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POSTMASTER: SEND FORM 3579 TO RADIO-TELEVISION SERVICE DEALER, 67 WEST 44TH ST., NEW YORK 36, N. Y.
A Paradox

The vowels EIU when properly combined with the consonants DNT spell the word “UNITED.” If changed around they also spell the word “UNITIED.” “UNITED” and “UNITIED” 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 servicemen 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 whining 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]
Based On Rigid U. S. Government Engineering Specifications

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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 treadle is pressed and the radio automatically changes to the next station. If a station further along the dial is desired the bar or foot treadle 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 6CH, 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 treadle 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 and cathode circuits.
5. A 20 µf 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

Description of the electron circuits involved in a typical "Signal Seeking" auto radio. These units are enjoying increasing popularity and will require servicing.
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 of the tuning bar which forces it to be depressed, contact being made in this extreme position. Thus, if a pulse occurs, during the retreat 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 the 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 that the stop action 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 IF transformer at resonance.

As tuning occurs, the IF best 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 heat difference signal will at first be less than the center IF frequency as tuning brings it toward the exact 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 by:

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

Fig. 2—Theoretical plate voltage changes of phase detector tube as a broadcast 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 $g1$ and $g3$. That is, the phase of the signal applied from the transformer secondary to grid $g1$ with respect to the signal applied from the primary of the transformer to grid $g3$. 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 $180^\circ$ 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 resonant 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 µf 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 sharpened 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.

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 know-how 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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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.

**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 pairs (B) and (G) of the figure to correspond with the correct position of the color guns shown in (A).

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.

**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.
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 to 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. 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 tingeing 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 de 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. 1—Simplified screen grid and control grid voltage supply of a typical I/Q receiver.
adjustment 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]
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 seaside 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-

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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]
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THE NEW 622 OFFERS...
- preset TV sweep frequencies
- 6 mc (-3 db) vertical bandpass
- 5' flat face CRT...undistorted edge to edge
- illuminated graticule with dimmer
- electronically regulated power supplies
- unusually light weight and
- AUTOMATIC TRIGGERED SWEEP

BASIC SPECIFICATIONS

VERTICAL AMPLIFIER
Frequency Response: 6 cps to 6 mc.; -3 db; down less than 0.5 db @ 4 mc.
Sensitivity: 10 mv rms (28 mv peak-to-peak) per inch
Input impedance: 1 megohm;
40 mmf (±2 mmf) over entire attenuator range

HORIZONTAL AMPLIFIER
Frequency Response: 1.5 cps to 600 kc.; ±3 db
Sensitivity: 75 mv rms (210 mv peak-to-peak) per inch
Input Impedance: 100k, 25 mmf

SWEEP CHARACTERISTICS
Usable writing speed...0.03 sec/in to .3 sec/in

RANGES...
- a. 10 cps to 300 kc
- b. Preset H & V television @ 7875 and 30 cps
- c. 60 cps, variable phase line
Type...automatic triggered or straight triggered (by switching)

SLOWING
- internal, external, positive, negative or AGC line

CALIBRATION
- Internal 60 cps square wave .05 volts peak-to-peak ±3%
- POWER REQUIREMENTS
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RADIO-TELEVISION SERVICE DEALER • JULY, 1955
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 clamping 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 a 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 clapper. 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 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...
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. 2—Partial schematic of sync clipper—Emerson Ch. 120174B.

Fig. 3—Partial schematic—Motorola Volumatic.
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7. Transformer winding resistances appear on the schematic.
8. Schematics are keyed to photos and parts lists.

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10. All parts are numbered and keyed to the schematic and parts lists.
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12. Complete, detailed alignment data is standard and uniformly presented in all Folders. See your parts distributor for a complete stock of PHOTOFACT Folders.
13. Alignment frequencies are shown on radio photos adjacent to adjustment number—adjustments are keyed to schematic and photos.

TUBE PLACEMENT CHARTS

14. Top and bottom views are shown. Top view is positioned as chassis would be viewed from back of cabinet.
15. Blank pin or locating key on each tube is shown on placement chart.
16. Tube charts include fuse location for quick service reference.

TUBE FAILURE CHECK CHARTS

17. Shows common trouble symptoms and indicates tubes generally responsible for such troubles.
18. Series filament strings are schematically presented for quick reference.

COMPLETE PARTS LISTS

19. A complete and detailed parts list is given for each receiver.
20. Proper replacement parts are listed, together with installation notes where required.
21. All parts are keyed to the photos and schematics for quick reference.

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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 af, 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 mf, instead of being connected to the center arm of the volume control, was connected to the ungrounded arm, while C222, .02 mf, 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.

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

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### I-P System, Initial Alignment

1. If each coil and center core are not aligned, the tuning of the individual coils may be checked.
2. Select a probe set at one end of the coil. If the coils are not aligned, the tuning of the coil may be observed.
3. Connect scope to Test Point V; maximum vertical gain of probe is required.
4. Connect detector network between oscilloscope input and receiver Test Point II as shown. In Figures 8-8 and 10.

### Alignment of L100 I-F Trap

The trap, L100, Figure 3 is for the purpose of receiving any frequency in the I-F range within any cause interference. It is normalized at the factory to 45.7 mc.

1. 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 outlined below.
2. Connect 5 volts bias from the A-C line to C12 located at the positive of the bias battery to B-2. Use an accurate marker generator to furnish marker of the same frequency as the interfering frequency.

### Alignment Chart

**Important**

1. Connect scope to view the response curve at the outputs of the video detector, Test Point III. (Use a sweep generator with its center frequency set approximately at the interfering frequency.)
2. Do not tune L100 so it will eliminate Channel No. 3.
3. Use the GE BT-56 balanced transformer and a 2-foot piece of 300-ohm transmission line to couple the I-F sweep to the antenna terminals of the receiver to properly match the input impedance of this receiver.
4. If the shape of the response curve changes when you grasp the 300-ohm transmission line, a leak path, as shown in Figure 14, should be inserted at the head-end antenna terminals.

**Alignment of L100 I-F Trap**

**Alignment Chart**

- **Channel**
  - VHF CHANNEL
  - UHF CHANNEL
  - IF CHANNEL

- **Frequency**
  - VHF: 40-100 mc
  - UHF: 40-100 mc
  - IF: 40-100 mc

- **Adjust**
  - L100, L101

- **Remarks**
  - Adjust for maximum gain and minimum interference.
COMPLETE

NOTE: If horizontal instability persists beyond what is considered normal, linearity may become a factor. See item 4, vertical deflection, for removal of linearity error (see also, CAUTION 1). If the brightness control is not properly adjusted, check for proper adjustment with good vertical linearity. The brightness control should be adjusted so that the brightness of the picture is properly adjusted but may be extended beyond the maximum limit. Be careful, however, not to damage the picture tube by extending the brightness control beyond the maximum limit.

HORIZONTAL INSTABILITY Volt: 1/2 volt on the vertical output, the bias to be tested in the horizontal output circuit may be extended beyond the maximum limit. Be careful, however, not to damage the picture tube by extending the brightness control beyond the maximum limit.

HORIZONTAL TUNING SOLIST: This control in the picture output may be adjusted so that the horizontal oscillation becomes stable. It may be necessary to adjust the stabilizer control, 

1. Adjust the stabilizer control until the picture becomes stable. Be careful, however, not to damage the picture tube by extending the brightness control beyond the maximum limit.

2. Connect a VOM between Test Point No. 2 and ground.

3. Be sure the horizontal oscillator control is at a maximum position before adjusting the stabilizer control. Be careful, however, not to damage the picture tube by extending the brightness control beyond the maximum limit.

CAUTION: Note that the stabilizer control should be adjusted at the stabilizer control in the horizontal output circuit.

Do not remove the HORIZONTAL OSCILLATION CONTROL while power is on as damage to the horizontal output circuit may result. Do not remove the stabilizer control while power is on as the output circuits may be damaged.

NOTE: If the stabilizer control is not properly adjusted, check for proper adjustment with good vertical linearity. The stabilizer control should be adjusted so that the brightness of the picture is properly adjusted but may be extended beyond the maximum limit. Be careful, however, not to damage the picture tube by extending the brightness control beyond the maximum limit.

HORIZONTAL TUNING SOLIST: This control in the picture output may be adjusted so that the horizontal oscillation becomes stable. It may be necessary to adjust the stabilizer control, 

1. Adjust the stabilizer control until the picture becomes stable. Be careful, however, not to damage the picture tube by extending the brightness control beyond the maximum limit.

2. Connect a VOM between Test Point No. 2 and ground.

3. Be sure the horizontal oscillator control is at a maximum position before adjusting the stabilizer control. Be careful, however, not to damage the picture tube by extending the brightness control beyond the maximum limit.

CAUTION: Note that the stabilizer control should be adjusted at the stabilizer control in the horizontal output circuit.

Do not remove the HORIZONTAL OSCILLATION CONTROL while power is on as damage to the horizontal output circuit may result. Do not remove the stabilizer control while power is on as the output circuits may be damaged.

NOTE: If the stabilizer control is not properly adjusted, check for proper adjustment with good vertical linearity. The stabilizer control should be adjusted so that the brightness of the picture is properly adjusted but may be extended beyond the maximum limit. Be careful, however, not to damage the picture tube by extending the brightness control beyond the maximum limit.
<table>
<thead>
<tr>
<th>R/C/W</th>
<th>Description</th>
<th>Unit</th>
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<tbody>
<tr>
<td>C153</td>
<td>30mmf., t5%, disc ceramic</td>
<td></td>
</tr>
<tr>
<td>C256</td>
<td>1200mmf., mica</td>
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</tr>
<tr>
<td>R258</td>
<td>2,650 ohms</td>
<td></td>
</tr>
<tr>
<td>R200</td>
<td>2,020 ohms</td>
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<tr>
<td>R162</td>
<td>1,620 ohms</td>
<td></td>
</tr>
<tr>
<td>C160</td>
<td>18mmf., t5%, disc</td>
<td></td>
</tr>
<tr>
<td>R308</td>
<td>0.308, 313 .033mF, 600V, molded.</td>
<td></td>
</tr>
<tr>
<td>R223</td>
<td>0.223, molded</td>
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<tr>
<td>R301</td>
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<tr>
<td>R158</td>
<td>158, 301</td>
<td></td>
</tr>
<tr>
<td>C160</td>
<td>18mmf., t5%, disc</td>
<td></td>
</tr>
<tr>
<td>R254</td>
<td>2,540 ohms</td>
<td></td>
</tr>
<tr>
<td>R313</td>
<td>313, 314</td>
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</tr>
<tr>
<td>R254</td>
<td>2,540 ohms</td>
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</tr>
<tr>
<td>C314</td>
<td>.0033mF, 1000V, molded.</td>
<td></td>
</tr>
<tr>
<td>C314</td>
<td>.015mF, 1000V, molded.</td>
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<td>R215</td>
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<tr>
<td>R268</td>
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</tr>
<tr>
<td>R167</td>
<td>120,000 ohms</td>
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<tr>
<td>R215</td>
<td>15,000 ohms</td>
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<tr>
<td>C152</td>
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</tr>
<tr>
<td>R268</td>
<td>820 ohms</td>
<td></td>
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</tbody>
</table>

**Table Notes:**
- **Capacitors:**
  - URE-1066, URE-109, URE-075, URE-073, URE-069, URF-r/S, URF-069, URF-041, URF-037.
- **Resistors:**
  - R264, 12,000 ohms.
  - R311.
  - R260, 680,000 ohms.

**Diagram Notes:**
- VOLTAGE MEASUREMENTS ARE:
  - Local voltage
  - Distinct voltage
  - Average voltage
  - Deflection voltage
  - Current
  - Wattage
  - Deflection coils and Yoke (vert. lin.)
  - Deflection coils and Yoke (vert. size)
  - Deflection coils and Yoke (control volume)

- GENERAL ELECTRIC

**General Electric Models:**
- Models 21C40, -C41, -C130, -C131, -C151, -C152, -C156, -C157, "O" Line

**Exclusive Service of Cowan Publishing Corp.**

*Set 10, Page 3 - General Electric*
OSCILLATOR ALIGNMENT
NOTE:
1. The 1-f. system must be in proper alignment.
2. Connect the sweep generator to T110 using the 0.05025 balanced adapter to obtain 300 ohm 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 center marker for the channel falls at 59.75 on the high frequency slope of the response curve.

OSCILLATOR ALIGNMENT CHART SWEEP GENERATOR SWEEP WIDTH 10-15 mc

<table>
<thead>
<tr>
<th>RECEIVER &amp; SQUID GENERATOR SWEEP WIDTH 10-15 mc</th>
<th>ADJUST</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. No. 13</td>
<td>Channel No. 13 oscillator adjustment</td>
</tr>
<tr>
<td>2. No. 7</td>
<td>Channel No. 7 oscillator adjustment</td>
</tr>
<tr>
<td>3. No. 11</td>
<td>Channel No. 11 oscillator adjustment</td>
</tr>
<tr>
<td>4. No. 13</td>
<td>Channel No. 13 oscillator adjustment</td>
</tr>
<tr>
<td>5. No. 2</td>
<td>Channel No. 2 oscillator adjustment</td>
</tr>
<tr>
<td>6. No. 9</td>
<td>Check tracking, Knife if necessary, L102, L109, L124</td>
</tr>
<tr>
<td>7. No. 8</td>
<td>Check tracking, Knife if necessary, L106, L112, L127</td>
</tr>
<tr>
<td>8. No. 6</td>
<td>Check tracking, Knife if necessary, L104, L111, L126</td>
</tr>
<tr>
<td>9. No. 5</td>
<td>Check tracking, Knife if necessary, L105, L110, L125</td>
</tr>
<tr>
<td>10. No. 4</td>
<td>Check tracking, Knife if necessary, L103, L108, L123</td>
</tr>
<tr>
<td>11. No. 3</td>
<td>Check tracking, Knife if necessary, L101, L107, L122</td>
</tr>
<tr>
<td>12. No. 2</td>
<td>Check tracking, Knife if necessary, L100, L106, L121</td>
</tr>
<tr>
<td>13. No. 1</td>
<td>Check tracking, Knife if necessary, L100, L114, L119</td>
</tr>
</tbody>
</table>

ожно: 40.0 cycle modulation. When this type of signal is used the traces should be adjusted for suitable 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 publications and technical literature supplied by the manufacturer.

These technicians who do not have equipment available to produce suitable signals should not attempt the trap alignment procedure. With the exception of the trap alignment procedures the traps should not become seriously misaligned due to tube change. The 4.5 mc audio trap, L155, may be tuned so that as close a trap alignment, if necessary, be substituted for a 4.5 mc signal as has been noted. A marked signal of 4.5 mc as is shown.

TRAP ALIGNMENT
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 30 to 48 megacycles at fundamental frequency, with available internal

FIG. 8 DETECTOR NETWORK

(© John F. Rider)
MUNTZ
Models 317T2, Ch 37A2
321T1, Ch 1782

TUBE LIST

<table>
<thead>
<tr>
<th>SYMBOL TYPE</th>
<th>CIRCUIT FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1</td>
<td>6BC5 RF Amp.</td>
</tr>
<tr>
<td>V1</td>
<td>6BQ7 RF Amp.</td>
</tr>
<tr>
<td>V2</td>
<td>6J6 Mixer-Osc.</td>
</tr>
<tr>
<td>V3</td>
<td>6AU6 Sound IF. Amp.</td>
</tr>
<tr>
<td>V4</td>
<td>6T8 Rat. Det., Audio Amp.</td>
</tr>
<tr>
<td>V5</td>
<td>6W6GT Audio Out.</td>
</tr>
<tr>
<td>V6</td>
<td>5U4C L.V. Rect.</td>
</tr>
<tr>
<td>V7</td>
<td>6C86 Vid. IF. Amp.</td>
</tr>
<tr>
<td>V8</td>
<td>6AU6 Vid. IF. Amp.</td>
</tr>
<tr>
<td>V9</td>
<td>6A16 Vid. IF. Amp.</td>
</tr>
<tr>
<td>V10</td>
<td>6C86 Vid. Amp.</td>
</tr>
<tr>
<td>V11</td>
<td>12AT7 Sync. Sep.</td>
</tr>
<tr>
<td>V14</td>
<td>6BQ6GT Hor. Out.</td>
</tr>
<tr>
<td>V15</td>
<td>1B3GT H.V. Rect.</td>
</tr>
<tr>
<td>V16</td>
<td>6W4GT Damper</td>
</tr>
<tr>
<td>V17</td>
<td>17BP4 Picture Tube 21WP4</td>
</tr>
</tbody>
</table>

KEY VOLTAGES
- H+-, plate of damper, V16 pin 5 210 vdc
- Roasted H+-, cath. of damper, V16 pin 5 220 vdc
- Plate of VERT. OSC. V12 pin 2 150 vdc
- Plate of Vert. Osc. V12 pin 5 250 vdc
- Plate(s) of Hor. Osc. (and controls), V13 pin 5 150 vdc
- Grid of Hor. Osc. V14 pin 5 150 vdc

All voltages are measured with a VTVM connected between the tube pins and chassis.
TO CHECK OPERATION OF RECEIVER

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

1. Connect the AC plug (100-125 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 1/2 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 given in the paragraph "ION TRAP". The set now should operate, picture and sound, with the following provisions:

(a) station operating on the air, (b) the oscillator adjustment turned 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 synchronisation with the transmitting station.

V. HOLD: The vertical hold control locks the receiver in vertical synchronisation 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 focusing and rotation purposes. 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 connected to the Focalizer by a universal joint. Up and down motion of this lever moves picture sideways while sideward motion moves picture forward and backward. 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 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.

Upon proper 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

WEAK PICTURE SIGHT AND RASTER OK

Tuner fine tuning

V2, V4, V5, V6, V7, V8

Check 0.047 and 0.047 mf caps. connected to pin 1 of V12

NO DISTORTION

Tuner fine tuning

V2, V4, V6, V7, V8

Check 0.047 and 0.047 mf caps. connected to pin 1 of V12

NOISY SOUND—PIX OK

Tuner fine tuning

Vol. con.

V2, V4, V5

Speaker connections are not correct.

Radio-TV Service Dealer

July, 1955

No 34

MUNTZ TROUBLE SHOOTING CHART

ENGRAVED EFFECT IN PIX

Tuner line tuning

Contract con.

V2, V3, V4, V5, V6, V7

Check 0.047 and 0.047 mf caps. connected to red lead of Vert. osc. trans.


Low line voltage

INSUFFICIENT RASTER HEIGHT

Vert. Site and Lin. con.

V6, V12

Check 0.047 and 0.047 mf caps. connected to red lead of Vert. osc. trans.


Low line voltage

INSUFFICIENT RASTER HEIGHT

V12

Check 0.047 and 0.047 mf caps. connected to red lead of Vert. osc. trans.


Low line voltage

NO VERT. DEFIL.

V12

Check 0.047 and 0.047 mf caps. connected to red lead of Vert. osc. trans.


Low line voltage

NO VERT. SYNC.—VERT. SYNC. OK

Vert. Hold con.

Vert. Int. network

V1, V2

Check 0.047 and 0.047 mf caps. connected to pin 1 of V12

Check 0.047 and 0.047 mf caps. connected to pin 2 of V11

NO HORIZ. OR VERT. SYNC.—PIX SIGNAL OK

V1, V2

Check 0.047 and 0.047 mf caps. connected to pin 1 of V12

Check 0.047 and 0.047 mf caps. connected to pin 2 of V11

NO HORIZ. OR VERT. SYNC—VERT. SYNC. OK

Hor. Hold and Range con.

Hor. osc. trans. adj. (T-6)

V1, V2

Check 0.047 and 0.047 mf caps. connected to pin 1 of V12

Check 0.047 and 0.047 mf caps. connected to pin 2 of V11

DISTORTED SOUND

Tuner line tuning

V2, V3, V4, V5

Check V4, V5, V6, V7, V8

Check 0.047 and 0.047 mf caps. connected to pin 1 of V12

Sound and Vid. IF alignment Z-2

Det. alignment Z-3

NO SOUND—PIX OK

Tuner line tuning

Vol. con.

V2, V4, V5

Speaker connections are not correct.

Sound and Vid. IF alignment Z-2

Det. alignment Z-3

NOISY SOUND—PIX OK

Vol. con.

V2, V4, V5

Check sound system for loose connections.

Speaker connections are not correct.

Sound and Vid. IF 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.

SERVICE DEALERS
Retail Firms that operate their own radio-TV service departments.

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

Service Firms & Service Dealer Coverage Provided by Magazines

<table>
<thead>
<tr>
<th>Classification</th>
<th>Service Dealer</th>
<th>Technician</th>
<th>Service</th>
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</thead>
<tbody>
<tr>
<td>Service Firms &amp; Servicemen</td>
<td>33,664</td>
<td>18,183</td>
<td>27,963</td>
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<td>Service Dealers</td>
<td>22,438</td>
<td>14,717</td>
<td>5,244</td>
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<tr>
<td>Industrial Electronic Servicers</td>
<td>1,548</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTALS*</td>
<td>57,650</td>
<td>32,900</td>
<td>33,207</td>
</tr>
</tbody>
</table>

*These figures are from the current ABC & BPA Publisher’s Circulation Statements.
C-D Miniature Electrolytic
Cornell-Dubilier announces the development of extremely small tantalum electrolytic capacitors. The C-D Series NT, measuring ⅛" in diameter and 5 1/4" in length, which have extremely low leakage, long shelf and service life, stability and power-factor characteristics within a temperature range of -50° to +55°C. All units are of polarized configuration. For more information, write for Engineering Bulletin 506 to: Cornell-Dubilier Electric Corporation, South Plainfield, New Jersey.

Phaestrans Panel Meter
A new 1 1/2" Panel Meter has just been announced by The Phaestrans Company, 121 Pasadena Avenue, South Pasadena, California. Known as The Phaestrans 1 1/2" "Cobra" Panel Meter, this new product is available in four types, all of which are housed in rugged, shock-resistant, "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 elementary assembly designated as the "Anto-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 unstapling them. It features an aluminum alloy frame, endless belt step-glide and quick tightening strap ratchet device. Basic line also includes the standard, Model T (50" high), and Model 9 (71" high) for handling consoles, pianos, freezers, etc. For information, write: Yeats Appliance Dolly Mfg. Co., 3139 N. 12th St., Milwaukee 8, Wisc.

RCF D.C. Midgetscope
A New D.C. Midgetoscope, Model 2554 has been announced by the Radio Consultants Company, Inc., Centre and Glenwood Blvds., Easton, Pennsylvania. It combines linear sweep with the simplicity for color television restorer circuits and for complex wave forms, and includes provisions for ac coupling, full vertical and horizontal expansion of the viewing screen, 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 40°. The CMIL is similar to the CIB, using a screen-in driver. It is rated at 3 watts continuous duty, from 400 to 13,000 cps. Write dept. NR-1, University Loudspeakers Inc., 89 South Kenisco 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 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 Wadsworth Avenue, Brooklyn 27, New York, announced recently their new Model 2401, UNISPEAK universal test speaker. An essential service aid for TV and radio repair. UNISPEAK's flexibility is enhanced by a socket providing speed checks for most sets which are frequently encountered. An adapter 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-range, multi-position, the Series 101 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 180 v.c.e. 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 of 100 ERIE GP Tubular Ceramicons in 18 popular values. According to the manufacturers, 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 network, and.
2. Protect 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.B.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 Sarks 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 heat 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 age 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.

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?

L. M.  

In examining the age system (Fig. 2) it will be noticed that there is a .01 uf 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 cberries, 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..."
These three new flybacks are mechanically correct and electrically correct, ruggedized versions of manufacturer's items — precisely engineered by TRIAD for specific makes and models — to give exceptionally high performance and long, trouble-free service.

**COMPOSITE REPLACEMENT**

Triad flybacks wherever possible are COMPOSITE items designed to meet the correct electrical and mechanical characteristics for as many television chassis as possible.

Ask your distributor, or write, for Catalog TV-155B

**Ask for Sprague By Catalog Number**

Know what you're getting . . . get exactly what you want. Don't be vague . . . insist on Sprague. Use complete radio-TV service catalog C-610. Write Sprague Products Company, 71 Marshall Street, North Adams, Massachusetts.

Don't just say "capacitors"

**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 Phaeton 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 Phaeton "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 Galen poul of Aerovox, Inc., Vice Chairman,
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 dealers 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 everywhere, especially officers of NATESA, (National Alliance of TV & Electronic Service Associations); ESFETA, (Empire State Federation of Electronic-Technicians Associations); FRSAP, (Federation of Radio Servicemen 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 dock-workers in its makeup, so in Radio-TV and appliance 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

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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 age voltage and when this condenser develops a slight leak it disturbs and reduces the age 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 worth remembering. Fig. 3 shows a partial schematic of the age system of the Philco 300 chassis. When this .01 uf 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.

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

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WORKBENCH
[from page 20]

minimum brightness control setting. This definitely isolated the trouble in the IB3 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 IB3 tube was removed and a resistance check was made of R443 by measuring it from the filament pins 22 and 27. The resistor measured about 27 ohms. Here was our trouble. The diagram called for R443 to read 2.7 ohms. The IB3 socket was then taken apart and a relatively new 27 ohm resistor was found connected instead of the 2.7 ohm resistor. R443 was then replaced.

[Continued on next page]

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

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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 services man) 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 25). 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

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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.

**CIRCUIT ANALYSIS**

[from page 18]

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

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