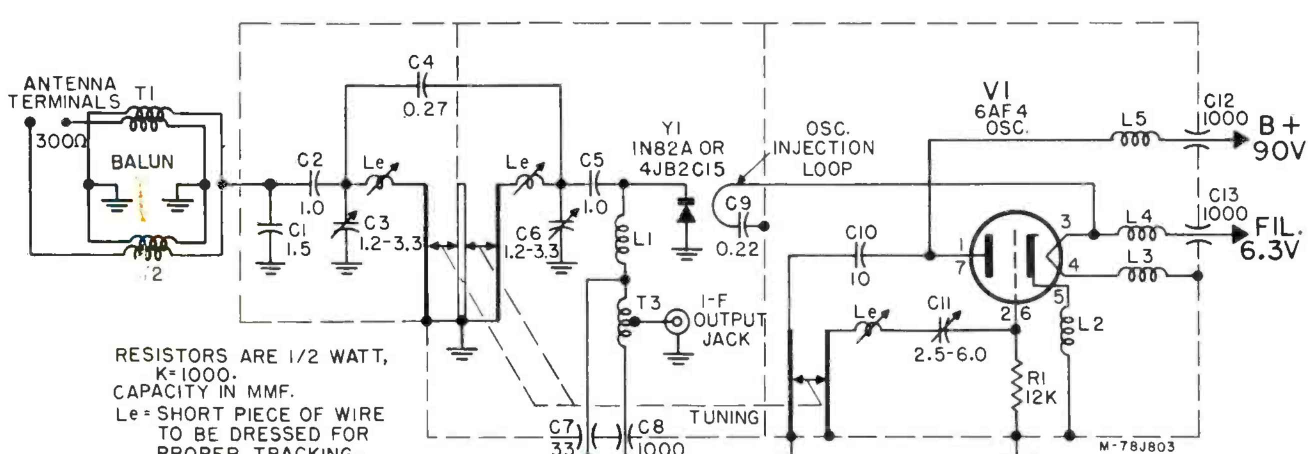

FIG. 5. SCHEMATIC DIAGRAM FOR UHF TUNER, RUX-008

General Electric

Models 21C40, -C41, -C130, -C131, -C151, -C152, -C156, -C157, "O" Line

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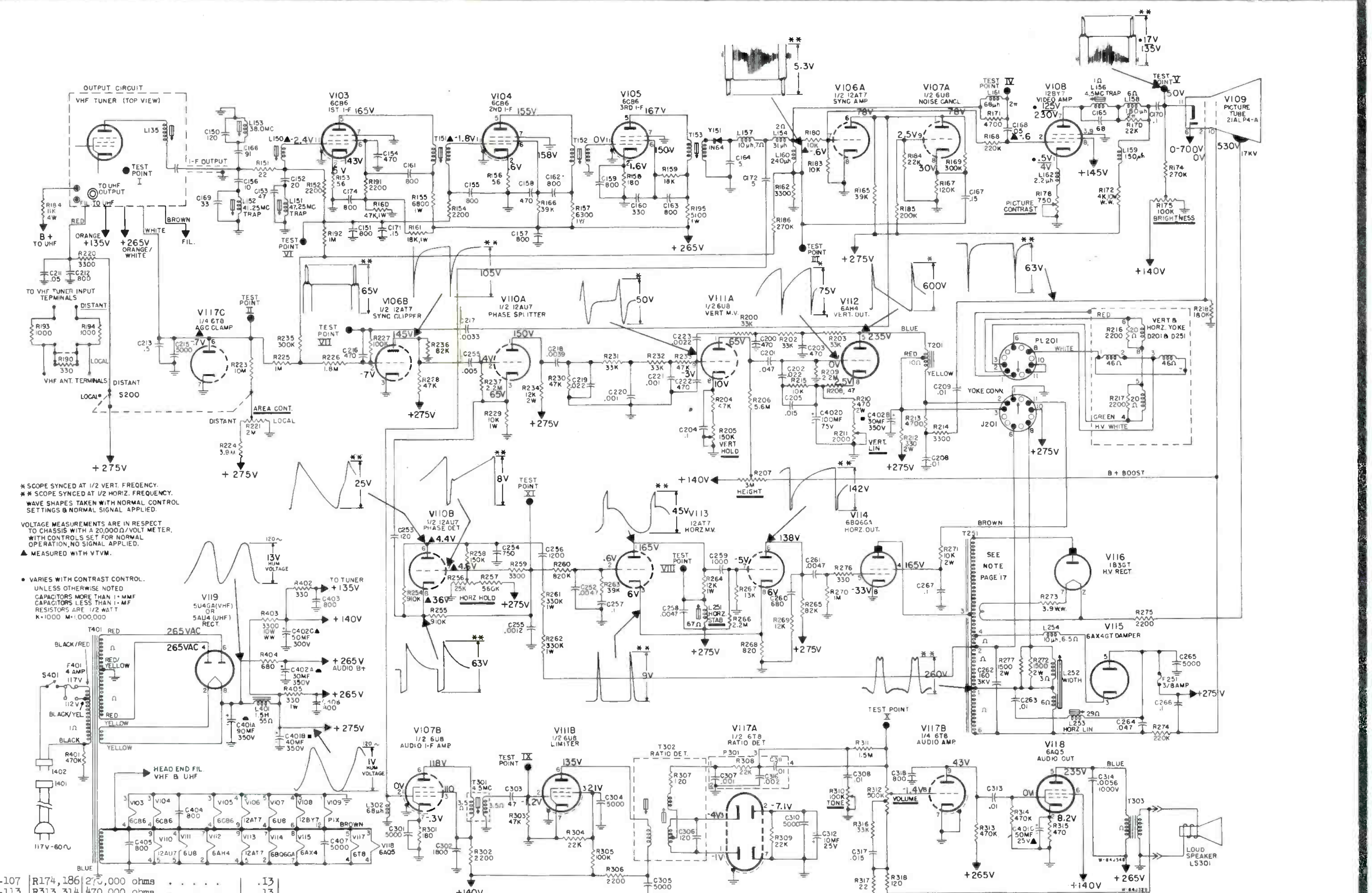

CAT.NO.	SYMBOL	DESCRIPTION	UNIT PRICE
		CAPACITORS (PAPER)	
RCC-016	C213	.5mf., 200V	$0.60
RCC-046	C170,266 267	.1mf., 600V	.45
RCC-105	C168	.05mf.,200V	.25
RCC-115	C255	.0012mf.,.600V.	.30
RCC-119	C220,221	.001mf., 400V	.35
RCC-131	C167,171	.15mf., 200V.	.65
RCC-136	C317	.015mf., 200V	
RCN-025	C208,263	.01mf.,600V. molded . . .	.35
RCN-034	C218	.0039mf.,600V.,molded . .	.35
RCN-041	C201,264	.047mf.,600V.,molded. . .	.55
RCN-042	C205	.015mf.,200V., molded . .	.35
RCN-045	C314	.0033mf.,1000V.,molded. .	.55
RCN-051	C252	.0047mf., 600V.,molded. .	.40
RCN-060	C223	.0022mf., 600V.,molded	
RCN-063	C209,219	.01mf.,600V.,molded . . .	.35
RCN-066	C217	.0033mf.,600V.,molded . .	.30
RCN-083	C258,261	.0047mf.,600V.,molded . .	.40
RCN-092	C202	.022mf.,600V., molded . .	.35
UCC-040	C308,313	.01mf.,600V.	.25
UCC-045	C211	.05mf., 600V.	.30
UCC-048	C204,257	.1mf.,600V.	.45
		CAPACITORS (MICAS & CERAMICS)	
N-RCG-002	C166	91mmf.,±5%,silver mica	
N-RCG-003	C150	120mmf.,±5%,silver mica	
RCU-320	C303	47mmf.,mica	.30
RCU-326	C259	1,000mmf.,±5%,mica . . .	.75
RCU-330	C216	470mmf., mica	.35
RCU-340	C254	750mmf.,±5%, mica	.50
N-RCU-342	C253	120mmf., mica	
N-RCU-343	C200,203	470mmf., 1000V,mica	
N-RCU-344	C256	1200mmf., mica	
RCW-3014	C215,265 301,304 305,310	5,000mmf.,disc ceramic. .	.25
RCW-3037	C151,155 157,159 161,162 163,174 212,214 403,404 405	800mmf.,disc ceramic. . .	.25
RCW-3051	C260	680mmf.,ceramic	.30
RCW-3057	C156	5mmf.,±5%,disc ceramic on L152	.25
RCW-3080	C152	18mmf.,±5%,disc ceramic on L151	.25
RCW-3097	C154,158	470mmf., ceramic	.40
RCW-3107	C302	1800mmf., ceramic	.35
RCW-3113	C164	5mmf.,±10%, ceramic . . .	.25
RCW-3151	C172	5mmf.,±5%, ceramic . . .	.30
N-RCW-3160	C153	30mmf.,±5%,disc ceramic on L151	.30
RCW-3162	C160	330mmf., ceramic	.30
N-RCW-3190	C165	68mmf.,±5%,disc ceramic on L156	
UCG-2030	C306	120mmf.,±5%,silver mica for T302	.30
		CAPACITORS (ELECTROLYTIC)	
RCE-192	C312	10mmf., 25V.	2.45
N-RCE-210	C401A,B, C	90mmf., 350V, 40mmf., 350V, 50mmf., 25V	
N-RCE-211	C402A,B C,D	30mmf., 350V, 30mmf., 350V 40mmf., 300V, 100mmf., 75V	
		RESISTORS (1/2 WATT, CARBON)	
URD-009	R151,317	22 ohms	$0.13
URD-019	R153,156	56 ohms	.13
URD-027	R318	120 ohms.	.13
URD-031	R158,301	180 ohms.	.13
URD-037	R276,402	330 ohms.	.13
URD-041	R315	470 ohms.	.13
URD-045	R404	680 ohms.	.13
URD-047	R268	820 ohms.	.13
URD-057	R152,154 191,275 302,306	2,200 ohms.	.13
URD-061	R162,214 220	3,300 ohms.	.13
URD-065	R213	4,700 ohms.	.13
URD-073	R180,183	10,000 ohms	.13
URD-075	R269	12,000 ohms	.13
URD-077	R215	15,000 ohms	.13
URD-079	R159	18,000 ohms	.13
URD-081	R184,309	22,000 ohms	.13
URD-085	R200,202 231,232 316	33,000 ohms	.13
URD-087	R165,263	39,000 ohms	.13
URD-089	R166,204 230,233	47,000 ohms	.13
URD-095	R258,265	82,000 ohms	.13
URD-097	R227,304 305	100,000 ohms	.13
URD-099	R167	120,000 ohms	.13
URD-103	R218	180,000 ohms	.13
URD-105	R168,228 274	220,000 ohms	.13
URD-107	R174,186	270,000 ohms	.13
URD-113	R313,314 401	470,000 ohms	.13
URD-115	R257	560,000 ohms	.13
URD-117	R260	680,000 ohms	.13
URD-121	R192,225 270	1 megohm	.13
URD-125	R311	1.5 megohms	.13
URD-127	R226	1.8 megohms	.13
URD-129	R209,266	2.2 megohms	.13
URD-135	R224	3.9 megohms	.13
URD-139	R206	5.6 megohms	.13
URD-145	R223	10 megohms	.13
URD-1058	R259	2,400 ohms,±5%	.24
URD-1076	R267	13,000 ohms,±5%	.24
URD-1105	R185	220,000 ohms,±5% . . .	.24
URD-1108	R169,235	300,000 ohms,±5% . . .	.24
URD-1120	R254,255	910,000 ohms,±5% . . .	.24
		RESISTORS (1 WATT)	
URE-037	R212,222	330 ohms	.17
URE-069	R155	6,800 ohms	.17
URE-073	R229	10,000 ohms.	.17
URE-075	R264	12,000 ohms.	.17
URE-109	R261,262	330,000 ohms	.17
URE-1066	R195	5,100 ohms,±5%	.32
		RESISTORS (2 WATTS)	
URF-037	R212	330 ohms	.25
URF-041	R210	470 ohms	.25
URF-069	R272	6,800 ohms	.25
URF-073	R157	10,000 ohms	.25
URF-075	R271	12,000 ohms	.25
URF-077	R234	15,000 ohms	.25
URF-081	R194	22,000 ohms, 2 required for UHF equipped sets	.25
		RESISTORS (W.W. & SPECIAL)	
N-RRE-003	R273	3.9 ohms, 1 watt, w.w.	
RRW-053	R172	4,000 ohms, 10 watts	$0.85
RRW-099	R403	3,300 ohms, 10 watts	
		POTENTIOMETERS	
RRC-291	R211	2,000 ohms, (vert. lin.)	1.50
RRC-301	R207	3 megohms, (vert. size)	.90
N-RRC-315	R256	25,000 ohms,(horz.hold)	
N-RRC-316	R178,312	750 ohms, 500,000 ohms (control volume)	
N-RRC-317	R175,310 S401	100,000 ohms, 100,000 ohms (brightness tone & on-off switch)	
N-RRC-318	R205,221 S200	150,000 ohms, 2 megohm (vert. hold range)	
		COILS AND TRANSFORMERS	
RLD-058	L252	COIL -Horizontal size	2.10
RLD-060	L253	COIL -Horizontal lin.	1.85
RLD-069	D201,251	YOKE -Horiz. & vertical deflection coils and resistors	
RLF-024	L154	COIL -31 uh choke	.65
RLF-062	L401	COIL -Filter choke. . . .	3.60
RLI-085	L162	COIL -2.2 uh choke. . . .	.25
RLI-153	L157,254	COIL -10 uh choke	.25
RLI-247	L251	COIL -Horizontal stab. . .	.75
RLI-260	L159,302	COIL -68 uh choke	.45
RLI-280	T301	TRANSFORMER -4.5 mc audio I-F	2.10
RLI-310	L158 R170	COIL -180 uh choke wound on 22,000 ohm resistor	.55
N-RLI-322	L161 R171	COIL -68 uh audio take off choke	
N-RLI-323	T150	LINK SECONDARY -1st video I-F grid	
N-RLI-324	L156,158 C165 R170	COIL -4.5 mc trap assembly	
N-RLI-325	L152, C156 169	COIL -41.25 mc trap assembly	
N-RLI-326	L151 C152 153	COIL -47.25 mc trap assembly	
N-RLI-331	L160	COIL -240 uh choke	
RLI-332	C150 L153 156	COIL -38 mc trap assembly	
RTD-018	T302 C306	TRANSFORMER -Audio ratio detector	4.15
N-RTL-178	T151,152	TRANSFORMER -1st & 2nd I-F transformer	
N-RTL-179	T153	TRANSFORMER -Video detector	
RTO-155	T201	TRANSFORMER -Vertical output	6.45
N-RTO-166	T251 R261,262 273,275	TRANSFORMER -Horizontal output	
N-RTO-169	T303	TRANSFORMER -Audio output tabe models	
N-RTO-170	T303	TRANSFORMER -Audio output consoles	
N-RTP-327	T401	TRANSFORMER -Power transformer, 60 cycles	
RED-001		CRYSTAL DIODE -Y151.	$1.90
REF-010		FUSE -4 amp slo-blo, F401. . . .	.35
REF-012		FUSE -3/8 amp fast acting, F251	.30
N-REK-007		AUDIO COUPLATE -P301, (C307, 311 316, R308)	.95

General Electric

Models 21C40, -C41, -C130, -C131, -C151, -C152, -C156, -C157, "O" Line

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OSCILLATOR ALIGNMENT

NOTES:

1. The i-f system must be in proper alignment.

2. Connect the sweep generator to T100 using the G-E ST-8A balanced adapter to obtain 300 ohms output. The adapter should be connected to the tuner through approximately three feet of 300-ohm transmission line and a resistor pad as shown in Fig. 2A. When using other test equipment of the unbalanced output type, a pad as shown in Fig. 2B should be used instead.

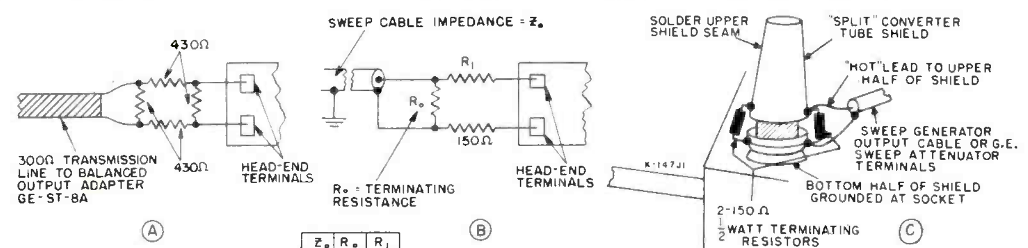
3. Connect a 3 volt bias battery to Test Point II with positive lead of battery connected to the tuner chassis.

4. Set fine tuning control to two-thirds from the counter-clockwise stop and leave fixed in this position throughout the entire alignment procedure.

5. Make indicated adjustments so that the picture carrier marker for the channel falls at 45% on the high frequency slope of the response curve.

OSCILLATOR ALIGNMENT CHART
SWEEP GENERATOR SWEEP WIDTH 10-15 MC

STEP	RECEIVER & MARKER POSITION	MARKER GENERATOR FREQUENCY	SIGNAL INPUT POINT	OBSERVE RESPONSE CURVE AT	ADJUST
1	No. 13	211.25 MC	Antenna terminals (See Note 2)	Test Point III (Video detector diode load)	L132 Channel No. 13 oscillator adjustment.
2	No. 12	205.25 MC			L123 Channel No. 12 oscillator adjustment.
3	No. 11	199.25 MC			L123 Channel No. 11 oscillator adjustment.
4	No. 10	193.25 MC			L123 Channel No. 10 oscillator adjustment.
5	No. 9	187.25 MC			L123 Channel No. 9 oscillator adjustment.
6	No. 8	181.25 MC			L123 Channel No. 8 oscillator adjustment.
7	No. 7	175.25 MC			L123 Channel No. 7 oscillator adjustment.
8	No. 6	83.25 MC			L122 Channel No. 6 oscillator adjustment.
9	No. 5	77.25 MC			L121 Channel No. 5 oscillator adjustment.
10	No. 4	67.25 MC			L120 Channel No. 4 oscillator adjustment.
11	No. 3	61.25 MC			L119 Channel No. 3 oscillator adjustment.
12	No. 2	55.25 MC			L118 Channel No. 2 oscillator adjustment.

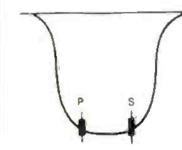
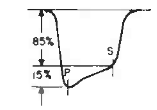
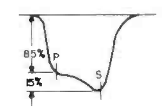
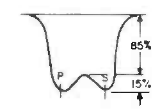
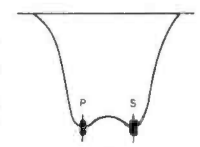
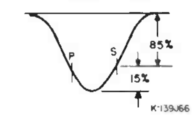


Z_o	R_o	R_1
50Ω	56Ω	120Ω
72Ω	82Ω	110Ω
92Ω	110Ω	100Ω

FIG. 2 TEST EQUIPMENT TERMINATION

R-F ALIGNMENT CHART

(a) Set generator sweep width to 10-15 mc.
(b) Signal input point at r-f tuner input transformer T100.
(c) Observe response curve at Test Point I, through 10,000-ohm resistor. Connect test equipment ground lead to r-f tuner chassis.
(d) Adhere to following order when performing a complete alignment.
(e) When following the procedure below, an attempt should be made to obtain the indicated ideal response curves. Minor deviations from the ideal curves may occur, the maximum limits of "tilt" and/or bandwidth being shown in the "Remarks" column.

STEP	RECEIVER & SWEEP GENERATOR C CHANNEL	MARKER GENERATOR FREQUENCY MC	ADJUST		REMARKS AND LIMITS
1	No. 13	211.25 215.75	L116, L131 for maximum gain, symmetry and "Ideal" bandwidth as shown below in curve "A".		If peaks or tilt are excessive, knife L134, Knife as little as possible to prevent loss of gain.
2	No. 7	175.25	C110, C117 for proper curve, symmetry and bandwidth. Adjust L107 for maximum gain and equal peaks.		Adjust (spacing between) L114 & L129 for proper coupling where necessary, being careful not to allow the coils to touch each other.
3	No. 12	205.25 209.75	Adjust L116, L131 and/or C110, C117 for suitable tilt, compromise for channels 7-13 if necessary.	 "A" STEPS (1-7) "IDEAL" CURVE	 Sound Carrier 15% Down
4	No. 11	199.25 203.75			
5	No. 10	193.25 197.75			
6	No. 9	187.25 191.75			 Picture Carrier 15% down
7	No. 8	181.25 185.75			
8	No. 6	83.25 87.75	L101, L114, L129 for maximum gain and optimum flatness		 Wide Limit
9	No. 5	77.25 81.75	Check tracking, knife if necessary, L102, L109, L124	 "B" STEPS (8-12) "IDEAL" CURVE	
10	No. 4	67.25 71.75	Check tracking, knife if necessary, L103, L110, L125		 K-139J66 Narrow Limit
11	No. 3	61.25 65.75	Check tracking, knife if necessary, L104, L111, L126		
12	No. 2	55.25 59.75	Check tracking, knife if necessary L106, L112, L127		Bandwidth Limit Curves

VIDEO I-F SYSTEM

The following alignment data is divided into two separate procedures. Because of the large trap attenuation, the conventional method of sweep observation of these traps becomes difficult. Hence all traps shall be pre-tuned by applying an amplitude-modulated signal and adjusted for minimum signal output.

The second portion of this procedure involves the shaping of the i-f response curve in the conventional manner by the application of a sweep generator signal. During this procedure, observe the usual precautions regarding warm-up time, equipment cable lead dress and generator output cable termination.

GENERAL NOTES:
1. Allow receiver and alignment equipment to warm up for 20 minutes before proceeding.
2. Set channel selector switch to channel #11, 12 or 13. Check for oscillator influence by turning the fine tuning control. If the shape of the response curve changes, switch to another high-frequency channel where oscillator influence is not noted. Set tuning control maximum clockwise.
3. Turn the volume control fully counter-clockwise. Turn the picture contrast control fully clockwise.
4. Remove V114 during alignment.
5. In order that the action of the noise inverter (V107A) does not cause false information during alignment, it is advisable to connect a 100,000 ohm resistor between pin #8 (V107) and B+ 275V. Be sure to remove the resistor after alignment.

TRAP ALIGNMENT

GENERAL:
As noted above, an AM signal is required for trap alignment. In many cases, the technician will have a suitable AM signal generator available. It should cover the range of 35 to 48 megacycles at fundamental frequency, with available internal 400 cycle modulation. When this type of signal is used, the traps should be adjusted for minimum 400-cycle signal as observed on the oscilloscope.

Users of General Electric sweep equipment may obtain the required amplitude modulated carrier frequencies by a simple manipulation of the controls as has been explained in previous publication and technical literature supplied by the manufacturer.

Those technicians who do not have equipment available to produce suitable signals should not attempt the trap alignment procedure. With the exception of the 4.5 mc audio trap L156, the traps should not become seriously misaligned due to tube change. The 4.5 mc audio trap L156, may be sweep aligned, if necessary, by substituting a 4.5 mc sweep signal in Step 3 below. The trap may then be tuned for minimum response at 4.5 mc as marked by a calibrated signal.

2.

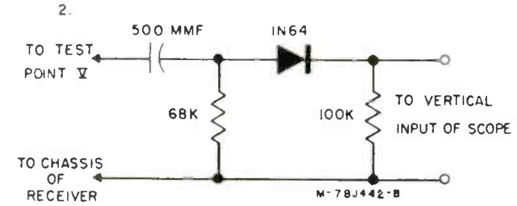


FIG. 4. DETECTOR NETWORK

TV FIELD SERVICE

Pre-published from Rider "TV Field Service M...

by Rider & Alsberg

MUNTZ

Models 317T2, Ch 37A2
321T1, Ch 17B2

TUBE LIST

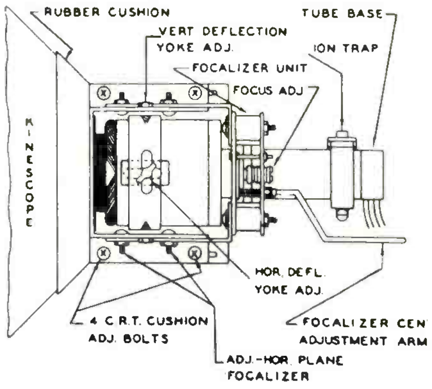
SYMBOL	TYPE	CIRCUIT FUNCTION
V1	6BC5	RF Amp.
V1	6BQ7	RF Amp.
V2	6J6	Mixer-Osc.
V3	6AU6	Sound IF. Amp.
V4	6T8	Rat. Det., Audio Amp.
V5	6W6GT	Audio Out.
V6	5U4G	L.V. Rect.
V7	6CB6	Vid. IF. Amp.
V8	6AU6	Vid. IF. Amp.
V9	6AU6	Vid. IF. Amp.
V10	6CB6	Vid. Amp.
V11	12AT7	Sync. Sep.
V12	6BL7GT	Vert. Osc.-Vert. Out.
V14	6BQ6GT	Hor. Out.
V15	1B3GT	H.V. Rect.
V16	6W4GT	Damper
V17	17BP4 21WP4	Picture Tube

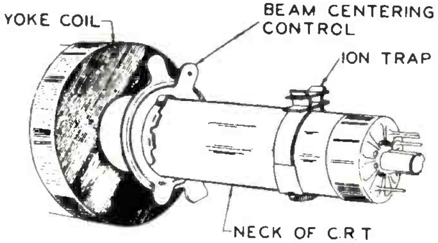
KEY VOLTAGES

B+, plate of damper, V16	pin 5	280 vdc
Boosted B+, cath. of damper, V16	pin 3	520 vdc
Plate of VERT. OSC., V12	pin 2	150 vdc
Plate of Vert. Out., V12	pin 5	460 vdc
Plate(s) of Hor. Osc. (and control). V13	pin 5	180 vdc
	pin 2	155 vdc
Grid of Hor. Out., V14	pin 5	−22 vdc

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

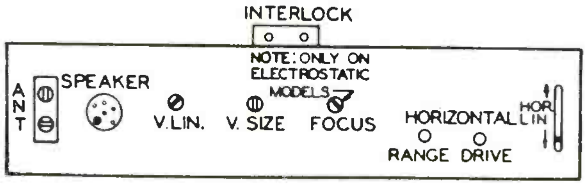
TOP VIEW—C.R.T. ADJUSTMENTS

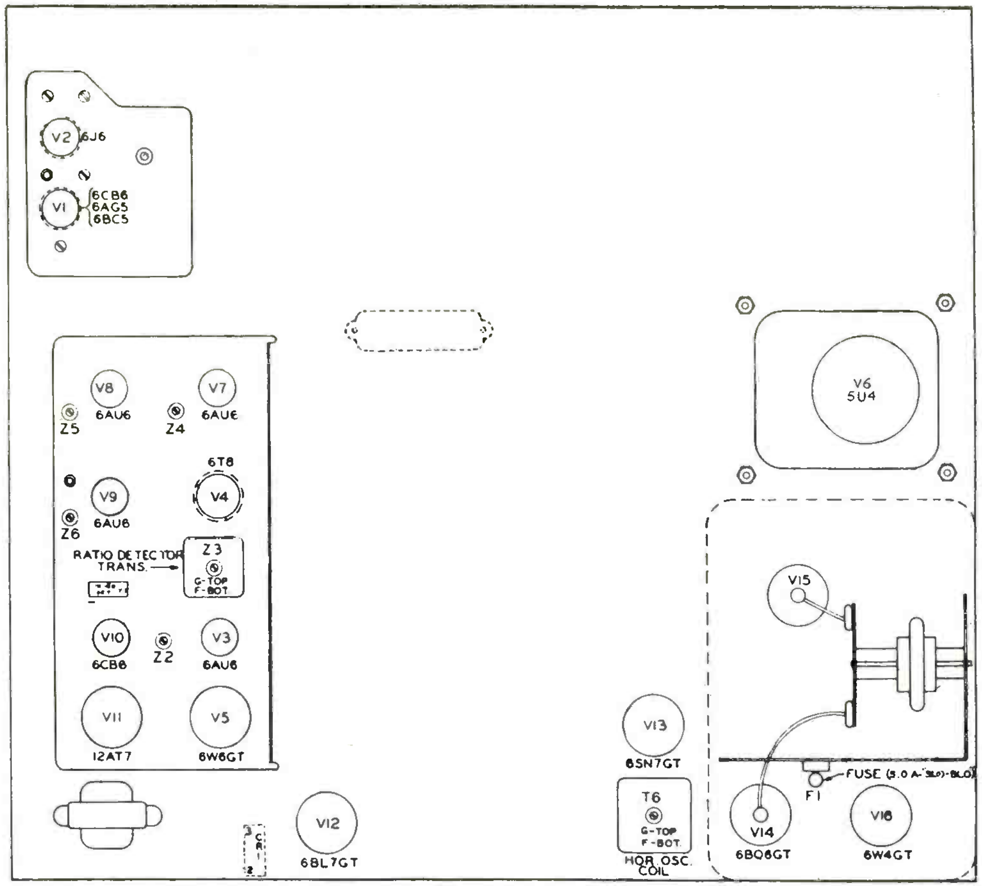




CRT ADJUSTMENTS
(ALTERNATE)

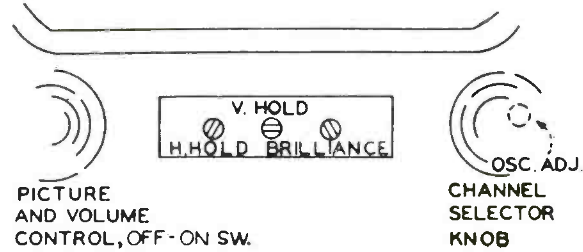
REAR VIEW OF CHASSIS





TOP VIEW

FRONT CHASSIS SERVICE ADJUSTMENTS



ADJUSTMENTS

TO CHECK OPERATION OF RECEIVER

All MUNTZ TV sets are adjusted during the final test procedure at the factory, but will require an adjusting and touch-up job in the customer's home at the time of installation.

1. Connect the AC plug (108-125 volts) to a 60 cycle wall socket. Turn the TV set on and allow a 10 minute warm-up period.
2. Advance the volume control ½ turn to the right.
3. Turn the channel selector knob to a local station.
4. Turn the picture control to the right. The screen of the picture tube will not be illuminated until Ion Trap is adjusted. Follow the instructions in the paragraph *ION TRAP*. The set should now operate, picture and sound, with the following provisions: (a) a station operating on the air, (b) the oscillator adjustment tuned to the station (see paragraph "Oscillator Alignment") and (c) tube and service adjustments are not too far out of alignment.

FRONT CHASSIS SERVICE CONTROLS

The most necessary service controls are conveniently located under the MUNTZ TV name plate on the front of the set between the two knobs.

H. HOLD: This control locks the circuits of the receiver in horizontal synchronization with the transmitting station.

V. HOLD: The vertical hold control locks the receiver in vertical synchronization with the transmitting station.

BRILLIANCE: The brilliance control must be adjusted simultaneously with the front panel picture control. Like photography, the final setting of the brilliance control should be left at a point where the picture displays a really dark black, a very brilliant white, and many shades of grey.

FOCALIZER ADJUSTMENT

The Focalizer is used to center the picture completely on the screen with the best possible line detail.

FOCUS: With a normal picture adjust focus adjusting screw. The purpose of this adjustment is to vary the Gauss strength of the Focalizer, which clarifies line detail throughout the picture.

CENTERING: The picture centering lever is coupled to the Focalizer by a universal joint. Up and down motion of this lever moves picture sideways while sideward motion moves picture up and down. With this action the picture can be centered squarely on the screen.

DEFLECTION YOKE ADJUSTMENT

If the picture is not squared in the picture mask, loosen the wing nut and move it to the left or right so as to rotate the deflection yoke. The picture will tilt to the left or right with the deflection yoke rotation. After the picture is square in the mask and before tightening the wing nut, press the entire coil forward as far as possible to the flare of the picture tube.

ADJUSTING THE ION TRAP

Set the BRIGHTNESS control for normal brightness.

Position the ion trap on the picture tube close to the base. Starting from this point, very carefully move the ion trap forward or backward and at the same time, rotate it slightly in either direction until maximum brightness is produced.

OSCILLATOR ALIGNMENT

An important adjustment that must be made in the customer's home at *time of installation*, is the *oscillator alignment tuning slug adjustment*. While they are accurately set at the factory, a touch-up job is necessary to bring the TV set exactly in tune with the local stations.

The tuning slugs may be reached through an opening located behind the channel selector knob.

Place fine tuning shaft in the center of its range and tune oscillator adjusting slug for most efficient COMPROMISE of both sound and picture.

HORIZONTAL OSC. SET-UP PROCEDURE

CHECKING NEED FOR HORIZONTAL OSC. ADJUSTMENT

Tune in a good signal (preferably a test pattern) and allow the receiver to warm up for a few minutes. When the horizontal oscillator adjustments are properly set the actions of the horizontal hold control are as follows.

Rotate the horizontal hold control (found beneath the Muntz nameplate) fully counter-clockwise. The picture should remain in horizontal sync. Rotate the control fully clockwise and the picture should fall out of sync showing one vertical black blanking bar near the center of the picture. If the horizontal oscillator does not fill the above requirements, the circuit needs readjusting and can usually be done in the customer's home by readjustment of the Horz. Range Trimmer, the top Horz. Slug, the Horz. Drive and the Horz. Hold control until settings are found that fulfill the above procedure. If these conditions cannot be obtained, the bottom slug of T-6 under the chassis probably requires adjustment. Then follow the procedure listed under "Complete Alignment of Horizontal Oscillator." For a stable setting of the Horz. Hold Control, turn the control fully clockwise. The picture should slip out of sync by one vertical black blanking bar. Now move the control counter-clockwise until picture locks into sync. Final setting of this control should be 20 degrees counter-clockwise from where the picture pulls into sync. Moving the control this extra amount allows the picture to stay in view under all conditions such as changing line voltage, variable signal strength channel to channel, temperature changes and other variables.

MUNTZ TROUBLE SHOOTING CHART

ENGRAVED EFFECT IN PIX

Tuner fine tuning
Contrast con.
V2, V7, V8, V9, V10, V17
Check Vid. Det. xtal Y1 (1N60)
Check 0.1 μf cap. connected to pin 1 of V10
Check Vid. Det. and Amp. peaking coils

VERT. BARS

Hor. Drive con.
V14, V16
Check 56 $\mu\mu f$ cap. connected to yoke terminals
Defl. yoke ringing

PIX BENDING

Hor. Hold and Range con.
Hor. osc. trans. adj. (T-6)
V11, V13, V14
Check 0.022 and 0.047 μf caps. connected to pin 3 of V13

INSUFFICIENT BRIGHTNESS

Ion trap
Brightness and Hor. Drive con.
V6, V14, V15, V16, V17
Low line voltage

INSUFFICIENT RASTER WIDTH

Hor. Drive con.
V6, V13, V14, V16
Check 820 and 1000 $\mu\mu f$ caps. connected to terminal "D" of Hor. osc. trans. (T-6)
Hor. Out. trans.
Low line voltage

NO RASTER—NO SOUND

Power input circuit
V6
Check Filter Choke and Elect. caps.
Check line fuse F1 (5 Amps Slo-Blo)

WEAK PIX—SOUND AND RASTER OK

Tuner fine tuning
Contrast con.
V2, V7, V8, V9, V10
Check Vid. Det. xtal Y1 (1N60)

POOR HOR. LIN.

Hor. Lin. and Drive con.
V14, V16
Check 0.047 μf cap. connected to hor. lin. coil
Check 0.047 μf cap. connected to pin 1 of hor. out. trans.
Hor. Out. trans.

PIX JITTER UP & DOWN

Vert. Hold and Contrast con.
V11, V12
Check 0.0022 μf cap. connected to pin 1 of V12

INSUFFICIENT RASTER HEIGHT

Vert. Size and Lin. con.
V6, V12
Check 0.047 and 0.1 μf caps. connected to red lead of Vert. osc. trans.
Vert. Out. trans.
Low line voltage

NO VERT. DEFL.

V12
Check 0.047 and 0.1 μf caps. connected to red lead of vert. osc. trans.
Check 1.2 Meg Ω res. connected to Vert. Size con.
Vert. Defl. coils (yoke)
Vert. Osc. and Vert. Out. trans.

NO VERT. SYNC.—HOR. SYNC. OK

Vert. Hold con.
Vert. Int. network
V11, V12
Check 0.0022 μf cap. connected to pin 1 of V12
Check 0.01 μf cap. connected to pin 2 of V11

NO HOR. OR VERT. SYNC—PIX SIGNAL OK

V11
Check 0.1 μf cap. connected to pin 2 of V11
Check 0.047 μf cap. connected to pin 7 of V11

NO HOR. SYNC.—VERT. SYNC. OK

Hor. Hold and Range con.
Hor. osc. trans. adj. (T-6)
V13, V14
Check 180 $\mu\mu f$ cap. connected to pin 4 of V13

DISTORTED SOUND

Tuner fine tuning
V2, V3, V4, V5
Check Vid. Det. xtal Y1 (1N60)
Check 0.01 μf cap. connected to pin 5 of V5
Sound and Vid. IF alignment Z-2
Det. alignment Z-3

NO SOUND—PIX OK

Tuner fine tuning
Vol. con.
V3, V4, V5
Speaker (open voice coil or defective connection)
Sound and Vid. IF alignment Z-2
Det. alignment Z-3

NOISY SOUND—PIX OK

Vol. con.
V3, V4, V5
Check sound system for loose connections
Speaker
Sound IF and Det. alignment Z-2 and Z-3

it takes BOTH HALVES to do the job

SERVICE FIRMS

Firms that do radio-TV servicing only—no retailing.

Only "Service Dealer" magazine reaches all of the nation's Service Dealer Firms.

SERVICE DEALERS

Retail Firms that operate their own radio-TV service departmens.

Only "Service Dealer" magazine reaches all of the nation's Service Firms.

SERVICE FIRMS will buy $667,833,000 worth of tubes, parts and accessories from Electronic Parts Distributors this year.

SERVICE DEALERS will buy $514,538,000 worth of tubes, parts and accessories from Electronic Parts Distributors this year.

All others, such as industrials, part-time servicemen, hobbyists, hams, etc., will buy $150,629,000 worth of tubes, parts and accessories from Electronic Parts Distributors this year.

Service Firm & Service Dealer Coverage Provided by Magazines

Classification	*Service Dealer*	*Technician*	*Service*
Service Firms & Servicemen	33,664	18,183	27,963
Service Dealers	22,438	14,717	5,244
Industrial Electronic Servicers	1,548	—	—
TOTALS*	57,650	32,900	33,207

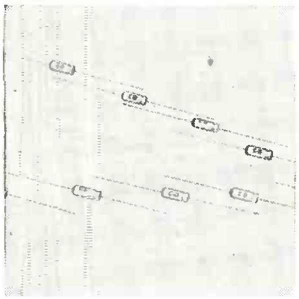
*These figures are from the current ABC & BPA Publisher's Circulation Statements.

'Radio-TV Service Dealer's" latest BPA Circulation Audit Report will be sent upon request.

Radio-Television SERVICE DEALER

NEW products

for better sales and service

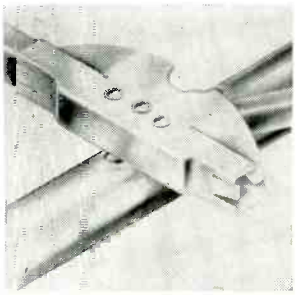


C-D Miniature Electrolytic

Cornell-Dubilier announces the development of extremely small tantalum electrolytic capacitors. The C-D Series NT, measuring ⅛" in diameter to 5/16" in length, which have extremely low leakage, long shelf and service life, stability and power-factor characteristics within a temperature range of −20° to +55°C. All units are of polarized construction. For information, write for Engineering Bulletin 528 to: Cornell-Dubilier Electric Corporation, South Plainfield, New Jersey.

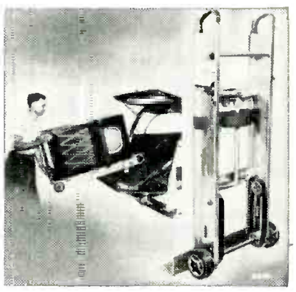
Phaostron Panel Meter

A new 4½" Panel Meter has just been announced by The Phaostron Company, 151 Pasadena Avenue, South Pasadena, California. Known as The Phaostron 4½" "Custom" panel Meter this new product is available in four types all of which are housed in magnetically shielded "unbreakable" metal cases with large easy-to-read scales (readable from eight to ten feet) and front zero adjustments. 2% accuracy is insured. For more information, please write the manufacturer.



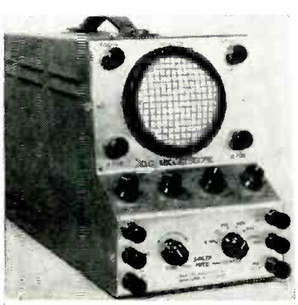
Taco Antenna Lock

Taco engineering has presented an element assembly designated as the Auto-Lock clip which rivals the spring loaded design of Taco's Trapper. Now low-band antennas such as the Taco 1840 and Shark are made ready for installation in a matter of seconds without use of tools. This construction permits the antenna to be assembled on the roof-top with minimum effort.



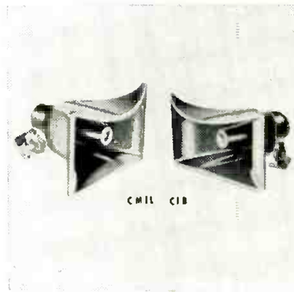
Yeats Dolly

Yeats Appliance Dolly Mfg. Co. is producing a short framed dolly, called the "Shorty," with a frame only 47" high, making it possible to load appliances into low height openings of station wagons and some panel trucks without unstrapping them. It features an aluminum alloy frame, endless belt step-glide and quick tightening strap ratchet device. The Yeats line also includes: the standard, Model 7 (59" high), and Model 9 (71" high) for handling consoles, pianos, freezers, etc. For information, write: Yeats Appliance Dolly Sales Co., 2139 N. 12th St., Milwaukee 5, Wisc.



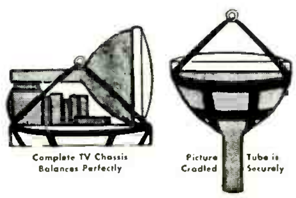
RCP D.C. Midgetscope

A New D.C. Midgetscope, Model #534 has been announced by the Radio City Products Company, Inc., Centre and Glendale Sts., Easton, Pennsylvania. It combines linear sweep with *dc* amplifier for color television restorer circuits and for complex wave forms, and includes provisions for *ac* coupling, full vertical and horizontal expansion of trace, automatic astigmatism control circuit, linear time base and sweep, returned trace automatically blanked, vert. or horiz. operation.



University "Cobra" Horn

University Loudspeakers, Inc., has introduced the model CIB and model CMIL which both feature a reflexed "cobra" air column for wide angle horizontal dispersion. The CIB is rated at 12 watts continuous duty with a response of 300 to 13,000 cps. Horizontal dispersion is 120°, vertical 60°. The CMIL is similar to the CIB, using a screw-in driver. It is rated at 3 watts continuous duty at from 400 to 13,000 cps. Write dept. NR-1, University Loudspeakers Inc., 80 South Kensico Avenue, White Plains, N. Y.

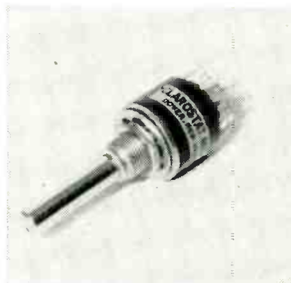


Jacobson TV Hammock

The S. I. Jacobson Mfg. Co. of 1414 S. Wabash St., Chicago 5, Ill., has marketed a TV hammock with which the serviceman can easily and safely carry any size TV chassis, or CRT. An adjustable strap fits over shoulders or neck, leaving hands free to open doors or carry equipment. Made of heavy harness webbing, 380 lb. breaking strength. For more information, please write the manufacturer at the above address.

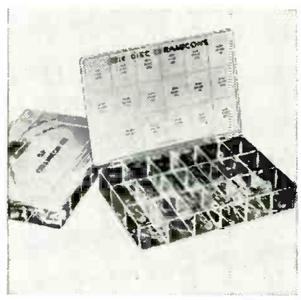
Authorized Test Speaker

Authorized Manufacturing Company, of 919 Wyckoff Avenue, Brooklyn 27, New York, announced recently their new Model #401 UNISPEAK universal test speaker. An essential service aid for Television and Radio repair. UNISPEAK's flexibility is enhanced by a socket providing speedy connections for most sets which are frequently encountered. An adaptor cable is made up, and plugs in to the speaker and/or the set.



Clarostat Miniaturized Switch

Slightly larger than a penny in diameter yet providing for a wide range of multi-switching operations, the Series BH miniaturized rotary selector switch is announced by Clarostat Mfg. Co., Inc., Dover, N. H. Available in single-pole (up to 12 positions), two-pole (6 positions), three-pole (4 positions) and four-pole (3 positions). Shorting or non-shorting, as required. Mounting is the same as that for the usual volume control. Ratings: 50 ma. at 300 v.a.c. or d.c.; 500 ma. at 30 v.



Erie Ceramicon Kits

Erie Resistor Corporation, Erie, Pa., has announced two new Erie Ceramicon Kits for servicemen and engineers to meet the needs for replacements. Each kit consists of an 18 section plastic storage case containing 100 High Stability ERIE Disc Ceramicons or 100 ERIE GP Tubular Ceramicons in 18 popular values. According to the manufacturer, these kits are exceptional values and effect substantial savings. They are available through Stocking ERIE Distributors.

ASSOCIATION NEWS

by Samuel L. Marshall

Radio & TV Association of Santa Clara Valley, Calif.

From the San Jose News, "More than 30 area firms which offer TV set repairs have formed a Radio and Television Assn. of Santa Clara Valley with a two-fold purpose:

1. Elevate professional and business standards to levels becoming a complicated science, and,
2. Protection of the public against fraud and deception, improper or inadequate service. overcharging, substitution of off-brand or used parts for specified new repair parts, and general sharp practices designed to give the customer less than he pays for.

Heading the new professional organization are H. F. Ash, President; Len Scarpelli, Vice-President; Jack Kellogg, Treasurer; and Wesley Strouse, Secretary. Directors are Al Limberatos, Herman Sund, James Wright and Quentin Muchow."

Northeast Television Service Dealers Association, Phila.

An election of officers for the current year of the above Association took place at the last meeting. Mr. R. H. Cherrill was elected for the third straight year as President; for Vice President, Mr. C. Settle; Secretary, Mr. H. Morris; Treasurer, Mr. F. Weissman.

Philadelphia Radio Servicemen's Association

There's a "cute" item in the May 1955 issue of P.R.S.M.A. News on "cliques." It seems that word reached the Advisory Board that the Association is run by a clique. Here is their reply:

"Upon investigation we find this statement is true. Furthermore we find the clique is composed of faithful members who are present at every meeting, who accept appointments to committees, who give willingly of their time, energies, and efforts, and who sincerely believe that the more one puts into his association, the more he will get out of it. There is no question that the enthusiasm, responsibility and efforts of these members are of inestimable value to your association. And we would, therefore, suggest that you join this clique. It is not a difficult matter to do

[*Continued on page 39*]

Dear Answerman:

In this area we are having trouble with the new TV receivers. Some of these sets affected use the Standard coil tuner and others use the Sarkes Tarzian tuner. The factory alignment has not been disturbed.

Here is the trouble: All sets were receiving Channel 2, 8 and 11 very well. Then, a new station was put into operation on Channel 13. From then on Channel 11 pictures came in with diagonal bars, like beat frequency interference and faint horizontal blanking bars that drift across the picture. Occasionally, Channel 13 pictures can be seen faintly, especially during camera fadeouts. This only happens when these sets are tuned to Channel 11. The condition disappears when Channel 13 goes off the air.

Is there a fault in the design of the sets? If not, what can be done to remedy the situation?

C.R.W.
Sugarland, Texas

What you have described is cross-modulation, and its effect is sometimes known as the "Windshield Wiper Effect." It generally is caused by the manner in which the *rf* amplifier is operated. The bias on the *rf* amplifier becomes very negative when a strong signal is being received on Channel 11. Heavy biasing places the *rf* signal at the bend in the *rf* amplifier characteristics curve with the result that due to this marked non-linearity of the curve cross-modulation takes place. Actually, the *rf* amplifier tube is being operated outside its normal limits, in the region of the cutoff bias point where the degree of curvature of the tube characteristics curve is high. A heterodyning action takes place and Channel 13 signals mix with Channel 11 signals. Thus, the signal of one carrier is caused to modulate the other carrier. For this reason the Channel 13 picture and horizontal blanking bar is visible on Channel 11. The sliding back and forth of the weak picture or blanking bar is the reason "Windshield Wiper Effect" is used in reference to this type of interference problem. The drifting of the blanking bar is due to the incorrect phase of the horizontal blanking bar of Channel 13 with respect to the channel being received.

The answer to the problem is much simpler than that for adjacent channel interference which is the greatest technical problem in television facing service technicians. Reduce the signal strength of Channel 11 applied to the receiver antenna with a pad and this will correct the problem. A reduction can easily be tolerated since the trouble arises from the very strong signal now causing the *agc* system to bias the *rf* amplifier back almost to cutoff. It may involve installing a switch, however, since other channels may possibly be reduced below a tolerable level. The resistor pad to accomplish this reduction should be the one that just eliminates the cross-modulation so as not to sacrifice signal strength of other channels.

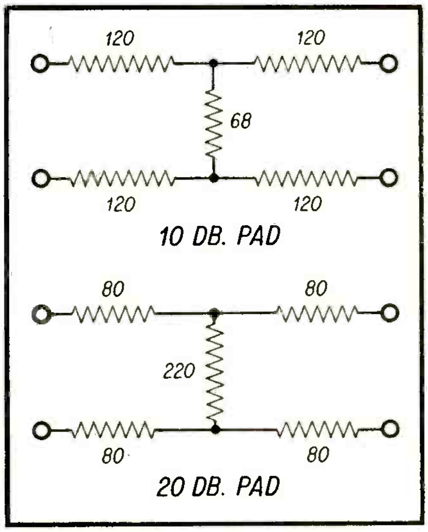


Fig. 1—Typical pads that may be used to attenuate signals from unwanted stations causing interference.

Two generally acceptable pads for this purpose are shown in *Fig. 1*. Pads such as these are made available commercially in various db ranges. They are nicely constructed on a small panel and they save the technician the bother of constructing them since they are so inexpensive, and can usually be obtained at any electronic supply house.

Dear Sir:

I am having considerable trouble in a General Electric 16H series TV receiver with an overloaded or overdriven picture at maximum setting of the contrast control. I have gone over the circuits thoroughly and can't seem to discover the cause. The only other symptom is poor vertical sync with the picture control in this position. Having tested practically everything I can think of, I was wondering if you have any ideas?

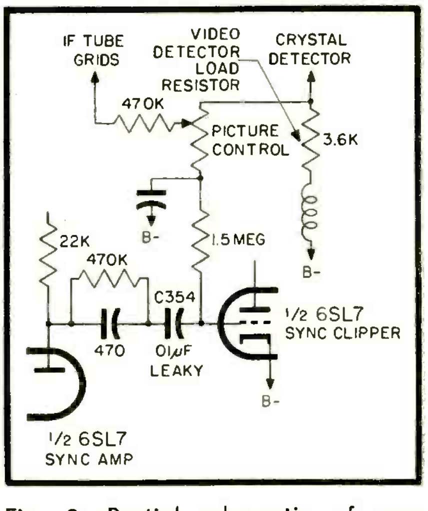


Fig. 2—Partial schematic of sync amp.—G.E. 16H.

L. M.
Philadelphia, Pa.

In examining the *agc* system (Fig. 2) it will be noticed that there is a .01 μf condenser coupling the sync amplifier

[*Continued on page 42*]

ASSOCIATIONS

[*from page* 37]

so. Begin by attending meetings regularly; take a more lively interest in association activities; make helpful, constructive suggestions, and accept responsibilities to serve on committees. Show a continual interest in all affairs pertaining to your association. Before you realize it, you will become a member of the clique and you would be surprised to know how anxious they are to have you."

Associated Radio-TV Service Dealers (Columbus, Ohio)

Funny, yet not so funny, is "My Favorite Gripe" submitted by Olin Payne, who says, "It is the way Auto Manufacturers are installing the auto radios in their new cars. Seems they put in the radio, then BUILD THE CAR AROUND IT. Sure, they have a lid that may be removed from the set to get to the tubes—but if the lid is on the bottom, they proceed to cover it with cables, etc.—if it is on the front, fine, but did you ever try to get one of these 7 prong miniature tubes back in its socket while the set is still mounted on the car?"

Radio & TV Servicemen's Association (Pittsburgh, Penna.)

One of the busiest spots at the Home Show at Hunt Armory May 10 to the 15 was the booth of the Radio and Television Servicemen's Association of Pittsburgh, Inc. This booth tastefully decorated and containing a complete test bench with all equipment necessary to do a quality TV service job was one of the points of interest. The Code of Ethics and their insignia were prominently displayed. The booth was manned ten hours a day by members of the association. Interest in the display was very gratifying and better than ten thousand persons in the Pittsburgh area are more cognizant of the aims and efforts of the RTSA of Pgh., Inc.

Long Island Electronic Technicians Guild

The Guild is seriously weighing the promulgation of a lawsuit to test the legal right of manufacturers to discriminate against Service Dealers. The following excerpt from The "Guild" News points up the following questions that may be answered by such a move:

"Can a manufacturer engaged in interstate commerce 'discriminate in price between different purchasers of commodities of like grade and quality' . . . or, to put it another way . . . is it lawful under the provisions of the Robinson-Patman Anti-discrimination Act for a manufacturer to sell his product to a 'distributor' who sells directly to the public, at a better price than to the retail service dealer against whom (the distributor) is competing? Does this practice create unfair competition? Would a manufacturer be operating illegally in restraint of the trade, if he were to refuse to sell his product to the service dealer at the same price as to the so called 'distributor'?"

Alumni Association of RCA Institutes (N.Y.C.)

Members of this group were treated to an interesting talk on air conditioners (an ever-increasing source of off-season revenue for the servicing technician).

The principal speaker of the evening was Mr. Dudley Heath of Servel, Inc. Mr. Heath was assisted by George Heinz, New York Service Manager of Servel, N. Y. Also present, representing Servel, were Lou Yeager, Regional Service Manager and Ed Neubauer, Servel's Eastern appliance representative.

Federation Radio Servicemen's Associations of Penna.

The Television Service Dealers Association of Chester, Pa. Inc. became affiliated with the Federation Radio Servicemen's Associations of Pennsylvania. President of the Chester Group is Mr. John Mathews, 3109 W. Chester Pike in Larchmont, Pa.

A resolution was passed by unanimous decision that the Federation Radio Servicemen's Association of Pennsylvania would support a UNITY meeting to be held in Pittsburgh in the immediate future. This meeting will include delegates from NATESA, NETSDA, and other state organizations to explore the possibilities of a format for UNITY within the Electronic service profession.

Radio Servicemen's Association, Inc., of Trenton, N. J.

An open house Color TV Demonstration took place on May 10, 1955 at the WTTM auditorium. Delivery was by Mr. M. E. Heath, Westinghouse Color Engineer. A question and answer period followed the interesting talk and Color TV Demonstration.

TRADE FLASHES

[*from page 13*]

resentative of the widely known Pioneer Chassis Punches, the Ham-R-Press, and Knurl-Tite wrenches.

A recent spurt in the growth of The Phaostron Co. of South Pasadena, Calif. was evidenced last month by the addition of seven new Manufacturers Representatives. With the recent advent of a new Multimeter for both A.C. and D.C. Currents, known as The Phaostron "555," general interest in all the firm's products became so great that, according to Irwin W. Eisenberg, president of the company, an increase in representative personnel became necessary.

GE makes available a "Dealer's Simplified TV Service Handbook" for their 1954-55 TV line which is designed to help the Dealer save valuable time. While primarily designed to aid the Dealer it is a valuable accessory for the technician as well. In short, it provides layouts of the G, H, J, K, N and O Series of TV chassis. Along with these layouts are provided symptoms of defective operation and tubes to be checked for the symptoms given. In addition, important adjustments of rear controls are given as well as pertinent remarks designed to obtain the optimum operation from these receivers. Further information may be obtained from the manufacturer or by writing us directly.

A brighter, high-focus line of popular size replacement picture tubes called the "Twin-Screen Hi-Lite" line, will be added to Du Mont's list of available aluminized picture tubes. They will use the same type of high resolution electron gun used in non-aluminized picture tubes. The result is an aluminized tube which provides the same clarity as the non-aluminized type.

At the last meeting of the Sales Managers Club, Eastern Group, the following officers were elected to serve for the next year: Chairman, Charles Golenpaul of Aerovox, Inc., Vice Chairman, *George E. Martin of Weston Electrical Instrument Corp., and Secretary, Walter Jablon of Radio City Products Co., Inc. This marks the 20th anniversary of the Club, Eastern Group.*

EDITORIAL

[*from p. 4*]

Associations in Michigan, Texas, California, etc. . . . and we recognize the advantages that would accrue from expanding in that direction." He continued, "Not only would we (NARDA) like to function more closely with other service dealer and servicemen's associations, but we'd also welcome your suggestions as to how we, and other associations, might join forces . . . for the mutual benefit of all parties concerned."

That letter presented the opportunity—and it came at a time—which makes me feel that my twenty-six years of close association with servicemen and service dealers may yet resolve into the dream I've always had that eventually there would be a "getting together of the different groups" so that there will result the "Congress of TV-Radio-Appliance Service Dealers and Technicians"—or some such over-all body representing the segments from coast-to-coast.

So, servicemen everwhere, and especially officers of NATESA, (National Alliance of TV & Electronic Service Associations); ESFETA, (Empire State Federation of Electronic-Technicians Associations); FRSAP, (Federation of Radio Servicemens Associations of Pennsylvania)—why not consider the ways and means of "getting together." Why not aim at the ultimate goal of a "Congress?" Your views on this subject would be welcome.

Remember this: explore the problem in all its aspects and not merely from the local viewpoint. In other words, like the American Federation of Labor, which has plumbers, painters and dockworkers in its makeup, so in Radio-TV and appliance sales-service there can be all types of local chapters and state-wide federations with each functioning to meet their respective local needs. To obtain national recognition, prestige, stature and standards so badly needed, that "Congress" which I propose would promulgate laws and edicts which would be formulated by the various representatives from all parts of the country and all segments of the dealer-service field who are delegated to that particular task.

Things to Come

Starting with our September Issue there will be a series of exclusive, basic articles covering all phases of selling and servicing radiation equipments such as Geiger Counters, Scintillators, etc. And there will be in subsequent issues articles on the installation and maintenance of industrial electronics devices. Included in this coverage will be the servicing of air-conditioners. There is a valid reason for this broadening of our editorial scope as you shall see.

As matters stand, all through the country, the average radio-TV service shop owner and employed technician finds himself in a "slack period" during which his income drops. It is our job to help eliminate these seasonal or regional dips, aiming at a year-round higher and steadier income level. Careful analysis and research shows we can help Service Dealers accomplish just that.

Color TV Service Clinics

In many eastern communities of late members of our editorial staff have conducted color TV service clinics for different servicemen's associations and groups. Starting with the basic hookup and installation problems the lectures go through all phases of servicing from A to Z . . . and without exception, at every clinic held to date the unanimous consensus has been "It's a wonderful contribution." Our own experience with color TV has taught us that factual and actual demonstrations with Q & A sessions following does the trick. Besides, by using several different makes of test instrument at each demonstration we can show servicemen how, for instance, two competitive brands of Dot Generators—or how two different makes of 'scopes—work in covering the same problem. Our only regret is that we can't "put the show on the road coast-to-coast." For now we'll have to confine our efforts to points nearby N. Y.

ANSWER MAN

[*from page* 38]

to the sync clipper. The negative bias generated in this grid circuit is employed as an *agc* voltage and when this condenser develops a slight leak it disturbs and reduces the *agc* voltage supplied to the grids of the *if* and *rf* amplifiers. This particular condenser, C354 in *Fig.* 2 has failed several times in receivers using this circuit. This is therefore worthwhile remembering with respect to this type of trouble in this line of receivers.

Another example of a similar case is

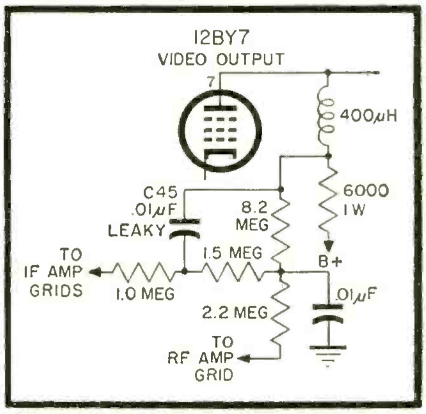


Fig. 3—Partial schematic of video output—Philco 300 chassis.

worth remembering. *Fig.* 3 shows a partial schematic of the *agc* system of the Philco 300 chassis. When this .01 µf condenser, C45, develops a slight leakage it will cause a pull or bend only at the top of the picture. If the leakage is appreciable the picture will become overloaded.

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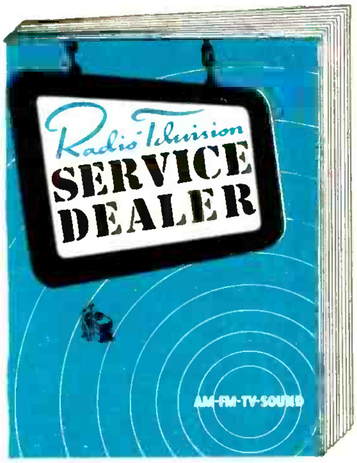

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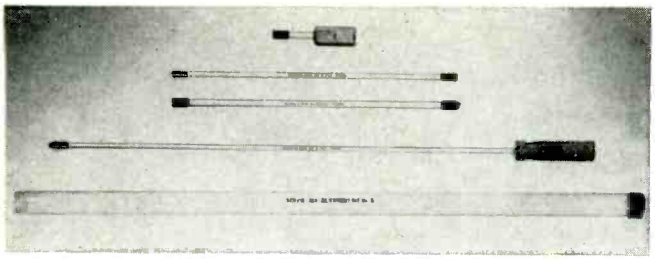

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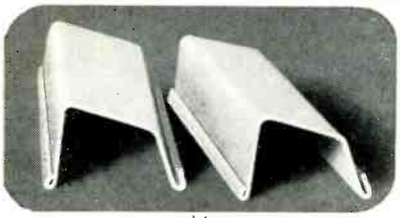

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WORKBENCH

[from page 20]

minimum brightness control setting. This definitely isolated the trouble in the 1B3 circuit. *R444* the high voltage filter resistor was next resistance checked, but was found to be OK. The high voltage condenser *C429* was next clipped out of the circuit but the blooming trouble still remained. Next the 1B3 tube was removed and a resistance

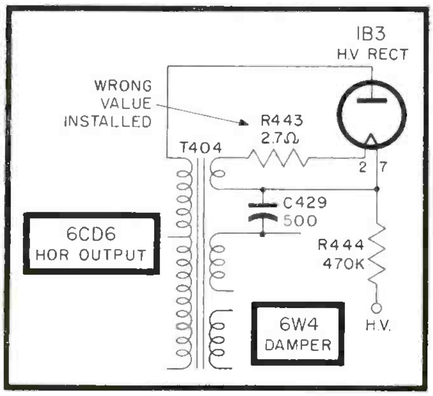

Fig. 2—Partial schematic of high voltage section—Admiral 22E2.

check was made of *R443* by measuring it from the filament pins #2 and #7. The resistor measured about 27 ohms. Here was our trouble. The diagram called for *R443* to read 2.7 ohms. The 1B3 socket was then taken apart and a relatively new 27 ohm resistor was found connected instead of the 2.7 ohm resistor. *R443* was next replaced

[Continued on next page]

with the proper 2.7 ohm resistor. The receiver was now turned on and the receiver functioned properly.

As a positive check the customer was called to determine whether anyone had serviced the receiver recently. The customer replied that since his neighbor (an electrician and not a TV serviceman) had serviced the receiver, he had had the blooming trouble.

Motorola TS 101

The receiver was turned on and an "S" shaped bend was noted in the picture. A check was made to see if there were any hum bars in the picture but none could be found. Next the 6AL5, V15 horizontal phase detector (see *Fig. 3*) was removed from its socket. This was done to determine whether the trouble was caused by the horizontal oscillator. Even though the picture was out of horizontal sync, the bend could still be seen in the horizontal bars. Thus we deduced the trouble to be in the horizontal oscillator circuit. The 6SN7, horizontal oscillator, was then replaced but did not solve the problem. We noted that the "S" shaped bend was not too noticeable when a video tube was removed. In other words, the bend really showed up when the video signal was applied to the picture tube grid.

At this point, the diagram was consulted. The horizontal oscillator in this receiver was a cathode coupled multivibrator with a 15,750 cycle sine wave tank circuit in the plate circuit (pin #5). The tank circuit L24 and C72 was used as a frequency stabilizer. The shape of the horizontal saw tooth had to be OK as there was no evidence of a horizontal linearity or width problem. The horizontal frequency was in range and did not drift. This eliminated the horizontal hold section of the oscillator as a cause of the trouble.

Next the oscillator tank circuit was

examined. *L24* seemed brand new and recently installed. Seeing this, we decided to call the customer. The customer was asked if anyone had serviced the receiver recently. He replied that his brother-in-law had installed an oscillator coil about two weeks ago and since then the bend was in the picture. He also mentioned that his brother-in-law had been going to TV school for about four weeks and seemed to know what he was doing. We thanked the customer and returned to our work.

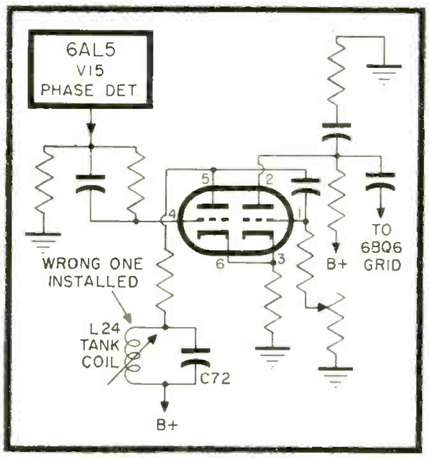

Fig. 3—Partial schematic horizontal oscillator circuit of Motorola TS 101.

We had another tank coil, *L24* in stock. Its resistance was checked and it measured about 35 ohms. The *L24* in the receiver was measured and it was found to measure 70 ohms. The correct horizontal tank coil, *L24*, was then installed. The receiver was turned on, the bend was gone, and the receiver now functioned properly.

The incorrect *L24* probably had the same inductance, but more resistance. Thus the Q of the tank circuit would now be different. A different Q would cause the phase relationship between the multi-vibrator pulse and the 15,750 cycle tank circuit sine wave to be different. Thus the tank circuit would not properly stabilize the multi-vibrator pulse. The result was the "S" shaped bend in the picture.

CIRCUIT ANALYSIS

[from page 18]

fication of this stage inversely as the bias supplied. This voltage, obtained from the demodulator and proportionate to the received signal, as in a conventional *avc* circuit, serves to maintain the input to the audio amplifier essentially constant.

Albert Arnold
Motorola

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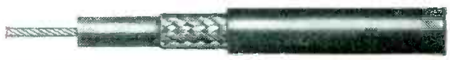

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