Successful
SERVICING

OCTOBER, 1951

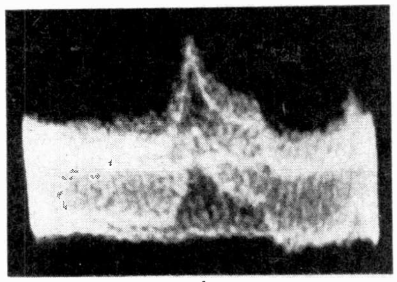

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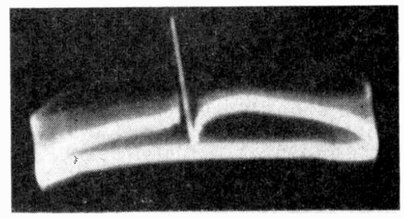
Fig. 1. Buzz waveform caused by cross-modulation in the r-f amplifier.

Fig. 2. Buzz waveform caused by horizontal and vertical crosstalk.



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TV RECEIVERS

ALIGNMENT HINTS *and* INTERCARRIER RECEIVER NOISE*

by Bob Middleton

Buzz Caused by Vertical-Output Transformer

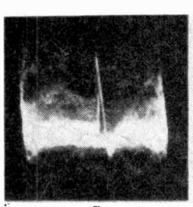
In some intercarrier TV receivers, the vertical-output transformer will cause buzz in the sound unless the core of the transformer is securely connected to the chassis of the TV receiver. This transformer can also produce buzz because of stray field coupling. This can occasionaally be lessened by re-orienting the vertical-output transformer so that the stray field does not produce crosstalk in the audio components. Shielding the transformer with an iron case will also help in such instances.

Cross-Modulation Buzz

Buzz generated in the high-frequency circuits, video circuits, or 4.5-Mc driver, must pass through the f-m detector before it becomes an audio-frequency wave. Accordingly, it is evident that the buzz-producing circuits produce a spurious frequency modulation of the sound carrier, since amplitude modulation is normally rejected by the f-m detector. However, the fact that an improperly aligned ratio detector will respond to a-m must not be overlooked. In such cases, a-m buzz will become audible in the audio output. Also, an improperly biased gated-beam detector or an improperly operated limiter-discriminator system will pass a-m buzz.

Cross-modulation is produced in non-linear amplifiers. In the typical cases encountered in TV servicing, such cross-modulation will contain both a-m and f-m components. Therefore, to minimize this type of buzz, the r-f, i-f, video, and 4.5-Mc amplifiers should be operated as linear Class A amplifiers.

It should be noted that the local oscillator tube in a split-sound type of receiver may introduce hum into the audio signal if the tube develops heater-cathode leakage. The grid (cathode) bias in such cases becomes modulated at a 60-cycle rate. This produces both frequency modulation and amplitude modulation of the sound carrier. The frequency-modulation component alone is audible under normal circumstances.



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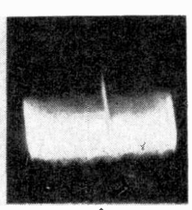

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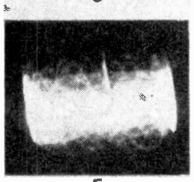

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Figs. 3, 4, 5. Buzz waveforms with various amounts of sound modulation.

Vertical Sweep Crosstalk vs. Carrier Cross-Modulation

Practically all TV receivers show some crosstalk between the vertical sweep circuit and the audio channel. This crosstalk shows up on the scope as a narrow triangular pip, riding on an elliptical baseline. This baseline is produced by the residual 60-cycle hum of the audio circuits. If the buzz and hum is below the threshold of audibility, the service engineer need not concern himself about it although the scope will show these low voltages. If the crosstalk is coming from the vertical sweep circuits, the pip will appear to revolve around the ellipse when the vertical-hold control is changed. In addition, the tone of the buzz as heard in the speaker will change. Furthermore, the pip will appear whether the receiver is tuned to an active channel or not.

Almost the same shape of pip is seen on the scope when the picture and sound carriers cross-modulate each other. This cross-modulation may take place in the r-f tuner, for example, if the grids are returned to ground instead of to a negative bias source and a strong signal is applied to the tuner. A buzz is heard in the speaker and the typical pip-on-ellipse appears on the scope screen (60-cycle line sweep used). This pip changes in height as the fine tuning control is varied. It may even go through zero and reverse in polarity (extend down instead of up) as the fine tuning control is adjusted.

The buzz waveform, as it appears on a scope connected to the discriminator output, is shown in Fig. 1. The buzz pulse rises above the tone from a TV station during the transmission of the test pattern. This buzz is caused by overloading and the resulting cross-modulatiton in the r-f amplifier. The display was obtained with a 60-cycle sine-wave sweep.

The cross-modulation pip does not revolve on the curve in response to a change in the vertical-hold control as is the case with the pip due to vertical sweep crosstalk. The pip usually stands still, because the transmitter frequently operates at the same line frequency as the receiver. However, if the pattern is observed with a relayed signal, the pip may revolve slowly on the ellipse. This rate of revolution is unchanged as the vertical-hold control is varied.

Since the horizontal-sweep circuits also crosstalk with the audio channel in most receivers, a close picket-fence of horizontal pips is usually seen with the vertical pip. This picket-fence will revolve on the elliptical baseline in accordance with the setting of the horizontal-hold control. A scope pattern showing the result of vertical and horizontal crosstalk is seen in Fig. 2. The vertical pulse shows up as a pip on the elliptically distorted baseline. The horizontal pulses appear close together around the ellipse. Only the vertical pulse is audible. The display was obtained with a 60-cycle sine-wave sweep.

(Continued on page 15)

Television Changes

DuMont RA-103

Power-line voltage fluctuation can be the cause of flickering of the picture. The indication observed on the screen of the picture tube is similar to the effect seen when an airplane flies overhead. In a number of cases where flicker was encountered, it was found to be caused by a faulty installation or a bad 6AG5 in the video i-f strip. An undamped a-c voltmeter having a range suitable for measuring 117 volts can be used to check the a-c line voltage. Once it has been established that fluctuating line voltage is causing the flicker, it is recommended that the following changes be made:

1. Connect a 0.5-μf capacitor from the cathode of the crt (arm of potentiometer R227) to the junction of R222, R223 and C216B.

2. On chassis which have not had the sync noise immunity change, involving the change of V205 from 6AC7 to 6AG7, disconnect R219 from the junction of R216, C215 and R220, and connect to a bleeder of a 27,000-ohm, ½-watt resistor connected to —12-volt line, a 8200-ohm, ½-watt resistor connected to ground, and a 25-μf, 6-volt capacitor connected to ground.

This change will make a considerable reduction of the flicker for small amounts of line variation (well under one volt). For larger amounts of line variation, size fluctuation becomes as objectionable as brightness fluctuation and the only effective solution is to use a regulated transformer.

●

Westinghouse H-226, Ch. V-2146-21DX, Ch. V-2146-25DX

The part numbers of the cabinets should be changed in the Parts List to read V-1179-1 for the mahogany cabinet and V-1179-2 for the blonde cabinet. Later production chassis have a 100,000-ohm resistor (RC20AE104M) inserted in series with the brown wire that extends from the cathode of the CRT to the rotor of the brightness control. The purpose of the added resistor is to correct for "blooming."

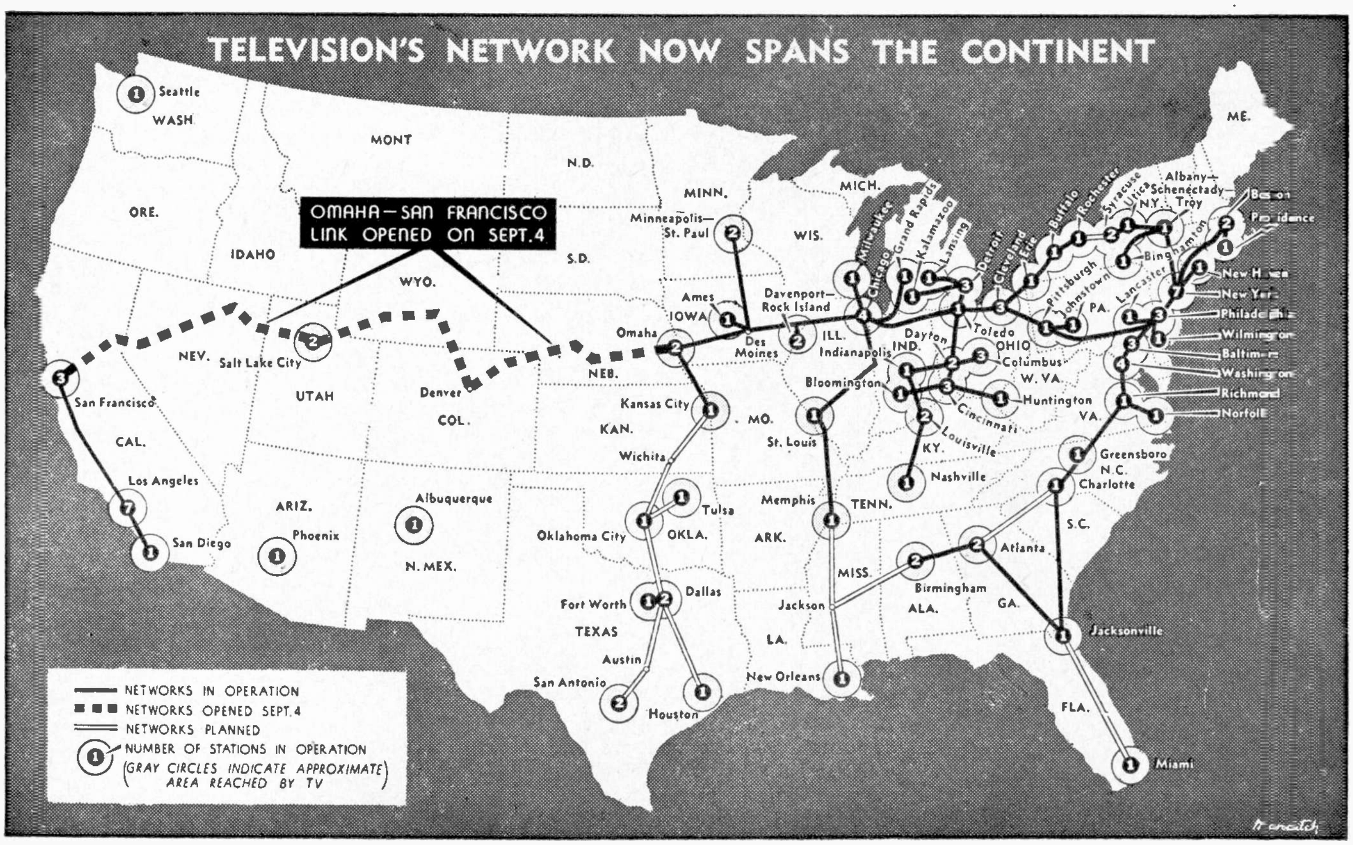
TRANSCONTINENTAL TV

Extension of the TV network westward to San Francisco brings both new opportunities and new problems to the industry. The opportunities are immediately apparent. The number of families within range of the network is now approximately 13,100,000, nearly 30 per cent of the country's total of 44,167,000. This brings the number of families now in range of all TV services, network and non-network, up to some 27,400,000. Since only 13,800,000 families, or about half the possible total, have TV sets at present, it is plain that the industry's potential market has been tremendously increased.

From the standpoint of entertainment value, another immediate benefit is the ability to interchange East and West Coast programs. The World Series coverage, relayed to the West Coast this month, and the Hollywood-originated programs sent to the East are obvious examples. Moreover, the cost of the new coast-to-coast facilities is not expected to be exorbitant. The rate by the American Telephone and Telegraph Company is approximately 10 cents per mile per half hour. Thus, for the total A. T. and T. network of about 6,000 miles, (that is, the 3,000 miles of transcontinental network plus the loops and spurs serving the East and Midwest), the cost of relaying facilities is only about $1,200 per hour, a moderate item compared to the cost of time on the network stations themselves.

Inevitably, with this great increase in facilities, there are new technical and administrative problems. The facilities of the network between San Francisco and Omaha, a distance of 1,700 miles, provides for only one "road" in each direction. This means that the four TV systems, NBC, CBS, ABC, and Dumont, must split up the time somehow between them.

Then too, there are new problems due to the difference of time between the East and West coasts. For instance, Hollywood programs timed to reach New York at night are only afternoon shows in California. The answer to this problem is still being debated. Two performances, one for each coast, the use of films, kinescoping, or a combination of all three, are possible solutions. Future experience will decide which is the most satisfactory answer. However, with all its problems, the new coast-to-coast network marks an all-important stage in the television industry.



Courtesy Mr. Manditch and N. Y. Times

IS MY SCOPE IN GOOD CONDITION?

by M. Snitzer

An oscilloscope is a pretty useful piece of test equipment, especially in these days of TV receiver servicing. However, the scope is not very helpful if it does not operate properly or if it does not operate at all. Like the scope's big brother, the TV set, much of what ails it on the inside is disclosed by the appearance of the pattern on the screen. Just as the manipulation of the operating and adjustment controls shows by its effect on the screen pattern that the circuits of the TV receiver are doing their job, so does the operation of the scope controls show whether or not the scope is operating properly. Many troubles are readily disclosed by using the cathode-ray tube itself as the trouble shooting device. Some of the checks on the scope can be performed without even applying an external signal to the scope.

Residual Hum

One check the serviceman can make is for the residual hum in his scope. This can be done by a close examination of the bright spot produced by the undeflected electron beam of the cathode-ray tube. The spot should be perfectly round with no sweep applied to the horizontal circuits and with no signal being applied through the vertical channel. Both horizontal and vertical gain controls should be at minimum setting. If the spot is elongated either vertically or horizontally, the presence of some deflecting voltage is indicated. If the input terminals of the scope are shorted (using the shortest possible length of lead) and if the sweep generator is turned off, then this elongation can be the result of residual hum in the scope.

This residual hum may be examined by turning the sweep generator on and by advancing the horizontal gain control. The pattern seen in Fig. 1 may be produced in which the slight waviness of the baseline indicates the presence of hum voltage. Residual hum may be caused by a faulty component, especially one of the power supply filter capacitors, or it may be caused by stray fields from the power transformer or power wiring within the scope itself. Heater-to-cathode leakage may also produce residual hum. If, with maximum vertical gain, the hum pattern is no worse than is shown in Fig. 1, it can be disregarded in most cases. This is true since the ordinary stray field coupling in most scopes is sufficient to produce this type of pattern at low sweep frequencies. At higher sweep frequencies, the effect is to increase the thickness of the trace.

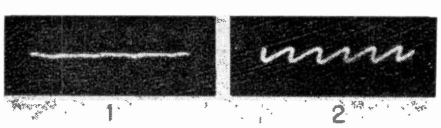


Fig. 1, 2. Residual hum waveforms.

On the other hand, if patterns such as are shown in Figs. 2 and 3 are seen with no vertical signal input, then this represents a condition that cannot be tolerated. Actually these patterns represent the result of insufficient low-voltage power supply filtering. Fig. 2 shows the effect of an open input filter capacitor while Fig. 3 shows the effect of an open output filter capacitor. In both cases a bad ripple voltage is acting to produce vertical deflection. Needless to say, the faulty components should be replaced. If the serviceman were to try to use his scope under these conditions, let us say, for example, to look at a 20 cycle sine wave, then the pattern seen in Fig. 4 would result. The sweep frequency is set to 10 cycles in this case and 2 cycles of the sine-wave signal are seen, but with 12 cycles of the 120 cps ripple voltage superimposed on the pattern.

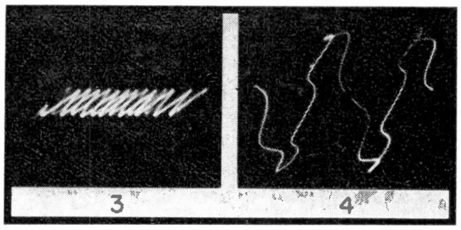


Fig. 3, 4. Waveforms with open filter capacitor.

Intensity and Focus Controls

Having determined that the residual hum is within the allowable limits, the serviceman can proceed to check the operation of the scope front panel controls. First, consider the *intensity* or *brightness control.* With an undeflected spot of light on the screen, this control should be rotated through its entire range. When this control is at its minimum setting, the screen should be absolutely dark without any sign of the light spot being visible. When the control is advanced to its maximum setting, the spot should be so bright that considerable halation occurs. A dim circle of light surrounds the intense spot of light. The control is then reduced until the halation ring disappears. The intensity control should then be reasonably close to its mid-position setting.

The *focus control* can then be adjusted to determine whether or not its operation is proper. When this control is set to either its minimum or maximum positions, a large, poorly defined, defocused spot should be seen. The control is then adjusted for minimum spot size. A sharply focused pinpoint of light should appear on the screen with this control set reasonably close to its mid-position.

If either of these controls do not operate properly, the scope should be removed from its cabinet and their related components and circuits checked. The controls themselves should be checked with an ohmmeter first for opens, shorts, and for smooth variations in resistance. To check the intensity control further, the intensity-grid voltage of the cathode-ray tube should be measured as the intensity control is varied. If this voltage does not fall within its normal limits or the values specified by the manufacturer, the reason for the incorrect reading should be investigated by checking back into the power supply, the voltage dividers, and the associated components. If the measured voltage is correct, then the cathode-ray tube should be suspected.

To check the focus control, the focus-anode voltage of the cathode-ray tube should be measured as the control is varied. If the voltage is not normal, the power supply and voltage divider should be checked into. A normal voltage reading indicates that the cathode-ray tube may be at fault. Sometimes, with a pattern on the screen and the focus control properly set, it is found that the trace is out of focus over a *portion* of the screen. To correct this condition, some scopes have an internal astigmatism control that must be readjusted along with the focus control.

Positioning Controls

Both horizontal and vertical *positioning* or *centering controls* can be checked by operating with the undeflected spot still showing on the screen. The vertical positioning control should have sufficient range of operation so that the spot is moved completely off the top and bottom of the screen. The horizontal positioning control should be able to move the spot completely off the screen both to the right and to the left. Both these controls should be near their mid-settings when the spot is at the exact center of the screen.

The spot motion may be sluggish and may lag behind the controls. This is a normal condition in many scopes and should not be considered a fault. It is caused by the very large time constants of the deflection plate coupling circuits. This means that when the d-c positioning voltage is varied, a second or more must elapse before the large coupling capacitors can change their charge accordingly.

If the positioning controls do not operate as mentioned above, the controls themselves should be checked by measuring the deflection plate voltages as the controls are varied. If the voltage is incorrect, the scope power supply should be checked. If the voltage is normal, the cathode-ray tube is probably at fault.

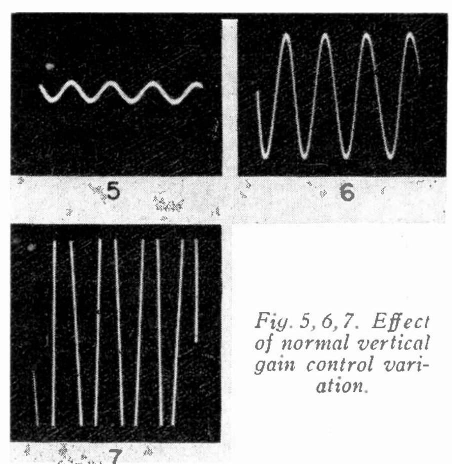


Fig. 5, 6, 7. Effect of normal vertical gain control variation.

Gain and Attenuator Controls

The vertical and horizontal *gain* or *amplitude controls* and the *attenuators* (if used) should also be operated to determine whether these controls and their associated circuits are operating properly. Before using these controls, apply deflecting signals to the cathode-ray tube. The horizontal signal can be obtained from the internal sawtooth genera-

(*Continued on page 20*)

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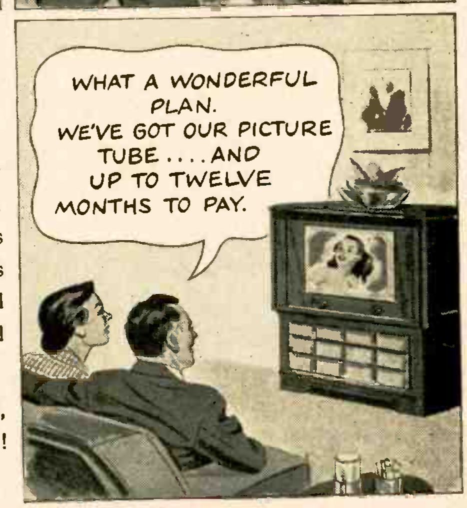

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Vol. 12 OCTOBER, 1951 No. 12

Dedicated to the financial and technical advancement of the Electronic Maintenance Personnel

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JOHN F. RIDER, Editor

CURTAIN TIME

Unfair Press

We have before us a vivid example of what we deem to be "unfair press" for the television technician. We gave a talk to several hundred servicemen in Pittsburgh on the evening of September 19th. A reporter from the *Pittsburgh Sun-Telegram* was there. We gave examples of malpractices by some *few* television technicians and contended that it was unfair to indict the whole industry for the actions of these few. We also stated that licensing was inevitable because the City Fathers in many communities had come to the conclusion that policing of the industry was required—especially after some of them had some unfortunate experiences.

We stated that we were wholly opposed to licensing, as was the entire radio servicing industry, but that the day had come when the industry is face to face with the issue—namely, licensing in many parts of the United States. That being the case, we asked the listeners to become *active* in the preparation and the contents of the licensing bills, to find out what their city or state legislators were doing about it! We warned them that if they did not take a hand in the formation of the regulations, they would be forced to operate under some very stringent and very unfair ordinances. We pleaded that the men not be apathetic in their efforts—that no service shop was *too busy* to attend city council hearings on TV servicing bills.

We have before us the article written by the reporter who attended the meeting. It represents the rankest of journalism tactics. He selected those parts of the talk which suited his fancy and omitted everything else. He deliberately chose those fractions of sentences which were uncomplimentary to the television servicing industry, omitting those ideas which were favorable. Fortunately the entire talk was recorded. In every way his article was a deliberate attempt to hurt rather than help. It is a sad commentary on this segment of the fifth estate.

Passive Attitude Prevails

A passive attitude has prevailed concerning unfair press of this kind. The television servicing industry is here to stay—small shop and big shop. The public needs them and the industry needs every one of these facilities. To allow newspapers and magazines to ride the pants off the industry as a whole is very bad. Every television set distributor—every television set dealer—every television receiver manufacturer—every television parts manufacturer has a duty to the television servicing industry and to himself. . . . These wrong quotations, wholesale indictments, and tricked gimmicks, must be stopped.

We have a free press it is true, but it must be a *fair* press. The fact that dishonest servicemen practice, and a sensational article based on 5 or 10 cases can be proved, does not mean that all who practice the trade are dishonest. The television servicing industry's voice is a weak one shouting in the wilderness. Help must come from the producers of receivers and all the vendors of receivers. This aid must stop the *unfair* press. Fair and honest press is all right—but an unfair press defeats everything which everyone is trying to attain.

Every dollar spent by the receiver manufacturers, set distributors, parts manufacturers, and parts distributors, to help raise the technical level of the servicing industry by lectures and demonstrations, is money thrown into a drain as long as the unfair press exists. What good are all these efforts if newspapers and magazines make life, for the industry as a whole, very difficult? Why should men attend lectures and make an effort to become better qualified when they start out with two strikes against them—a bad name! Why should men enter the television servicing business when, no matter how good they are, they face the threat daily of sensational headlines; when good and bad are treated alike—and all are called bad.

There is no reason why a newspaper which indicts the whole television servicing industry because of the malpractices of a few should carry advertising of television receivers. We understand that several television manufacturers have withdrawn their advertising from one weekly publication which published an unfair and obviously biased article on the television serviceman. Congratulations to those manufacturers!

State All the Facts

Fair press is fine. It can be as critical as it wants to be, but state *all* the facts—not only those which are unfavorable and therefore make sensational copy. The newspaper or magazine which publishes an article hounding the television servicing industry is not helping the industry, nor is it aiding its readers. Somewhere along the line these readers' television receivers will require service. Where shall they go for such work? Do newspapers and magazines determine which shops are good? . . . No, they seek out the bad ones, and then, imply that all are bad. Who then, repaired those millions of TV receivers which are functioning properly? Newspaper reporting and magazine editing of this kind are a disgrace.

Advertisers Must Aid

The television servicing industry needs help. It does not have the funds to carry a fight to the public. Those organizations who advertise to the public at large *must* aid the television serviceman. The unfair press must cease—it is a dangerous press. All it takes is a line or two at the bottom of each ad. How about it, Mr. Manufacturer, Distributor, Set Dealer?

JOHN F. RIDER

ATTENTION AUTHORS:

We are soliciting articles concerning radio, television, and allied electronic maintenance. All aspects are of interest. Articles of 1,000 to 2,000 words are desired. Preference is given to subject matter which reflects practical work rather than theory. The presentation should be *direct*, to the *point*, and amply illustrated. Finished art work will be prepared by us from the roughs submitted. Photographs are welcome. The rate of payment is on a word basis—and, needless to say, good writing rates good pay!

Submit all articles and inquiries to Editor, *Successful Servicing*.

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Television Changes

Belmont 10AXF44, Ch. 10AX21, M-701; Ch. 10AX22

Hum in the picture, evidenced by snake-like wavering, or a horizontal displacement of a portion of the picture or raster in the 10AX series chassis, can easily be corrected after first determining the cause. To determine the cause, follow the procedure given below:

1. Momentarily short pins 1 and 2 (horizontal winding) of the deflection yoke socket and quickly notice the white vertical line on the face of the picture tube.
2. If the line wavers or is displaced horizontally, remove the power transformer mounting bolts and replace the insulated washers with metal lock-washers.
3. If the vertical line did not waver in the above check, then short the grid of the horizontal multivibrator (pin 4 of tube 16) to ground, and manually sync the horizontal hold control and notice if hum continues to exist.

If in step 3 the hum does not displace the picture horizontally, the cause may be a cathode-to-filament leakage in tube 15 or tubes 1 through 9, or improper 155-volt or 250-volt B+ filtering; or, the cause may be one of the following:

1. Shorted resistor R-103.
2. Improper 350-volt filtering.
   a. Faulty input or output filtering capacitors, C-118A or C-118B.
   b. Shorted choke L-25.
   c. Defective 5U4 tube.
3. Faulty power transformer.
   a. Secondary winding connected wrong, making the windings in phase giving half-wave rectification. This condition can be identified by placing a voltmeter between pins 4 and 6 of the 5U4 and obtaining a zero reading instead of 700 volts a.c.
   b. Secondary windings different or a shorted portion will give different voltages at pins 4 and 6 of the 5U4 to ground. This condition can be checked by measuring the voltages or checking the ripple content with an oscilloscope (60 cycles).

●

Westinghouse H-231, Radio Ch. V-2137-3, V-2137-3S

The tone compensating capacitor (C21 on the V-2137-3 radio chassis schematic; C24 on the V-2137-3S radio chassis schematic) is correctly shown as 0.01 μf in the service notes. However, a 0.002-μf capacitor was used in some of the early production chassis. In these chassis, the tone control range can be increased by inserting a 0.01-μf capacitor in place of the 0.002-μf capacitor.

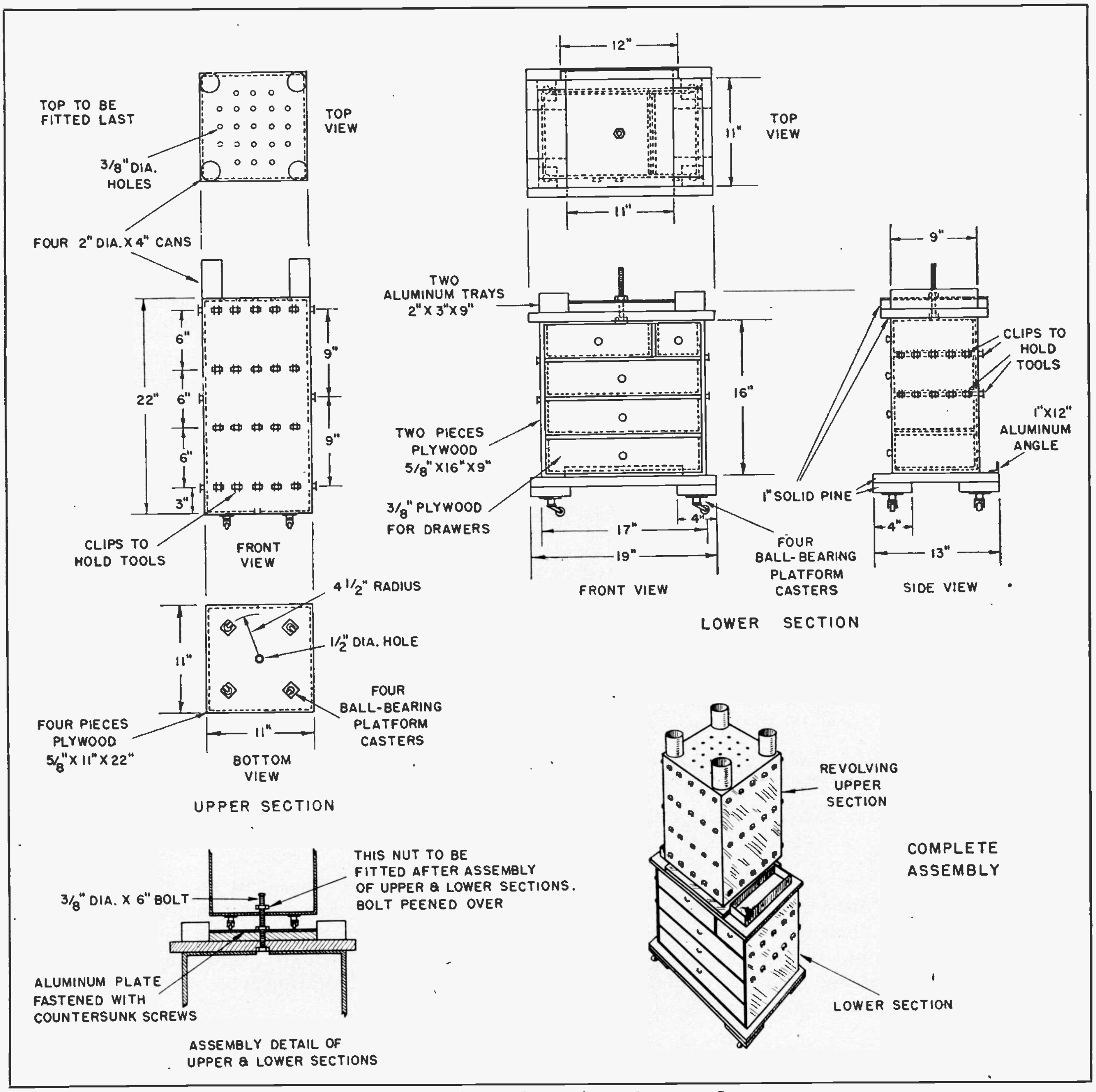
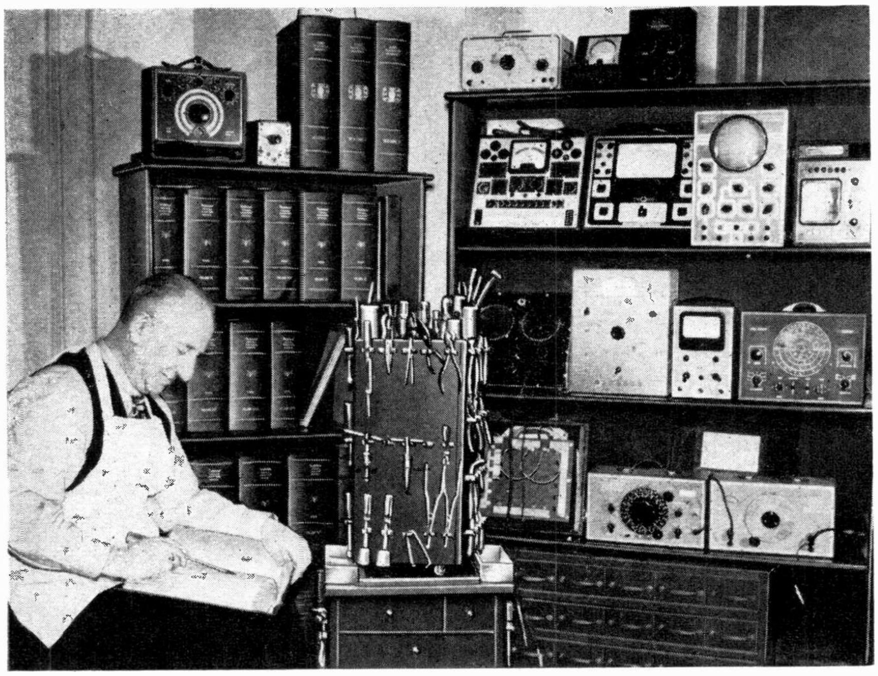


Diagram of Lazy Susan discussed on page 7.

YOUR WORK—HIS HOBBY



Marcus Moses at work—his "Lazy Susan" within easy reach.

Marcus Moses' approach to the radio servicing field is an unusual one. He is a 59 year old New Yorker who "plays" around with equipment—just for fun! The finest servicing publications, meters and tools are accumulated by him with the same avidity that others collect rare antiques or baseballs hit into the bleachers by a favorite batter.

As a fascination for his hobby grew, he found that it began absorbing more and more of his time and interest, and now, he is eagerly looking forward to his retirement so that he can work at it full time. Mr. Moses became interested in electronics about 10 years ago and he set out to learn theory by attending night courses and correspondence schools. He gained practical experience by working on his friends' sets in his spare time.

Much of this work was done during the second World War when electronic equipment was scarce and often unprocurable. Mr. Moses surmounted this obstacle by salvaging old parts and using them. He built his own multimeter, audio signal generator and set analyser, and adapted an obsolete tube checker and r-f signal generator. Nowadays, of course, as we see in the photograph of his shop, Mr. Moses has the most modern equipment and—we are glad to see in the background—a full set of Rider Manuals.

He assures us he is as intensely interested in servicing now as when he first took up the hobby that grew to a full-time job.

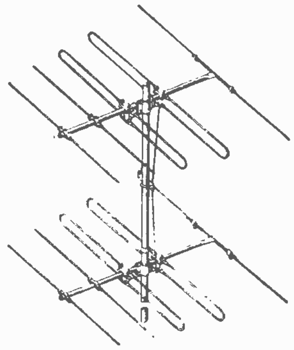
However, one home-made contraption that Mr. Moses considers too valuable to discard for something more modern, is his "Lazy Susan." This gadget has been so helpful to him in keeping his tools within easy reach that he is passing along the tip to other servicemen. He assures us that with the help of his blueprint anyone with a mechanical bent will find its construction easy. In his own "Susan," Mr. Moses keeps a comprehensive assortment of wrenches, pliers, files, clamps, wire strippers, screwdrivers, etc. To get at any of them, he simply spins his "Susan" and picks out what he needs without moving from his work.

You will find a mechanical drawing of his "Lazy Susan" on page 6. Why don't you take his friendly tip—and if you have played at being a "gadgeteer," won't you pass your ideas and designs on to us? If we feel that they might be helpful to other servicemen, we will be glad to publish them.

NEW PRODUCTS

5-Element Twin-Driven Yagi Antenna

A new antenna designed for extreme fringe area is announced by Technical Appliance. The new antenna, known as Super 980, is a 5-element twin-driven Yagi design and is

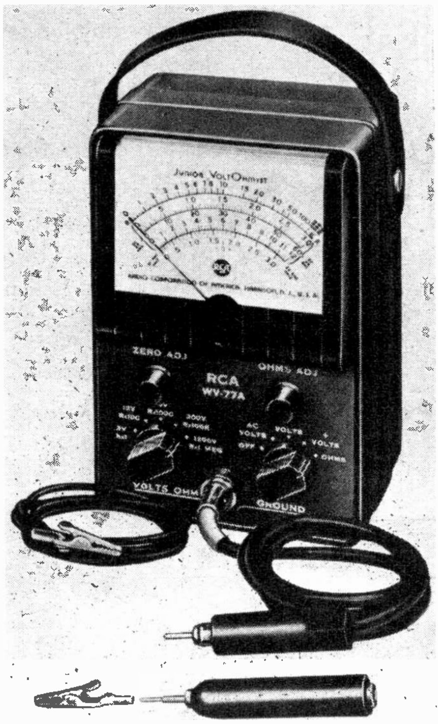


available either as a single bay or stacked array. Tuned for any one of the low-band channels, the Super 980 features a gain greater than the 4-element, twin-driven design. The antenna consists of three parasitic elements, two directors, one reflector and two driven elements. These driven elements are folded-dipoles connected in parallel with a terminal impedance matching the 300 ohm twin lead line.

●

Multi-Test Junior Voltohmyst

The latest addition to RCA's test equipment line is a junior voltohmyst meter which measures a-c volts, d-c volts, and resistances



in five different ranges. This all-electronic meter features a high-impedance diode tube as a signal rectifier, an electronic bridge circuit, a 200-microampere movement, and carbon-film multiplier resistors.

Television Changes

Andrea Ch. VK-15-16

Fig. 1 shows the tube location for this chassis. Fig. 2 shows tube location for the 2nd anode high-voltage supply.

●

Crosley 10-404MU, 10-404M1U, 10-412MU, 10-418MU

The change notice on the prevention of breakdown due to arcing, and horizontal sweep sing, that appeared for Model 10-401 in the December 1950 issue of SUCCESSFUL SERVICING also applies to the above models.

In the change notice for Model 10-401 that appears in the April 1951 issue of SUCCESSFUL SERVICING the sections on drift, neck shadow, and picture and sound separation apply to Models 10-404MU, 10-404M1U, 10-412MU, and 10-418MU.

●

DuMont RA-103D, RA-104A, RA-110A

The following corrections should be made in the service notes for these chassis.

1. Connect pin #4 of V211, the 2nd sound amplifier, to the positive side of capacitor C208B. Without this connection, the plate of the 1st sound amplifier and the screen grid of the 2nd amplifier would be without B+ power.

2. Westwood Teleset RA-110A (Miscellaneous Parts List)

Component	*Incorrect Part No.*	*Correct Part No.*
Deflection yoke	21004241	21004971

The following changes have been made:

1. C308 in the plate circuit of V202, the 2nd video i-f stage was deleted. This reduces regeneration caused by the incorporation of the "bottom-coupled inputuner." If the inputuner is changed on early RA-103D or RA-104A chassis to a "bottom-coupled inputuner," this change should also be made.

2. The specification of capacitor C315, used in the local distance switch circuit, was changed to 0.8 to 7 μμf. The part number is not affected.

Changes 3 and 5, which follow, apply to RA-110A main chassis only. Change 4 applies to RA-104A and RA-110A main chassis.

3. R304, 50,000 ohms, has been deleted from Chassis RA-110A, to improve the horizontal linearity. The horizontal J206-1 has been deleted; and, because of this deletion, the four-prong cable assembly P206 has been changed from part number 50016842 to part number 50016843. The only difference between these two cable assemblies is that the white wire has been removed from pin 1, since it is no longer necessary when R304 is deleted.

4. The linearity coil L219 has been changed from part number 21004771 to part number 21004752, improving the horizontal linearity.

5. The part number of T204 has been changed from 2004521 to 20004581. The high-voltage output obtained with this new transformer is approximately 9000 volts, which is 1000 volts lower than that obtained from part number 2004521. The change reduces the high voltage and produces a greater picture size.

The letter "D" stamped on the rear of the chassis, identifies it as containing changes 3, 4, and 5.

6. The values of the line filter capacitors C260 and C261 have been changed from 0.05 μf, 600 v, to 0.02 μf, 600 v. These parts are described as follows:

Ref. No.	*Part No.*	*Description*
C260, C261	03018570, 03018560	Capacitor, paper, 0.02 μf, 20%, 600 v.

This change reduces shock hazard between chassis and ground. A large letter "K" stamped on the rear of the main chassis also identifies it as containing these changes. The first chassis affected by this change are identified as follows:

Model No.	*Serial No.*
RA-103D	033565
RA-104A	0411020
RA-110A	1016691.

7. C312 has been added between S202 Sec. 2 rear, terminal 10 and R246, to remove the d-c component of discriminator from volume

(continued on page 11)

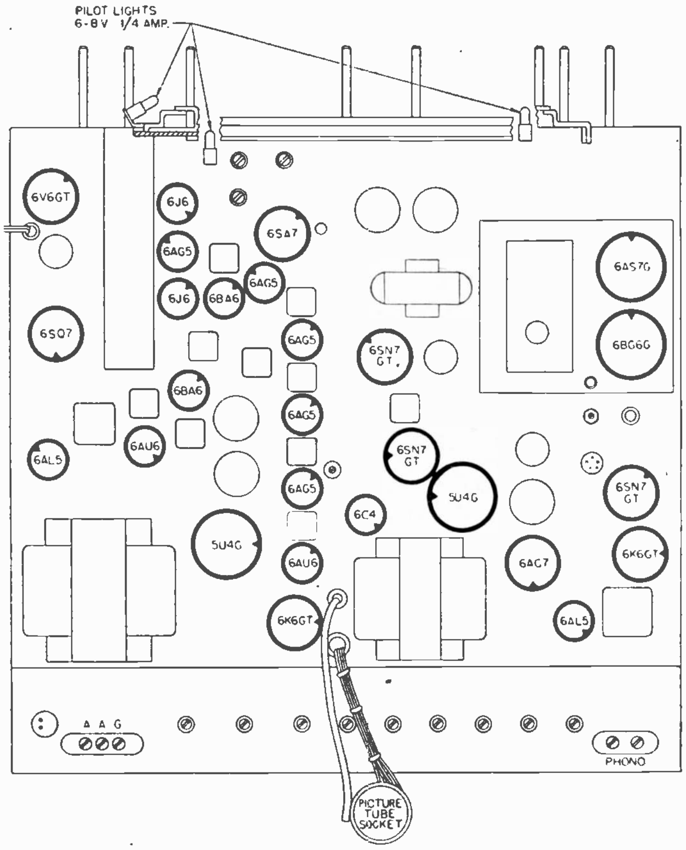


Fig. 1. Tube location for Andrea Ch. VK-15-16.

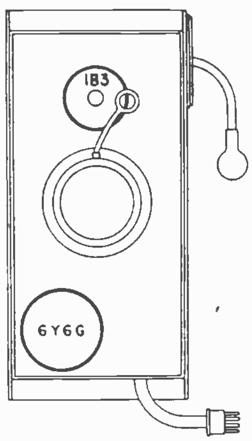


Fig. 2. Tube location of second anode high voltage supply for Andrea Ch. VK-15-16.

DuMont RA-103D, RA-104A, RA-110A

(Continued from page 9)

control in order to prevent the control from becoming noisy. The new part is described as follows:

Ref. No.	*Part No.*	*Description*
C312	03000950	Capacitor, paper, 0.05 μf, 25%, 200v.

8. Tubes V201, V202 and V203 have been changed from 6AG5 to 6BC5 to obtain increased gain. The 6BC5 has G_m=6000, compared to the 6AG5, G_m=5000. When it is necessary to replace a 6AG5, it is recommended that it be replaced with a 6BC5. If V203 is replaced with a 6BC5, C213 should be changed from 0.005 to 470 $\mu\mu$f, 600 v, part number 03016480.

The first chassis affected by this change are identified as follows:

Model No.	*Serial No.*
RA-103D	0340724
RA-104A	0413334
RA-110A	1022236.

9. The following changes have been made in the capacitor specifications.

Ref. No.	*New Part No.*	*New Description*
C217, C276	03014770	Capacitor, paper, 0.1 μf, 20%, 400 v
C218	03019120	Capacitor, paper, 0.047 μf, 20%, 400 v
C221	03014820	Capacitor, paper, 0.1 μf, 20%, 600 v
C224	03019110	Capacitor, paper, 0.047 μf, 20%, 200 v
C257, C275	03019130	Capacitor, paper, 0.1 μf, 10%, 400 v
C258	03014770	Capacitor, paper, 0.1 μf, 20%, 400 v
C263	03014910	Capacitor, paper, 0.01 μf, 20%, 400 v.

The critical paper-cased paper capacitors are replaced by plastic-moulded paper capacitors to eliminate possible failure under humid conditions.

10. Change specifications as follows:

Ref. No.	*New Part No.*	*New Description*
C255	03015940	Capacitor, paper, 0.02 μf, 10%, 400 v
R274	02032070	Resistor, f.c., 330,000 ohms, 10%, ½ w
R276	02032140	Resistor, f.c., ½ megohm, 10%, ½ w
R279	02032130	Resistor, f.c., 2 megohm, 10%, ½ w
R326	02031750	Resistor, f.c., 680 ohms, 10%. ½ w

These changes have been made to eliminate high-voltage arcing in the vertical output tube, since such arcing disturbs the raster vertically. The first chassis affected by these changes are identified as follows:

Model No.	*Serial No.*
RA-103D	0336701
RA-104A	0411701
RA-110A	1017121.

11. A 560-ohm, ½-watt resistor R355 (part number 0203170) has been added between L221-4 and L221-5 (of deflection yoke L221). Resistor R356, 560 ohms, ½ watt, has been added between L221-5 and L221-6.

12. J204-8 and J204-1 were connected in series from the junction of C296 and R233 to the junction of C266 and pin 3 of V220, the reactance tube. Delete the connection from the junction of R233 and C296 to J204-8 and ground the junction of R233 and C296. Delete J204-9 and J204-1 from the position mentioned above. "Break" the connection from pin 2 of V224 to K201 and insert J204-8 and J204-1 so that J204-8 goes to K201 and J204-1 goes to pins 2 and 7 of V224.

The value of capacitor C213 has been changed from 5000 $\mu\mu$f to 470 $\mu\mu$f, 600 volts, part number 02016480.

●

Regal 1731-1736, 1931-1936, 2031-2036, 2431-2436

Schematic diagrams of the above models are identical to that of Model 17HD31, Chassis Code No. 77, except that DX models use two 6CB6 tubes in place of 6AG5s. Note that the suppressor grids, pin 7, of the 6CB6 tubes must be grounded.

●

Capehart-Farnsworth 3001-B, 3001-M, 3002-B, 3002-M, Ch. C-272, Ch. CX-30; 3007-B, 3007-M, Ch. C-276, Ch. CX-30

The following service suggestions are given as an aid to servicing CX-30 chassis:

Hum

1. Improper tuning of receiver.
2. Defective circuit tube (6T8 or 25L6).
3. Insufficient capacitance at input of filter. See also "A-4" series production changes.
4. Heater return wiring from 6AU6 driver and 6T8 ratio detector. See also "A-4" series production changes. The small B minus choke may be shorted out to quickly make this correction.
5. Series-heater string wiring should be altered to place 25L6 heater at B minus end of circuit.
6. Defective speaker. Hum-bucking coil may be shorted or, leads reversed. Test by substitution.

Inability to Focus

1. Improper position of deflection yoke and focus coil. Yoke should be tight against bell of picture tube.
2. Defective focus coil or leads to coil reversed.
3. Operating range of focus control may be increased by the following changes:
   a. Reduce current limiting resistance in series with focus control from 1000 ohms to 220 ohms, ½ watt.
   b. Remove the two 10,000 ohm 2-watt resistors which are connected in series between B plus and the focus coil, if used.

Distorted Sound

1. Improper tuning of receiver.
2. Defective circuit tube 6AU6, 6T8, 25L6.
3. Defective speaker.
4. Ratio detector transformer misaligned.
5. Improper i-f alignment.

Picture Detail

1. Improper tuning of receiver.
2. Improper focus.
3. Touch up 1st picture i-f coil by carefully adjusting the slug from ½ to 1½ turns while observing a test pattern.
4. In "Early" CX-30 chassis, change 4th i-f grid resistor from 47,000 to 22,000 ohms.

Inability to Center Picture—Early Production Chassis

1. Deflection yoke must be pushed fully forward.
2. Beam bender (or ion trap) magnet must be of proper strength. Proper magnet will have red dot painted on side.
3. Focus coil must be tilted to center raster. Tilting to the side moves picture up or down, tilting forward or back moves picture side to side.
4. A fixed d-c "bias" may be applied to the horizontal deflection coils of "Early" CX-30 chassis to assist in horizontal centering, by the following operations:
   a. Remove jumper from pin 1 of speaker socket to end terminal of height control.
   b. Connect a new wire from terminal of height control where jumper was removed to the free center terminal on the terminal strip mounted on the side of the chassis under the horizontal scanning circuits.
   c. Connect a 470-ohm, 1-watt resistor from this terminal on terminal strip to the adjacent terminal where white wire from deflection yoke connects.
   d. Connect a 4-μf, 50-volt electrolytic capacitor from the B plus terminal of the height control to pin 1 of the speaker socket.
   Note: To prevent "buzz" remove from the end terminal of the height control the red lead which passed around the corner of the chassis and carried B plus voltage to the audio stages. This lead should be connected directly to pin 1 of the speaker socket.

Instability—Horizontal Oscillator Drift

1. Check 12SN7 horizontal oscillator tube by substitution.

(Continued on page 13)

Capehart-Farnsworth 3001-B, 3001-M, 3002-B, 3002-M, Ch. C-272, Ch. CX-30; 3007-B, 3007-M, Ch. C-276, Ch. CX-30

(Continued from page 11)

2. Check 12SN7 sync amp and 6H6 sync clamp by substitution.
3. Check by substitution the 240-μμf grid blocking capacitor in the horizontal oscillator stage.

Vertical White Lines—Left Side of Raster

1. Reduce horizontal drive consistent with necessary brightness and width.
2. Check by substitution the 19BG6 horizontal amplifier tube.

Foldover—(Bright white shadows reaching in from left side of picture.)

1. Remove feedback circuit from terminal 4, horizontal output transformer back to junction of the 6-μμf capacitor and the 150,000-ohm resistor in the horizontal oscillator circuit. Remove this feedback circuit completely, including the two 6-μμf capacitors, the two 560,000-ohm resistors, and the brown lead to the output transformer terminal. The 150,000-ohm resistor should be left in place.
2. Check, by substitution, the 25W4 damper tube.

Instability—Horizontal Sync ("A-2" and "A-3" chassis only)

1. These series chassis may be modified to correspond with the "A-4" final production chassis by the following changes:
   a. Remove 1 megohm resistor between picture tube grid and B minus.
   b. Reconnect this resistor from pin 3 to pin 4 of the 6H6 tube.
   c. Disconnect pin 3 of the 6H6 tube from the B minus circuit.
   d. Connect a 470,000-ohm resistor from pin 3 of the 6H6 tube to B minus.
   e. Disconnect the 0.05-μf sync coupling capacitor from the junction of the 3,900-ohm and 1,000-ohm resistors in the 12AU7 second plate load circuit.
   f. Reconnect the capacitor to pin 3 of the 6H6 tube.
   g. Change coupling capacitor from pin 2 to pin 4 of 12SN7 sync amp. and clipper from 600-μμf to 100-μμf.
   h. Remove the 350-μμf bypass capacitor from pin 6 of same tube to B minus.
   i. From the junction of the 240-μμf capacitor and the 0.002-μf capacitor between pin 6 of the same tube and pin 1 of the 12SN7 horizontal oscillator and afc tube, connect a 100-μμf capacitor to B minus. (Note: This 100-μμf capacitor may be increased in value to 200-μμf if traces of instability persist.)
2. Check by substitution the following circuit tubes:
   12SN7 Sync amplifier
   12SN7 Horizontal oscillator
   6H6 D-C Restorer and sync clamp.

Insufficient Height—Vertical Scan

1. Check by substitution, the 12SN7 vertical multivibrator tube.
2. Check the 4.7-megohm resistor between height control and pin 1 of vertical m.v. tube. If resistance is too high, replace with correct value.

Radio Changes

Philco 50-920, 50-921, 50-922

The following changes have been made in the replacement parts list:

New service part numbers:

Symbol	Description	Part Number
C4	Condenser, fixed trimmer, temp. comp., 20 μμf	30-1224-42
C6	Condenser, d-c blocking, 47 μμf	60-00475417
C15	Condenser, line by-pass, .047 μf	45-3505-45
LA1	Loop aerial, 50-920	32-4052-39
	Drive Shaft (Codes 123 and 124)	76-3671-6
	Socket, loctal	27-6207

Additions:

	Cabinet (mahogany) 50-920	10770-2
	Dial scale (mahogany)	54-5070-3
	Cabinet (gray) 50-920	10770-3
	Dial scale (gray)	54-5070-4
	Baffle and cloth assembly	40-7892
	Clip (scale mtg.)	56-7886FE7

It should be noted that if an old cabinet, service part number 10770 or 10770-1, is being replaced by a new one listed above, a new dial scale and a new baffle and cloth assembly must also be ordered.

For these models, 50-920, 50-921, 50-922, Code 121, the following production changes have been made:

Run 5: The neutralization network in the i-f amplifier circuit has been removed. The capacitors, C7 and C8, have been taken out of the circuit and pin 3 of the 7B7 i-f amplifier tube is connected to pin 5 of the 7A8 converter tube. The resistor, R6, has also been taken out and the B+ lead of the transformer, Z3, is connected directly to the low side of the resistor, R14.

For these models, Code 122, the following production changes have been made:

Run 1: The output tube has been changed to a 50C5.

Run 2: The same changes as in Run 5 for Code 121.

Run 3: To reduce low volume hum, the black wire from the 7B7 tube socket to the low (B—) side of the volume control, R10, should be removed from the volume control and wired to the set side of the A-C switch.

For these models, Code 123, the following production changes have been made:

Run 1: The output tube is changed to a 50C5 and the rectifier tube is a 35Y4.

Run 2: The same changes as in Run 5 for Code 121.

Run 3: The same changes as in Run 3 for Code 122.

For these models, Code 124, the following production changes have been made:

Run 1: The output tube is changed to a 50B5 and the rectifier is a 35Y4.

Run 2: The same changes as in Run 5 for Code 121.

Run 3: The same changes as for Run 3 for Code 122.

●

Philco 50-1424

The following changes, new service part numbers, have been made in the replacement parts list:

Symbol	Description	Number
R9	Volume control (with on-off switch) 1 megohm	33-5566-22
R13	Resistor, cathode bias, 130 ohms	66-1128340

There has also been added:

	Stud, tapped, hinge mtg.	56-6296

In Run 2, to reduce minimum hum, a wire has been added between pin 7 of the 14B6 detection and 1st amplifier tube socket and the low side of the volume control resistor, R9.

Philco 50-925, Code 123, 50-926

In the schematic diagram, a .01 μf capacitor, part number 61-0120, should be added, leading from the filament, pin 5, of the 12AT7 oscillator mixer tube to ground. The values for the capacitors, C13, C24, and C25, and the resistor, R12, have also been changed. The proper substitutions, with their service part numbers are as follows:

Symbol	Description	Number
C13	Condenser, cathode by-pass, 51 μμf	30-1224-2
C24	Condenser, de-emphasis, 47 μμf	30-1224-2
C25	Condenser, de-emphasis, .004 μf	61-0179
R12	Resistor, plate dropping 2200 ohms	66-2228340

For Model 50-925, Code 123, only, several production changes have been made.

Run 2: In order to increase f-m sensitivity, the resistor, R14, the 12BA6 2nd i-f tube cathode resistor, is increased in value from 47 ohms to 68 ohms. The service part number is now 66-0688340.

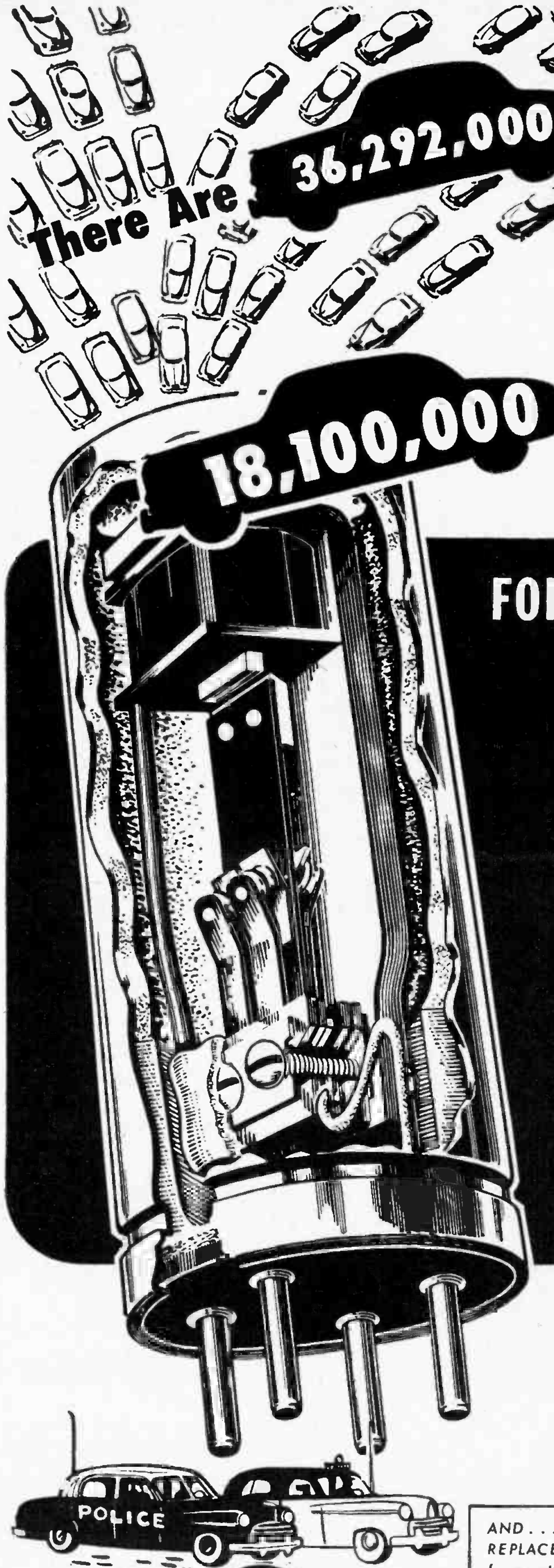
Run 3: The wiring panel connections of the resistor, R2, the screen-dropping resistor in the 12BA6, f-m, r-f amplifier tube circuit, and the coil, L1, are interchanged from those given in the manual base view.

Capacitor C44, the filament by-pass condenser, is removed.

The .01 μf condenser, part number 61-0120, added above, is changed to wire from pin 3 of the 12BA6 f-m, r-f amplifier to the ground lug of the nearest wiring panel.

Run 4: To reduce oscillations the capacitor C43, the ceramic button filament by-pass con-

(Continued on page 17)



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TV RECEIVERS

(Continued from page 1)

Buzz in the I-F Amplifiers

Buzz can be traced through the high-frequency circuits of the TV receiver by use of a signal-tracing crystal probe. Figs. 3, 4 and 5 show different displays of buzz as found in the sound i-f amplifier. When the sound modulation is at a low level, the buzz pulse is seen very plainly (Fig. 3). Even when the modulation is relatively high, the buzz pulse can still be seen, as shown in Figs. 4 and 5. It must be observed, however, that extremely strong sound modulation will mask the buzz so that it becomes temporarily invisible on the scope.

Checking Oscillator-Injection Voltage During Alignment

When a front end is being aligned, operation or non-operation of the local oscillator is determined readily. In case of doubt, the technician can check the signal-developed bias across the oscillator grid-leak resistor with a VTVM. This check must be made with an isolating resistor in the d-c test lead. The amount of bias is a fairly reliable guide to the amplitude of the r-f output of the oscillator.

However, the fact that the oscillator is operating at its normal level does not necessarily indicate that the oscillator-injection voltage to the mixer is adequate. In case of persistent low gain, this value should be checked at the injection grid of the mixer. A typical value of injection voltage as measured at the injection grid of the mixer is about 2.5 volts. However, the manufacturer's service data should be consulted, to obtain specific values. Insufficient oscillator injection voltage results in reduced conversion gain and a weak picture.

Alignment by Alternate Loading

Some TV receivers have overcoupled picture i-f transformers. The slugs in the primary and secondary windings can be adjusted for the proper double-humped response by means of a sweep generator and markers but sometimes the technician must do the job with a conventional signal generator and VTVM.

The overcoupled transformer can be peaked somewhat like a stagger-tuned stage if the method of alternate loading is used. In this method, a 1,000-ohm carbon resistor is shunted across the primary winding and the secondary is then tuned for maximum response at the center frequency of the required double-humped response curve. Next, the 1,000-ohm resistor is removed from the primary and shunted across the secondary winding. The primary is then tuned for maximum response at the center frequency. Finally, the resistor is removed and the over-coupled transformer is in alignment.

This method depends for its operation on the fact that resistance loading of either primary or secondary of an over-coupled transformer causes the double-humped stage to show a single-humped response at the center frequency.

A note of caution should be added in case the manufacturer utilizes stagger tuning as well as overcoupling. In such a case, the method of alternate loading cannot be used and a sweep generator with markers and a scope represents the only practical approach.

Contrast Control Producing Ghosts

If ghosts appear in the picture as the contrast control is advanced, the cause is usually

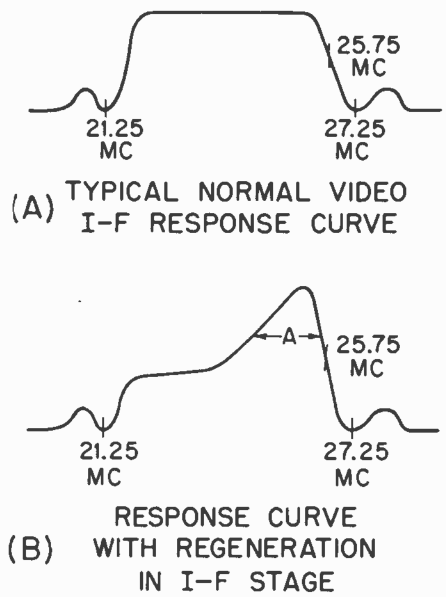


Fig. 6. Video—i-f frequencies falling in region (A) will ring, producing an artificial ghost on the screen.

due to changes in the shape of the i-f response curve as the bias varies. At higher gains the curve may become excessively peaked, which leads to transient ringing. The effect is to produce ghosts on the screen. The resultant response curves are shown in Fig. 6B. A normal response curve (Fig. 6A) is shown for comparison.

Curve peaking occurs because of regeneration in one or more of the i-f stages. Steps must be taken to stagger the stages properly, to replace faulty bypass capacitors, or to correct the lead dress.

Test for Regeneration During Alignment

A peaked visual-response curve which cannot be flattened out by slug adjustments is usually caused by regeneration. Under these conditions, the response curve will change shape markedly when the hand is brought near the offending stage.

Checking for Low-Level Hum

When checking with a scope for low-level hum in the sweep circuits, switch the receiver to a no-signal channel. The vertical oscillator will speed up slightly, and the hum (if present) will roll and become much more visible.

**These trouble shooting data are abridged from a forthcoming TV Troubleshooting Guide Book. This is a brand new type of book relating to television servicing to be published soon by John F. Rider, Publisher, Inc.*

Philco 50-925, Code 123, 50-926

(Continued from page 13)

denser of .005 μf value, is changed from pin 4 of the 12BA6 f-m, r-f tube to ground to pin 3 of the 12BA6 1st i-f tube to the adjacent ground lug.

Lead 2 of the capacitor, C39, the two-section ceramic button, filament by-pass condenser, is changed from the ground lug of the 3-lug wiring panel at the rear of the set to the ground lug of the 3-terminal wiring panel parallel to the tuning gang. Lead 3 of C39 is changed from pin 3 of the 12BA6 1st i-f amplifier tube to the rear lug of the wiring panel parallel to the tuning gang (the same lug to which the coil, L7, is wired).

The capacitor, C42, the filament by-pass condenser of 100 μμf, is removed from the wiring panel near the tuning gang and wired from lug 7 of the switch, WS1-2(F) to the ground lug by the 12BA6 f-m, r-f tube socket. The switch lead of this condenser should be kept as short as possible.

Run 5: To stabilize the a-m, i-f stage, the capacitor C22, the .002 μf screen by-pass condenser in the 12BA6 2nd i-f amplifier tube is changed in value and type from a .002 μf paper condenser to a .0022 μf paper moulded one. The service part number of the substituted condenser is 45-3505-5.

Run 7: To reduce delay hum on f-m, the wiring of pins 4 and 5, the filament pins of the 19C8 a-m, f-m detector tube, is interchanged. Pin 5 now goes to ground (with the wiring grounding the resistor R19) while pin 4 is now connected to the .004 μf filament by-pass condenser, C38B.

For Model 50-926, the production changes for various runs are as follows:

Run 2: The by-pass condenser, C20, is changed in value from 100 μμf to 51 μμf. The service part number for the new condenser is 30-1224-2.

The plate-dropping resistor, R1, is changed in value from 4700 ohms to 2200 ohms. The new service part number is 66-2228340.

The grid return resistor, R13, is changed from 4700 ohms to 1 megohm. The new service part number is 66-5108340.

Run 3: The same changes as in Run 4 for Model 50-925, Code 123.

Run 4: The same changes as in Run 5 for Model 50-925, Code 123.

Run 5: The same changes as in Run 6 for Model 50-925, Code 123.

Run 6: The same changes as in Run 7 for Model 50-925, Code 123.

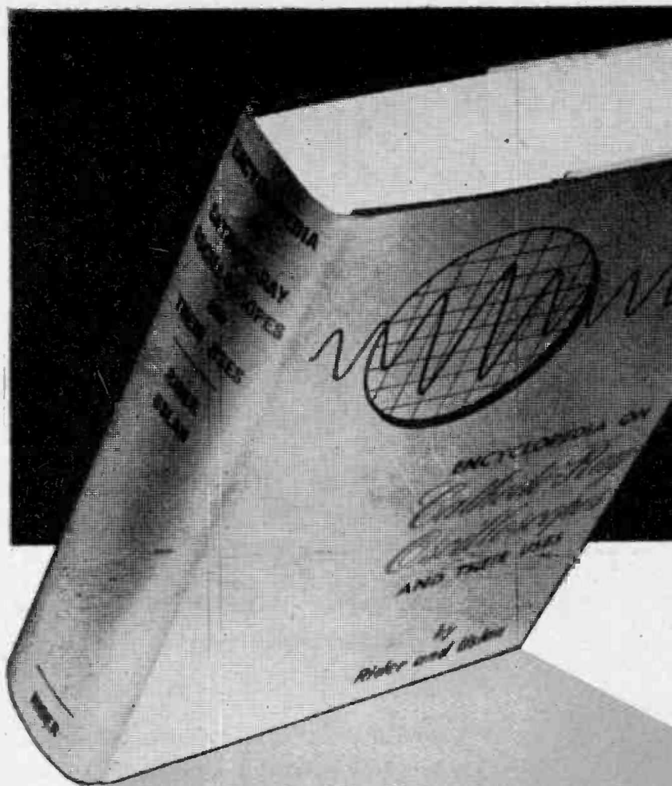
Note: To preserve service life, the filter resistor, R27, should be changed from a 150 ohm, 1 watt resistor to a 150 ohm, 2 watt resistor, service part number 66-1155340. In order to minimize grid-to-plate capacity and remove regeneration, a tube base shield, service part number 56-3978-1FA3, was added to the 12BA6 1st i-f amplifier tube socket. The 50C5 tube base shield has the same service part number.

●

Philco 50-1721, 50-1723, 50-1724

The negative voltage readings of the grid bias supply in the schematic diagram for the above models should be corrected. The value of —67 volts, on the high side of the resistor, R46, is correct; the value of —56 volts on the high side of the resistor, R47, should read —14 volts; the value of —52 volts on

(Continued on page 19)



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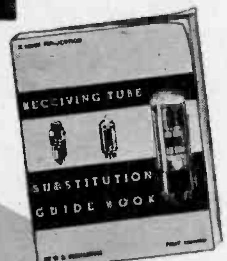

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(Continued from page 17)

the high side of the resistor, R37, should read —13 volts; and the value of —38 volts on the high side of the resistor, R36, should read —12 volts.

In the f-m alignment chart, the value of the condenser used in step 1 should be changed from .1 μf to read .01 μf. Under the heading, Special Instructions and Adjust, TC4B should read TC10; TC4A should read TC9; TC3A should read TC7; TC1B should read TC4; and TC1A should read TC3.

The following production changes have been made for various runs:

Run 2: To provide for a longer life for the pilot lamp, a 1 ohm, ½ watt, dropping resistor, service part number 66-9108340, has been wired between pin 1 of the 6Y6G output tube and pin 1 of J3, the changer power socket. Also the strap connecting pins 1 and 2 of the 6Y6G socket has been removed.

Run 3: To reduce parasitic oscillation in the 6Y6G output stage, a 10 ohm resistor, part number 66-0104340, has been added to the 6Y6G plate lead. It is wired between pins 1 and 3 of the 6Y6G socket. In addition, the red lead from the transformer, T1, has been moved from pin 3 to pin 1; the two brown leads and the 1 ohm resistor added in Run 2 are removed from pin 1 and wired to pin 6, and the ground point of C50 is changed from pin 8 of the 6Y6G socket to the center lug, ground, of the 3-lug wiring panel that lies in front of the rectifier and output tube sockets.

Run 4: In order to reduce phonograph distortion when playing high modulation records, the following changes have been made:

a. The cathode bias resistor, R9, is changed from 4700 ohms to 6800 ohms, part number 66-2688340.

b. The plate lead resistor, R7, is changed from 10,000 ohms to 18,000 ohms, part number 66-3188340.

c. The tone compensation condenser, C11, is changed from 100 $\mu\mu$f to .001 μf, part number 43-3500-5.

d. A 100 $\mu\mu$f condenser, part number 62-110009001, is added in parallel with the cathode bias resistor, R9, to serve as a cathode by-pass for phonograph frequencies in the 7F8/5 oscillator, mixer and phono pre. amplifier tube circuit.

e. A 330,000 ohm resistor has been added as a grid return in the phonograph position of the switch. This added resistor is wired from lug 5 to lug 10 of the switch, W5-2 (F).

●

Spiegel 459.5015, 459.5015.1

Model 459.5015 is the same as 5015, except for the following changes:

There is no longer a 0.1-μf capacitor, C1, connected between pin 4 of tube 12SA7 and ground. The 0.25-μf capacitor, C11, connected between oscillator coil L2 and ground, has been replaced by 0.1-μf, 400-v capacitor C1. The 0.05-μf capacitor C2 connected, between the primary of the output transformer T3 and pin 5 of the power supply tube 35Z5 has been deleted. There is now a 33-ohm resistor, R7, connected between pin 8 of the same tube and the primary of T3. There is now an 0.05-μf, 400-v capacitor, C2, connected between pin 2 of tube 35Z5 and pin 3 of tube 12SK7.

The following changes in value occur: R2 from 3.9 megohms to 3.3 megohms; R4 from

(Continued on page 24)

IS MY SCOPE IN GOOD CONDITION?

(Continued from page 3)

tor and the vertical signal from the *test* or 6.3-volt terminal which is on the panel of many scopes. The effect on the screen pattern of varying the vertical gain control under these conditions is shown in Figs. 5, 6 and 7. The potentiometer control was set to about one-tenth of its maximum setting in Fig. 5, to about one-fifth in Fig. 6, and to about one-half in Fig. 7. A variation in the horizontal gain control should produce the same sort of effect except that the pattern is expanded horizontally instead of vertically as shown in the figures. In cases where part of the pattern is off the screen (as in Fig. 7), the positioning controls can be used to move the patterns so that all portions of it can be examined.

A faulty gain control potentiometer may produce the pattern shown in Fig. 8 when the control is operated. Random, erratic noise voltages are superimposed on the pattern as shown. In addition, the pattern usually jumps as the faulty control is operated. These conditions may disappear once the control is set to a definite position. However, the control should still be replaced since its condition usually gets worse.

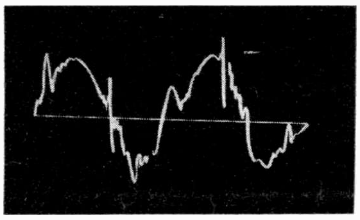


Fig. 8. Pattern produced while adjusting a noisy vertical gain control.

A good method of checking the gain of the scope amplifiers to determine whether it is normal or not is by means of the deflection factor as given in the instruction book. In one particular scope, the deflection factor through the vertical amplifier is given as 0.8 volt (rms)/inch. This means that if a sine wave whose rms value is 0.8 volt, or whose peak-to-peak value is 2.26 volts, is applied to the input of the vertical amplifier, then a vertical line whose length is exactly one inch will be produced (see Fig. 9). Since it is

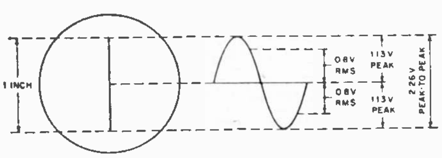


Fig. 9. Measurement of deflection factor.

necessary that the amplifier introduce no attenuation under these conditions, the attenuator and gain controls should be set for maximum gain. The required input voltage can be obtained from a voltage calibrator. Lacking this, a simple voltage calibrator can be constructed from a 6-volt heater transformer, a potentiometer, and an accurate, low-range a-c voltmeter as shown in Fig. 10.

If the vertical line is much shorter than one inch, the next problem is to determine whether the gain of the amplifier is low or the sensitivity of the cathode-ray tube not up to par. To localize the fault, the deflection factor of

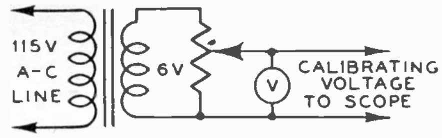


Fig. 10. Simple voltage calibrator for scope.

the cathode-ray tube itself is measured as described above. Once the factor of low cathode-ray sensitivity is eliminated, we can assume that the amplifier gain is low.

This may be the result of a defective amplifier tube. If the vertical amplifier tube is burned out, the screen shows only a horizontal line because of lack of vertical deflection (see Fig. 11). If the horizontal amplifier tube is burned out, the screen shows only a vertical line because of the lack of horizontal deflection (see Fig. 12).

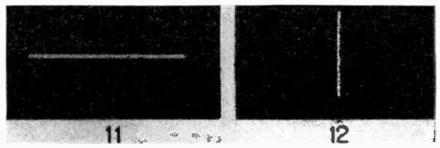


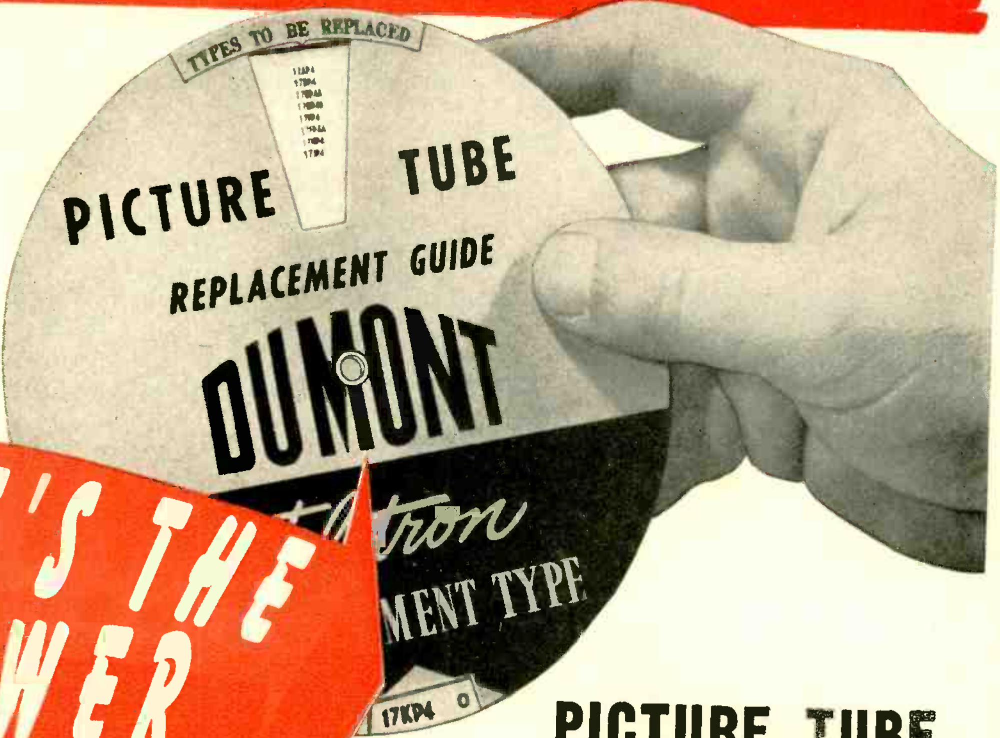
Fig. 11, 12. Screen patterns with burned out amplifier tubes.

Sweep Oscillator Controls

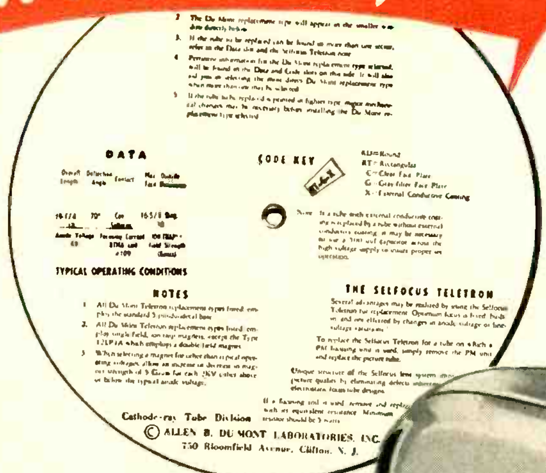
The sweep circuit oscillator can be checked by operating the *sweep* and *sync controls* and

(Continued on page 24)

JUST DIAL THE TYPE...



HERE'S THE ANSWER



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Antennas and accessories—TV, FM, AM

BUD—Mast coupling model AM-69 replaced by AM-66. Assembled antenna tower model TA-8043 temporarily discontinued.

CAMBURN—Video Beam Indoor antenna model VB21 now $6.95 list.

COPPERWELD STEEL—3 No. 12 Guy Strand types GY-3122, 3124, 3126 replaced by 3 No. 14 Guy Strand types GY3144, 3145 at $11.00 and $20.00 list.

LA POINTE (Vee-D-X)—Discontinued Antennas JR-13, RLFY, SEC, SRLYF; packaged Towers PTGA, Mast Sections MS-1 to 31 and Transmission Lines TA-1, 2, 3. Added model RLYH 300 Ohm low channel $3.50 list, high channel $2.50 list. Packaged tower accessory, PTSA increased to $21.45 list.

PORCELAIN PRODUCTS—Antenna insulators, air-plane type, models 8130, 8131 added.

PREMAX—Standoff insulators #3SB-52 and #3SG-52 discontinued. 9 new items added to their line.

Communication receivers, TV chassis

HALLICRAFTERS—Introduced 3 new Communication Receivers, models S-80, S-81, S-82.

TECH-MASTER—Added TV chassis models 2430 at $189.50 and 2431 C and 2431 P at $199.95. Chassis 1930 D and 1930 T redesigned to 1931 D and 1931 T, respectively.

Miscellaneous radio, TV and electronic parts

ASTRON—Capacitor MRF-2-2M reduced to $2.60 list. Also prices decreased on 11 capacitors in EY series and 4 capacitors in MM series.

BUD—Panels in "PM" series discontinued. Also assembled Antenna Tower TA-8043 temporarily discontinued.

BURGESS BATTERIES—5 portable "A" and "B" batteries discontinued. Also, Ignition Battery 8FH and Portable "A" pack F4A60 discontinued. Flashlight batteries, types 151 and 350 added at $1.25 and $1.90 list.

BURLINGTON—10 Current Transformers in A series reduced approximately 10%.

CHICAGO TRANSFORMER — 25 transformers added. Type F-633 discontinued.

CLAROSTAT—Added TV components RTV 283 to 293. Also added Controls SWB, SWB1 and series "AG," "AK," "G," "K."

ERIE RESISTOR—General Purpose Ceramicons style GP2M replaced by GP2-333 with 6 additional capacities. Also added .01 Mmf. to #811 at $.25 list.

FEDERAL TELEPHONE—Price revised on miniature Selenium Rectifiers. Added a quantity discount for dealers. Also, type numbers and prices revised on their Cables.

INDUSTRIAL CONDENSER — Electrolytic condenser MS1191 reduced to $3.90 list.

JAMES VIBRAPOWR—2 Volt Battery Vibrators 2J70 and 2J71 increased to $11.20 and $10.25 list.

PLANEL MFG.—16 new dry electrolytics added.

RADIO RECEPTOR—Selenium Rectifiers, types 1M1, 5S1 and 6S2 reduced.

TRIAD TRANSFORMER—21 new transformers added.

STANDARD TRANSFORMER (STANCOR)—Deflection yoke DY-7 reduced to $8.95 list. Focus coil FC-11 and Transformer A-8124 added at $10.75 and $3.75 respectively.

SUPERIOR ELECTRIC (SECO) — Discontinued Powerstat Variable Transformers in "MT" series. Now available on special order only.

Recording equipment, speakers, amplifiers, needles, tape, etc.

ALTEC-LANSING—Discontinued amplifier A-323C, tuner ALC-101B and Equalizer TQ-910.

GARRARD—Dual speed motor model number changed from 201V to 201 B/3. New price $54.00 dealer net.

LANSING SOUND—9 new speaker enclosures added.

MILLER, M. A.—Added 4 replacement needles for G.E. cartridges. Discontinued No. 15 assortment and coin machine needle #544. Needle PH-13(S) decreased to $2.25 list. Revised prices on Assortment Combinations Nos. 1 to 4.

MINNESOTA MINING (SCOTCH)—Recording tape (plastic or paper base) ¼" x 300 ft. in plastic reel added. Also, empty Plastic Reel 4" (300 ft.) with box added at 65¢ list. New size splicing tape 7/32" x 66 ft. added at 57¢ list.

NATIONAL HOLLYWOOD—Paper magnetic recording tape KIR discontinued. Polystyrene reels for paper tape discontinued.

RADIO CRAFTSMEN—Introduced model C 500 tuner.

RECOTON—Added replacement needles type 366, 367 and 368.

SHURE BROS.—3 new cartridges added. Cartridge W56R reduced to $7.50 list.

SIMPSON MFG. (MASCO)—Discontinued amplifiers, models LV, LVP, MA-200, MB-200, MB-200P, MCA-2; Phonograph models RP-1, 2, 3; and Transcription players models T-16 and TD-16.

STEPHENS—Diaphragm model 15D reduced to $5.50 dealer's net. Diaphragm model 3040 D changed to 35D and reduced to $8.10 net. Mike C-1A changed to C-1. Speaker #112 added at $40 list, and Driver P-35 added at $130, list. Discontinued Speakers #100, P-22FR; High Frequency Drivers P-30 and P-40.

WALCO—10 replacement needles added. Also, "All-Groove" needle #WA-100-2 added at $1.00 list. Needle W-8A discontinued.

WHARFDALE — Increased prices on all their speakers.

Test equipment

CHICAGO INDUSTRIAL—Discontinued model 451B AC-DC Volt-Ohmmeter and model 452 high sensitivity Volt-Ohmmeter.

HICKOK—Added adaptor model 75 for Model 610A Television Alignment Generator at $4.50 net. Also increased model 650 Television Videometer to $310.90 net.

JACKSON ELECTRICAL—RF probe #645-P and Vacuum-Tube Meter model 109 discontinued.

WESTON—VU meter model 862 added at $50.00 list.

Tools and hardware

KRAEUTER—Line of multiple action industrial snips added.

PHILLIPS MFG.—Versa-Tool soldering guns and accessories added.

SCHOTT (WALSCO)—Wonder tools 555 and 555D discontinued. Pickup lead wires #3040 and 3045 will be discontinued after present stock is exhausted.

Tubes—receiving, television, special purpose, etc.

AMPEREX—Electronic tube 1701 (FG-17) discontinued.

DUMONT—Added 6 TV Picture tubes size 14", 20", 21" and 30". Decreased prices on all other TV tubes.

GENERAL ELECTRIC—5 receiving tubes decreased. Industrial tube 5R4GY increased to $2.20 and type GL-2C39A decreased to $34.00; and types GL-1Q26 and 12AY7 added. 4 Picture tubes 17" size decreased also 20CP4/A decreased to $57.50 list.

GENERAL ELECTRIC—Added receiving tube 6BK7 at $3.20 list. Nine pin miniature twin triode tube for low noise "cascode" r.f. amplifier service in VHF television receivers.

HYTRON—29 receiving tubes decreased in price. 2 Special Purpose tubes discontinued. 6 TV picture tubes decreased in price and 11 picture tubes discontinued. Introduced new Service-aid tool, Hy-tron-CBS pick-up stick at 5¢.

NATIONAL UNION—52 receiving tubes decreased. 4 receiving tubes added.

RAYTHEON—Picture tubes 17BP42, 17CP4 reduced to $37 list. 20 CP4 and 20 DP4A reduced to $58.50 list. Added 16KP4A at $50. list for immediate shipment.

RAULAND—8 TV picture tubes decreased. 5 picture tubes added.

RAYTHEON—43 receiving tubes decreased. 3 receiving tubes added.

THOMAS ELECTRONICS — Completely revised line of Picture Tubes to include new and discontinued items, also decreased prices.

TAYLOR TUBES—12 Triode tubes and 1 Pentode tube type 813 discontinued. Added, Twin-triode types 829B and 832A, Triode type 8000, Rectifier type 249-S and Diathermy types 218 and 468.

INDEX OF CHANGES

TELEVISION CHANGES

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		C6-2	—
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		C6-2	—
		C7-1	—
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		C6-2	—
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		4-1	4-4
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Spiegel 459.5015, 459.5015.1

(Continued from page 19)

2 megohms to 22 megohms; R7 from 39 ohms to 33 ohms; R8 from 2000 ohms to 2200 ohms.

Model 459.5015.1 includes all of the above changes plus the following:

Oscillator coil, L2, shown in the accompanying schematic, now consists of a primary across the oscillator capacitor, C9, and a secondary across pin 6 of tube 12SA7 and the high side of capacitor C1; note deletion of C10.

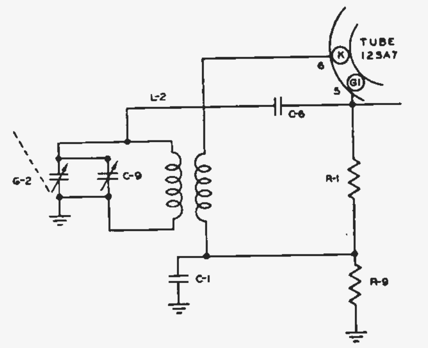

Fig. 1. Oscillator section of Speigel Model 459.5015.

The following values are changed: C6 from 100 $\mu\mu$f to 220 $\mu\mu$f; C7 from 500 $\mu\mu$f to 220 $\mu\mu$f.

Alignment and service data for 459.5015 remain the same as for 5015. However, on 459.5015.1 the ANT trimmer is located on the side of the ANT section of the gang condensor, instead of on the top of the ANT section, as in 459.5015 and 5015.

RADIO CHANGES

Model	Successful Servicing	From	To
Philco 50-920, 50-921, 50-922	13	21-1	21-4
Philco 50-1424	13	21-18	21-21
Philco 50-925, Code 123, 50-926	13	21-5	21-9, 10
Philco 50-172, 50-1723, 50-1724	17	21-11, 12	21-17
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† The Rider Manual Page Numbers given under Television Changes are for Rider TV Manuals. The volume number is the number preceding the dash. Volume numbers preceded by an asterisk (*) apply to the 8½" by 11" page size Manual only.

The Rider Manual Page Numbers given under Radio Changes are for Rider AM-FM Manuals. The volume number is the number preceding the dash.

IS MY SCOPE IN GOOD CONDITION?

(Continued from page 21)

by observation of the screen pattern. The linearity of the sawtooth sweep can be noted easily by looking at a pattern consisting of several cycles of a periodic waveform, such as the line voltage. With a linear sweep, the width of each cycle on the screen will be the same. However, if the sweep speed is greater at the beginning of the trace than near the end, a pattern such as is shown in Fig. 13 will result. The use of a transparent ruled scale over the screen pattern permits an easy measurement of the width of each cycle. All you need do is simply count the squares. For example, in the figure the first cycle is 10 squares wide, the second cycle is about 6 squares wide, and the third cycle is about 4 squares wide.

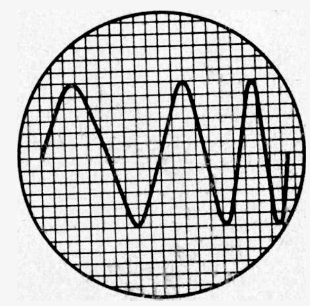

Fig. 13. The effect of a non-linear sweep.

If it is necessary to determine the accuracy of the sweep frequency calibration as given by the settings of the coarse and fine frequency controls on the operating panel, this can be done readily by applying a known frequency (such as 60 cps) to the vertical input terminals of the scope. The sweep frequency controls are then adjusted so that a single cycle of the applied signal appears on the screen. If the control calibrations are accurate, then, as now set, they should indicate a sweep frequency that equals the applied signal frequency. When the sweep frequency controls are readjusted so that two cycles appear, the sweep frequency is one-half the signal frequency and under these conditions, the control calibrations should indicate this frequency. This process can be repeated until the sweep frequency is a tenth or less of the input signal. In this way, the accuracy of sweep calibration can be checked over a fairly wide range.

Note: This is the first of a series of such articles dealing with test instruments.

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