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SERVICE NEWS

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DIRECTOR'S CORNER

BY

Harold J. Schulman

This summer the television industry seems to have reverted to the usual pattern of seasonal slow-up which was upset somewhat, last year, by the Korean outbreak.

You are not unique if you find that your service business has fallen off lately. Reports from all parts of the country indicate that the condition is general.

However, business is expected to pick up considerably in the fall. The wise technician knows this and will be ready when the rush begins.

These words are to urge you not to let this slow period pass without some constructive work on your part.

Check your equipment; go over your paperwork; increase your knowledge of customer psychology; and most important, develop more efficient servicing techniques.

One of the peculiarities of learning is that you can read the same technical book or article a number of times — and get something new out of each reading. What starts out as an obscure point, which you don't quite understand, becomes real and valuable knowledge as you go over it again and again.

I doubt that there are many of us who could not benefit, in new understanding, by going through a book of basic fundamentals. Don't take your knowledge for granted.

I would like to suggest an often-overlooked tool for increasing your servicing know-how, as you read a book or article on television.

It is this; keep asking yourself, "How would this affect the picture or sound?"

While reading a circuit description,

(CONTINUED ON PAGE 46)

PICTURE ANALYSIS No. 1

The ability to recognize the cause of a receiver failure by its effects upon the picture can often save a great deal of time in the servicing of a Teleset. This is the first of a series of articles which will discuss some of the more unusual picture defects and their causes.

Figure E-1 illustrates a picture defect which the technician will occasionally encounter. The vertical black bar in the picture is caused by a reflected signal or ghost.

A review of some of the fundamentals of television will better enable us to understand how the black bar is produced.

The waveform of the composite video signal, as it appears at the grid of the cathode-ray tube, is shown in Figure E-2. The waveform illustrated consists of the video information for one line and the horizontal blanking and sync pulses for two successive lines. That portion of the signal which is made up of the blanking and sync pulses does not normally appear on the screen. Consequently some technicians are not familiar with the pattern which is formed when it does appear.

The appearance of the screen, when the horizontal sync circuits are phased to place the blanking interval within the visible portion of the picture tube face, is shown in Figure E-3. Shown below the photograph is the composite sync signal which produces the screen pattern. Note that the relation between the wide gray band and the narrower black band, within the gray band, corresponds to the relationship between the sync and blanking pulses. The wide gray band is produced by the blanking pulse, while the narrower black band is produced by the sync pulse. When the photograph was taken the bright-

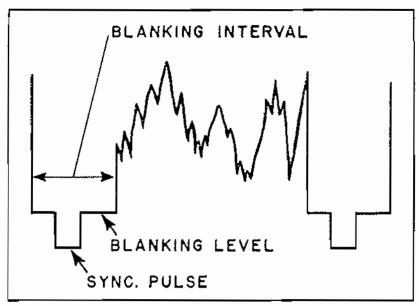


Figure E-2. Composite video signal.

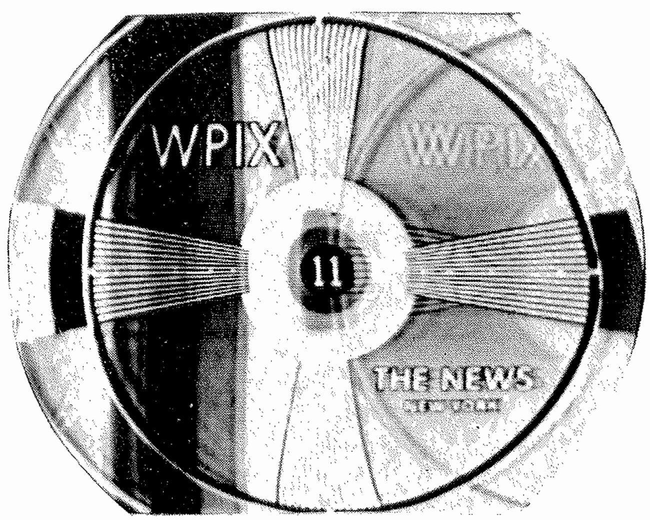


Fig. E-1. Test pattern showing vertical black bar caused by long path ghost.

ness and contrast controls were adjusted so that both vertical bands were visible.

Here the blanking level has been made to correspond to dark gray and the horizontal sync pulse, which extends further in the negative direction, produces a black band.

When the brightness and contrast controls are adjusted for normal operation, the blanking level corresponds to the cut-off voltage of the picture tube and the screen is black during the entire blanking period. Since the horizontal sync pulse is negative and occurs while the tube is cut off it has no visible effect on the picture. A wide black bar is thus produced when the horizontal sync circuits are phased to cause the blanking interval to appear on the screen.

Returning now to Figure E-1 and examining the vertical black bar we see that it corresponds to the blanking and sync pulses.

In addition to the vertical bar there is a strong ghost in the picture. This ghost is the result of a reflected signal which is arriving over a much longer path than the direct signal, as evidenced by the fact that it is displaced almost half the width of the picture. This displacement is great enough to cause the blanking and sync pulses of the reflected signal to fall within the visible area of the screen.

In the case illustrated in Figure E-1 the ghost is sufficiently strong to immediately indicate the need for reorientation of the antenna. If the ghost were considerably weaker, the black bar would appear but the displaced image would not. This happens because the intensity of the sync and blanking pulses is much greater than that of other portions of the reflected signal. When this condition occurs the technician may not readily recognize the cause of the vertical bar.

When the reflected signal is weak, the vertical band may not be noticeable on dark picture backgrounds but may be annoying when the picture background is light in shade. This sometimes causes the customer to claim that the condition comes and goes.

Figure E-4 illustrates the same condition shown in Figure E-1 except that the reflection is reversed in polarity and the black band is instead a white band. In either case the usual procedure for eliminating ghosts should be applied.

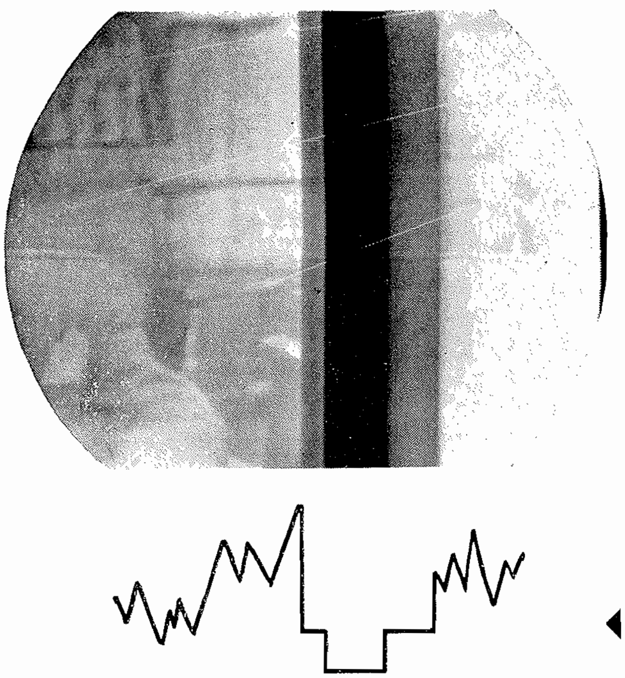


Figure E-4. Test pattern with reverse ghost.

Figure E-3. The illustration above shows the relation between the blanking and sync intervals and the vertical bar in the picture.

Temperature Compensation vs. Tuner Drift

The resonant frequency of a tuned circuit will vary slightly with temperature change unless some form of temperature compensation is provided. This variation is due to changes in the values of the components in the circuit. If such a frequency change were to occur in the tuned circuit of the oscillator stage of a television receiver, the receiver would continually drift out of tune.

Since the sound i.f.'s are considerably more selective than the video i-f stages, the effects of drift will show up primarily in the sound output of the receiver. Sound i-f and f-m detector stages in dual i-f channel television receivers are usually 200 kc wide.

The sound carrier accompanying a television signal deviates 25 kc above and below the carrier frequency. The sound signal therefore requires an i-f passband of 50 kc. Since the i-f passband is actually 200 kc wide, the sound i-f carrier may drift ±75 kc without affecting the sound output of the receiver. This is illustrated in Figure 1, which shows a typical discriminator response curve.

The linear portion of the discriminator response curve is 200 kc wide. If the sound i-f carrier drifts more than 75 kc, operation will take place over the curved portion of the response and considerable distortion will result.

The effects of temperature change may be minimized by introducing a reactive component, of proper value and temperature coefficient, in the tuned circuit of the oscillator. In practice, the temperature compensating element usually consists of a negative temperature coefficient capacitor. The value and temperature coefficient of the capacitor are chosen so that the frequency change which the capacitor tends to cause is approximately equal and opposite to that which occurs in the tuned circuit. The result is elimination of drift due to temperature change.

In the four-section, spiral type (Figure 2) Du Mont Inputuner, trimmer capacitor C118, in the local oscillator, is the temperature compensating element. The capacitance of C118 decreases as the temperature increases. The capacitor tends to cause the oscillator frequency to increase with increasing temperature, to compensate for oscillator drift in the low frequency direction.

A knowledge of the methods used to rate temperature compensating capacitors will prove helpful to the service technician. The value of a temperature compensating capacitor is usually given as its capacitance followed by a notation which expresses its temperature

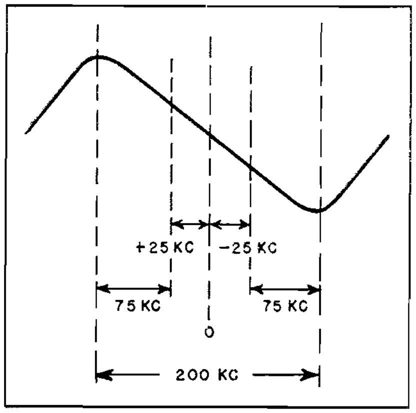


Figure 1. Discriminator response curve.

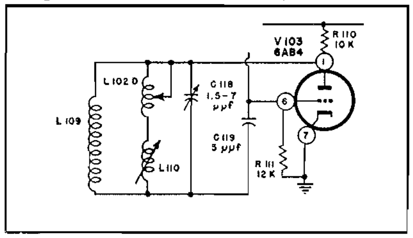


Figure 2. Oscillator stage of four section tuner.

coefficient. The temperature coefficient is expressed in parts per million per degree centigrade and is often preceded by the letters "N" or "P". "N" indicates a negative temperature coefficient, while "P" indicates a positive temperature coefficient. Consequently, a capacitor marked P300 has a positive temperature coefficient of 300 parts per million per degree centigrade, while a capacitor marked N300 has a negative temperature coefficient of 300 parts per million per degree centigrade. The technician may have encountered capacitors marked NPO. This indicates a zero temperature coefficient.

The color coding of the ceramic capacitors, used as temperature compensating elements in Du Mont Telesets, will be found in chart form elsewhere in this issue.

The actual change in capacity of a temperature compensating capacitor may be determined by dividing its temperature coefficient by one million and multiplying the result by its capacity and the temperature change in degrees centigrade.

Example:

Find the change in capacity of a 20 mmf, N500 capacitor for a temperature change of 10° C.

$$\frac{500}{10^6} \text{ X } 20 \text{ X } 10 = 0.1 \text{ mmf } \textit{ans.}$$

When replacing capacitors, particularly in oscillator circuits, the technician should determine whether or not the capacitor is providing temperature compensation. If it is, the capacitor should be replaced with a unit having the same temperature coefficient.

In addition, a zero temperature coefficient capacitor in a tuned circuit should never be replaced with a unit having a negative or positive temperature coefficient.

OSCILLOGRAPH CALIBRATION

The important waveforms occurring in the video, sync, and deflection circuits of Du Mont Telesets are shown on the schematic diagram of each model. One of the most effective techniques of locating faults in these circuits is to observe the waveforms on an oscillograph.

Further useful information can be obtained by providing a means for calibrating the oscillograph, so that peak-to-peak voltage measurements of the waveforms may be made. The peak-to-peak voltages measured in the set being tested may then be compared with those shown on the schematic. Analysis of this information will usually permit the trained technician to determine the cause of the difficulty.

The Du Mont Voltage Calibrator Model 264B, is an inexpensive instrument designed expressly for oscillograph calibration. It greatly simplifies the measurement of peak-to-peak voltages. If a voltage calibrator is not available an oscillograph may be calibrated, with useful accuracy, using an a-c voltage of known amplitude. Suitable sources of a-c voltage for calibrating purposes are a 5 or 6.3 volt filament supply — for measuring peak-to-peak voltages between 10 and 30 volts — the a-c power line, or the output of a Variac — for measuring peak-to-peak voltages above 30 volts.

When referring to the amplitude of a sine wave a-c voltage, the RMS value is generally used. To find the

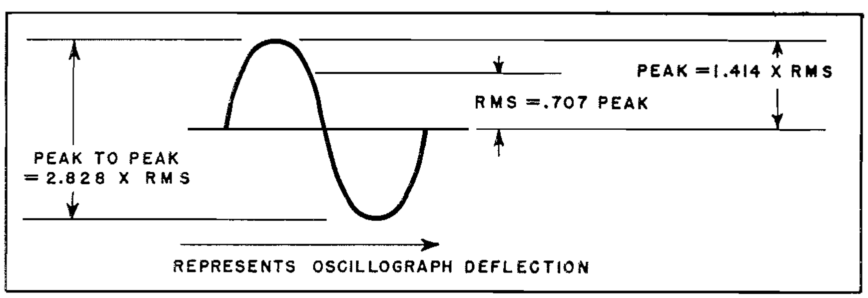


Figure W-1. Relationship between the RMS, peak and peak-to-peak values of a sign wave.

peak value, the RMS value must be multiplied by 1.414. The relationship between the RMS and peak values of a sine wave is illustrated in Figure W-1. Since the peak-to-peak value is twice the peak value, RMS values may be converted to peak-to-peak values by multiplying by 2.828.

Example: We wish to calibrate an oscillograph using the output of a 6.3 volt a-c filament supply. Since 6.3 volts is an RMS value, we must multiply by 2.828 to find the peak-to-peak voltage. 6.3 x 2.828 = 17.8 volts peak-to-peak.

If a Variac is used as a source of calibrating voltage, an a-c voltmeter is required to determine its output voltage at each setting. The voltmeter may be of the rectifier type, which is generally read in RMS values, or a VTVM, which may be calibrated in terms of RMS, peak or peak-to-peak values.

To calibrate the oscillograph, the a-c source should be connected to its vertical input terminals. The oscillograph controls should then be adjusted in the normal manner to display the waveform on the screen. The vertical gain control should be adjusted for the desired amount of deflection. For maximum ease in reading the oscillograph scale, the gain control should be adjusted to give a convenient relationship between the calibrating voltage and the units of the scale. If, for example, we are calibrating using a 6.3 filament source (17.8 volts peak-to-peak), the gain control may be adjusted so that the waveform displayed will be 18 units from top to bottom. One unit of the scale will then be equal to approximately one-tenth of a volt.

A calibrating voltage should be selected whose value is as close as possible to that of the voltage to be measured. The accuracy and dependability of the method of calibration described here does not compare with that obtained when a Du Mont Voltage Calibrator is used. Therefore it should only be used in an emergency, when a calibrator is not available.

RA-109A DIAL HINTS

After an RA-109A dial cable has been strung it may be slightly too loose or too tight. The cable tension may be adjusted by bending the rocker-arm spring supporting bracket. The bracket is shown in Figure D-1. To increase the tension on the cable, bend the bracket downward; to reduce the tension, bend the bracket upward. The bracket should not be bent more than ¼ inch in either direction.

If the dial cable continuously becomes unstrung, check the rocker arm stud. In early production, spiral type RA-109A tuners, a pulley was mounted on this stud (See Figure D-1). If there is a pulley on the stud, restring the cable so that it rides on the stud, instead of the pulley. The pulley should be pushed back against the rocker arm so that the cable can ride on the outer end of the stud.

When play in the fine tuning control of an RA-109A tuner is encountered, check the large dual gear on the inductuner shaft. This gear is equipped with two small springs and is designed to eliminate backlash and play in the gear train. The springs apply tension to the two sections of the gear so that a positive mesh with the vernier gear is always maintained. A sharp blow on the end of the fine-tuning-control shaft, or loosening of the three Phillips-head screws which fasten the dial-plate assembly to the tuner, may unmesh the vernier and backlash gears and release the spring tension.

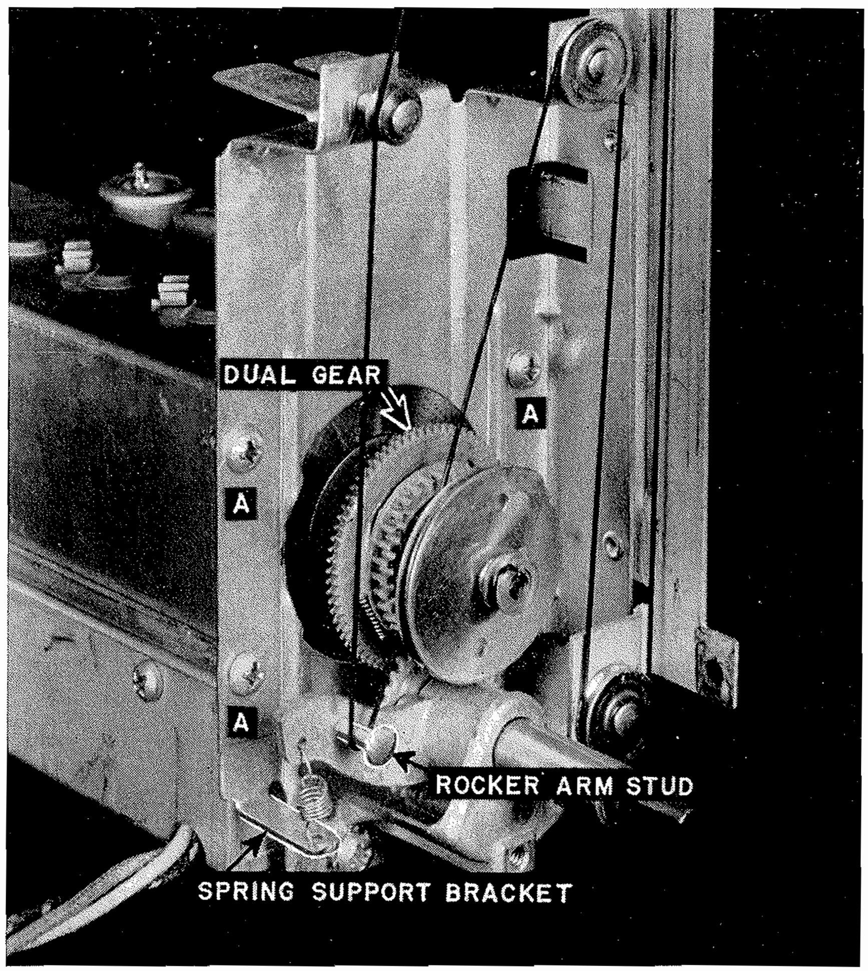


Figure D-1.

The mesh may be checked by observing the holes in the sections of the dual gear. These holes are aligned when the gears are properly meshed. If the holes are not aligned, loosen the three Phillips-head screws, A in Figure D-1, and unmesh the vernier and backlash gears. Rotate the sections of the backlash gear, remesh the gears and tighten the Phillips-head screws.

REVIEW OF SENSITIVITY MODIFICATIONS

Du Mont engineers are constantly striving to improve the performance of our Telesets. When a circuit improvement is developed it is incorporated in production as quickly as possible.

A number of such changes have been made in current models to increase their sensitivity. While the sensitivity of the early sets is adequate for the vast majority of installations, technicians in fringe areas, where sensitivity is of paramount importance, can increase the sensitivity of earlier chassis by incorporating these changes. A brief discussion of changes which were made to increase sensitivity follows.

RA—109A

In the RA-109A, the fourth video i-f tube was changed from a 6AU6 to a 6BC5. In order to obtain maximum performance from the 6BC5, the output transformer (Z209) was changed to part number 20 005 241 and the cathode bias resistor (R248) was changed from 120 to 220 ohms. The 6BC5 was shielded and a 68K resistor (R386) was added across the primary of Z209 to reduce the possibility of regeneration. This change is discussed on page 109-6J of the Du Mont Service Notes.

A choke (L217, part number 21 004 601) was added in the filament line between the first and second video i-f stages, to eliminate positive feedback between these two stages. The feedback was caused by the filament-cathode capacitances of the tubes concerned.

To reduce the amount of snow in the picture when receiving weak signals, the a-g-c delay resistor (R355) was decreased in value from 10 meg to 8.2 meg. This increases the signal level at which tuner a-g-c voltage is developed and raises the signal level at the grid of the first video i-f to override the noise generated in this stage. Further information concerning this change will be found in the June issue of the SERVICE NEWS on page 28.

RA—112A and RA—113

In the RA-112A and RA-113 only one change has been made to increase the video sensitivity, while several have been made to increase the sound sensitivity.

The video sensitivity was increased by changing the first and third video i-f tubes from 6AU6's to 6BA6's. This required a change in the screen dropping resistors of these two stages from 1K to 10K. Since the 6BA6 has greater gain than the 6AU6, the advantage of this change is obvious. See page 112-6H and I of the Service Notes for more information.

In the earliest RA-112A and RA-113 chassis, the discriminator circuit was the same as that of the RA-111A. To obtain greater sensitivity this circuit was changed to one giving greater gain. The details of the change will be found on page 112-6A of the Service Notes.

The cathode bias resistor (R216) of the sound output stage was bypassed with a 10 mf, 25V capacitor (C216). This eliminated the degeneration produced by the cathode resistor and increased the gain of the stage. See page 112-6C in the Service Notes.

The sound takeoff point was changed from the output of the first video i-f stage to the second. This had the same effect as adding another sound i-f stage and greatly increased the sound sensitivity. In order to accomplish this the transformers in the output of the second and third video i-f stages were interchanged and several other minor circuit changes were made. A complete discussion of this change may be found on pages 112-6H and I of the Service Notes.

The a-g-c delay resistor (R265) may be changed in the RA-112A and RA-113 from 10 meg to 8.2 meg for the same reason it was changed in the RA-109A.

Increasing the Sensitivity of RA-101 Telesets

The weak-signal performance of RA-101 Telesets can be considerably improved by substituting later type high gain tubes in the video i-f amplifiers and by modifying the tuner to take advantage of more modern circuitry.

The changes should be made using the following procedure. When working on the tuner, follow the parts positions shown in the illustration and be careful not to disturb the positions of other parts or leads.

1. Remove the 2nd, 3rd and 4th video i-f amplifier tubes (V11, V12, and V13) and replace them with 6CB6's.

2. Rewire the sockets of V11, V12 and V13 as follows:

a. Remove the lead connecting the socket center post to pin 2.

b. Remove the lead between pin 2 and ground.

c. Connect a lead from pin 4 to ground.

d. Remove R53, R58, and R64, the resistors connected between pin 7 of each tube and ground.

e. Connect a 200 ohm ½ watt resistor from pins 2 and 7 of each tube to ground.

3. Remove R68, the 1.5K resistor connected from pin 4 of V14 to ground.

4. Connect a 3K, ½ watt resistor from pin 4 of V14 to ground.

5. Disconnect all leads connecting the tuner to the circuits on the main chassis.

6. Remove the tuner from the R-f, I-f chassis and remove the tuner bottom cover.

7. Remove R44 and C47, the 110 ohm resistor and 470 mmf capacitor connected from pins 5 and 6 of V1, to ground.

8. Connect pins 5 and 6 of V1 to ground lug 1, as shown in figure M-1B.

9. Remove R1, the 200 ohm resistor connected from pin 7 of V1 to ground.

10. Remove C1, the 470 mmf capacitor connected from pin 7 of V1 to the antenna lead.

11. Connect one end of a 100 mmf capacitor, (C102), and a 100 ohm ½ watt resistor, (R102), to pin 7 of V1.

12. Connect the other ends of the 100 ohm resistor and 100 mmf capacitor of step 11 to one end of a coil, (L105), part number 21 004 571.

13. Ground the other end of the coil mentioned in step 12 to the bus wire, as shown in figure M-1.

14. Connect a coil, (L106), part number 21 004 571 from the center conductor of the coax cable to ground, as shown in figure M-1B.

15. Connect a 30 mmf ceramic capacitor, (C110) from the center conductor of the coax cable to the junction of the RC network and the coil mentioned in step 12.

16. Remove C44, the 1 mmf capacitor connected from pin 1 of V2 to pin 6 of V9.

17. Connect a 1.5 mmf capacitor from pin 1 of V2 to pin 6 of V9.

18. Replace the tuner bottom cover.

19. Reinstall the tuner on the R-f, I-f chassis and connect all of the tuner leads.

Symbol Number	Part Number	Description
C44	03 017 920	Cap Ce 1.5 mmf 400V
C110	03 013 070	Cap 30 mmf 5%
C102	03 016 700	Cap 100 mmf 500V
R102	02 030 240	Res 100 ohms ½W
L105	21 004 571	Coil
L106		Same as L105

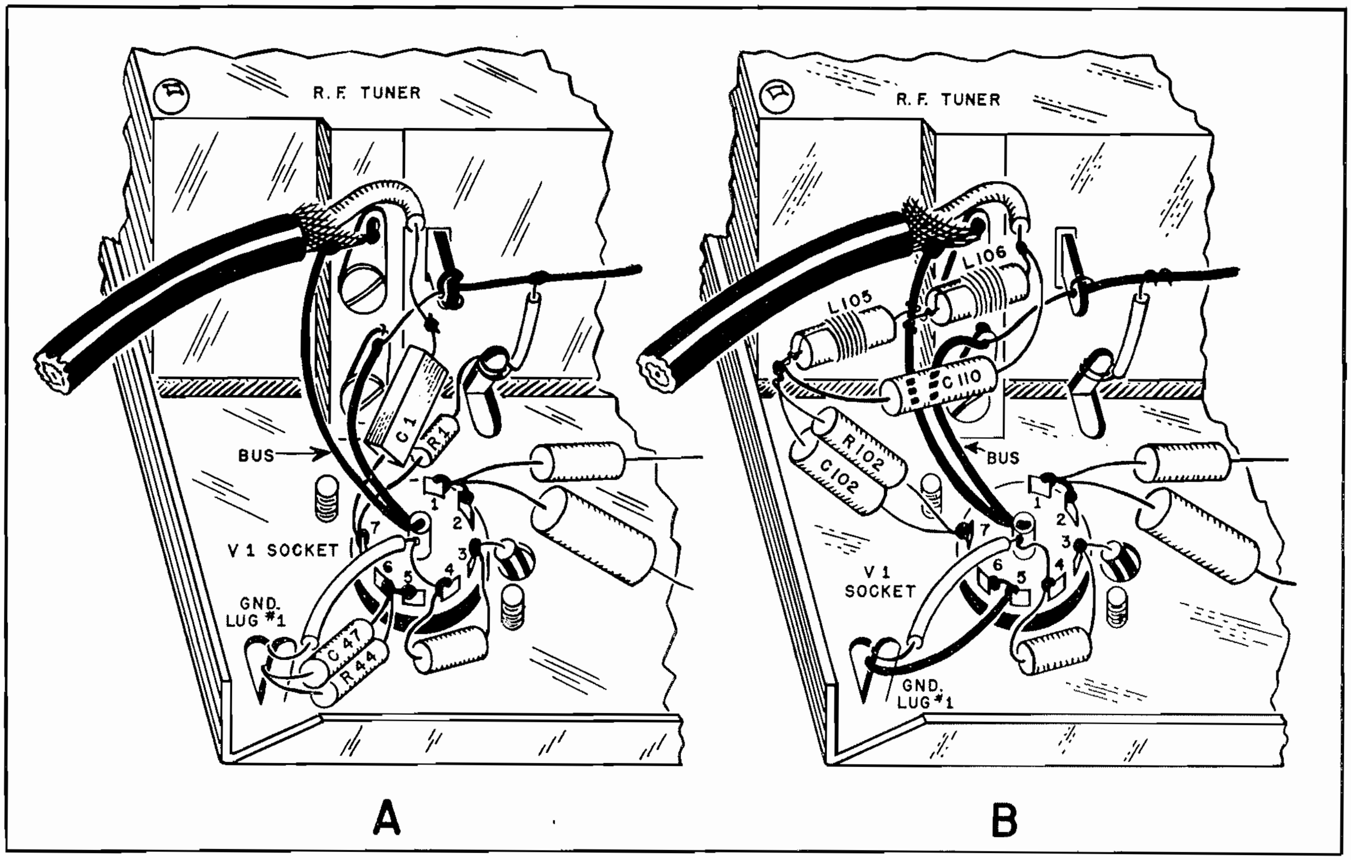


Figure M-1.

DIRECTOR'S CORNER—(Cont'd)

try to reason out what would happen if particular components were to open, short, or change in value.

The ability to interpret circuit faults in terms of their effects on the picture or sound will eventually make you expert in working in the reverse order —determining circuit failures by examining the picture and listening to the sound.

At one time or another all of us have marveled at the expert in action. He studies the picture closely, listens attentively — twists a few dials — and then, like the oracle at Delphi — he comes up with the answer: Try the X resistor in the Y circuit. And, more often than not, he's right!

No magic is involved here. Just hard preparatory work, and sound application of theory to practice.

In this summer period, catch up on your studies — and as you read, keep thinking in terms of "How does it affect the picture or sound!"

CHANNEL 5 TRAPS

When adjusting a trap, used to remove a channel 5 beat, allow the Teleset to warm up for approximately fifteen minutes before making the adjustment.

If this procedure is not followed, drift due to temperature change may reduce the effectiveness of the trap. It is a good rule to allow a warm-up period before making adjustments to any of the tuned circuits in a Teleset.

TROUBLESHOOTING HINTS

Teleset: RA-112A, RA-113 and RA-117A

Symptom: Audio in picture when Volume Control is at maximum or near maximum.

Probable Fault: Defective 10 mf section in C260.

Remedy: Replace C260.

Teleset: RA-109A, RA-116A and RA-119A

Symptom: Fluctuating picture contrast. Overload on strong signals. A check of the a-g-c line indicates that the a-g-c voltage is also fluctuating. Symptoms may occur only when the set is cold, or after several hours of operation.

Probable Fault: C243 in the plate circuit of the a-g-c detector, V217, is intermittently shorting.

Remedy: Replace C243.

Teleset: RA-109A, RA-116A and RA-119A

Symptom: No picture, raster normal. R239 and R241 burned up.

Probable Fault: Shorted coupling capacitor in Z206, applying B+ to the grid of V209, the second video i.f. As a result, R239 is overloaded and the current through V209 increases, damaging R241 the 39 ohm cathode resistor of the second video i.f.

Remedy: Replace Z206, R239 and R241. Check V209 and replace if necessary.

Teleset: RA-109A and RA-119A

Symptom: Hum in sound when the Volume Control is at minimum, and the Service Selector Switch is in the TV position. The hum level and volume level vary when the Brightness or Contrast Controls are adjusted.

Probable Fault: Stray coupling between the video circuits and the first and second sound amplifiers.

Remedy: Replace the first and second sound amplifiers, V206A and V206B (12AU7). If this does not remove the hum, try placing a shield over the tube.

Teleset: RA-119A

Symptom: No raster, no high voltage. The plates of the 6BG6G pulse amplifiers (V304 and V305) show a deep red color. Positive voltage on the grids of V304 and V305.

Probable Fault: C304 in the grid circuit of V304 and V305 is shorted.

Remedy: Replace C304.

The following hints were suggested by Morris Strohl of Friendly TV, Inc. Credit will be given for all Troubleshooting Hints received from readers.

Teleset: RA-103C

Symptom: When set is turned on picture is normal. Contrast gradually increases until picture becomes dark, as though contrast control were slowly turned up to maximum.

Probable Fault: Gassy 6AG5 second video amplifier, V202.

Remedy: Replace V202.

Teleset: All using 19" cathode-ray tubes

Symptom: Raster disappears intermittently.

Probable Fault: Loose connection at one of the CRT filament pins.

Remedy: Apply hot soldering iron to the CRT filament pins. Use solder if necessary.

Teleset: All

Symptom: Bright flashes on the screen.

Probable Fault: Arcing at the a-c interlock receptacle.

Remedy: Check the male and female interlock connectors and replace if necessary.

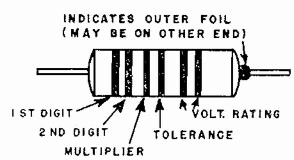
COLOR CODING OF CAPACITORS USED IN DU MONT TELESETS

The color codes used on the capacitors found in Du Mont Telesets are shown in the tables on this and the following page.

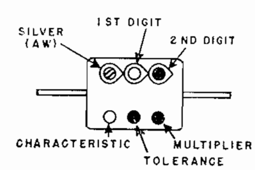
MOLDED PAPER CAPACITORS

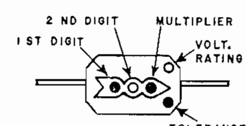
CAPACITY VALUE IN MMF		
Color	**Digits**	**Multiplier**
Black	0	1
Brown	1	10
Red	2	100
Orange	3	1,000
Yellow	4	10,000
Green	5	
Blue	6	
Violet	7	
Gray	8	
White	9	

TOLERANCE	
Color	**Tolerance**
Black Band or None	± 20%
White or Silver	± 10%
Yellow or Gold	± 5%



The voltage ratings of molded paper capacitors are given in hundreds of volts. The voltage ratings of the tubular type are indicated by one or two bands. Ratings of less than 1000 volts are indicated by one band while two bands are used for ratings of 1000 volts or more. The digit column of the capacitance value table should be used to read voltage ratings.



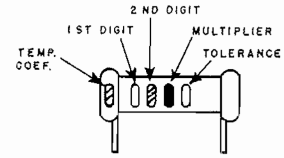


ARROW POINTS TO OUTER FOIL END

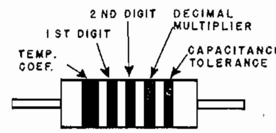
CERAMIC CAPACITORS

Color	Capacity MMF Significant Figure 1st	Capacity MMF Significant Figure 2nd	Capacity MMF Multiplier	Temp. Coef. of Capacitance End Color	Tolerance Values Cap. Greater Than 10 mmf	Tolerance Values Cap. of 10 mmf or Less
Black	0	0	1	0	± 20%	± 2.0 mmf
Brown	1	1	10	— 30 PPM /° C	± 1%	
Red	2	2	100	— 80 PPM /° C	± 2%	
Orange	3	3	1000	— 150 PPM /° C	± 2½%	
Yellow	4	4		— 220 PPM /° C		
Green	5	5		— 330 PPM /° C	± 5%	± 0.5 mmf
Blue	6	6		— 470 PPM /° C		
Violet	7	7		— 750 PPM /° C		
Gray	8	8	.01	+ 30 PPM /° C		± 0.25 mmf
White	9	9	.1		± 10%	± 1.0 mmf

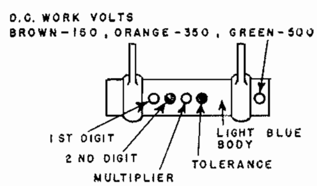
TUBULAR (INSULATED & NON-INSULATED)



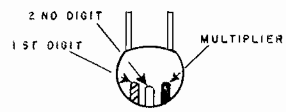
MOLDED INSULATED



The tubular, molded and flat disc type ceramic capacitors have operating voltage ratings of 500 volts D.C. and test voltage ratings of 1000 volts D.C. The voltage rating of the tubular type with light blue body, is indicated by the fifth color dot.



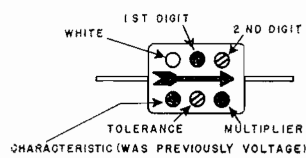
FLAT DISK



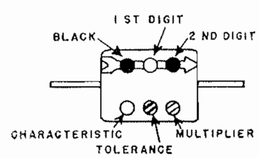
FIXED MICA CAPACITORS

Color	Figure	Multiplier	Tolerance	Characteristic Capacitance Drift	Characteristic Temperature Coefficient
Black	0	1		5% + 1 mmf	± 1000 PPM /° C
Brown	1	10		3% + 1 mmf	± 500 PPM /° C
Red	2	100	± 2% (G)	0.5% + 0.5 mmf	± 200 PPM /° C
Orange	3	1000		0.3% + 0.1 mmf	± 100 PPM /° C
Yellow	4	10000		0.1% + 0.1 mmf	$^{+100}_{-20}$ PPM /° C
Green	5		± 5% (J)		
Blue	6				
Violet	7				
Gray	8			0.3% + 0.2 mmf	$^{+150}_{-50}$ PPM /° C
White	9			0.2% + 0.2 mmf	$^{+100}_{-50}$ PPM /° C
Gold		0.1			
Silver		0.01	± 10% (K)		
Black			± 20% (M)		

RMA SYSTEM



JAN SYSTEM



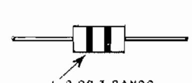
COMPOSITION CAPACITORS

One, two or three color bands are used to indicate the capacity of composition type capacitors.

Operating voltage 500 volts D.C.

Test voltage 1000 volts D.C.

Cap. mmf.	Color Code
0.68	Blue—Gray—Silver
1.0	Brown
1.5	Brown—Green
2.2	Red
3.3	Orange
4.7	Green



DUMONT
First with the Finest in Television
SERVICE NEWS

Service News

A PUBLICATION OF THE TELESET SERVICE CONTROL DEPARTMENT
OF ALLEN B. DU MONT LABORATORIES, INC., EAST PATERSON, N. J.

Volume 1 SEPTEMBER, 1951 Number 8

DIRECTOR'S CORNER

BY

Harold J. Schulman

September, among other things, is the back-to-school month. For us at Du Mont it means the re-opening of our famous Service School.

Frankly, we are looking for students. Considering what we have made available, this is the greatest educational bargain ever offered.

To the Du Mont dealer or service company executive — we offer the opportunity to make your men more familiar with the individual service needs of Du Mont Telesets. This means time saved on service calls and on the bench. It also means fewer calls because symptoms will be more accurately diagnosed and corrected.

To the servicemen, you have the opportunity to excel in your profession, with all the attendant personal satisfaction this affords.

Our school does not consist of mass meetings with a lecturer reading from notes away off in the distance, as some of you are familiar with. Our classes are small. Instruction is individualized. You work on a bench. Handle equipment. Become expert with the oscillograph.

The course is down-to-earth, practical and helpful—all the way through. Your questions are answered, not just acknowledged. If there were a charge for the course we would be glad to give you a double-your-money guarantee that servicing Du Mont Telesets would be faster and easier for you when you completed it.

But the course is *free,* fellows.

There are reasonable accommodations at near-by hotels or the Y.M.C.A. for out-of-towners. For someone who is

(CONTINUED ON PAGE 56)

TELEVISION INTERFERENCE

Du Mont Telesets are designed to be as free from the effects of interference as it is possible to make them. Despite all of the precautions taken, conditions occasionally arise when interference may become a problem. Such conditions are beyond the control of the designer and it is up to the service technician to find the remedy.

In most cases in which interference occurs a remedy can be found. The purpose of this article is to discuss the various types of television interference and to illustrate the techniques required to remedy them.

Determining the cause of the interference is probably the most difficult part of the job. Familiarity with the various types of interference and a certain amount of patience are required. Once the cause has been determined, the application of the proper remedy becomes a routine matter.

FM INTERFERENCE

While the term f-m interference is generally applied to all types of interference emanating from frequency modulated sources, it is used here to refer to interference of the following specific types.

a. Interference from standard f-m broadcast stations.
b. Interference from more than one source, when one of the sources is an f-m station.
c. Harmonics of the sound i.f. which feed back into the front end, to produce beats with the video carrier.

Figure 1 illustrates the effects on the picture of interference from an f-m broadcasting station. This type of interference occurs when an f-m signal beats with the video carrier of the t-v signal to which the Teleset is tuned. The herringbone pattern which appears in the picture varies with the modulation of the f-m station. If the f-m station is tuned in on an f-m receiver, at the same time that the interference in the picture is being observed, a definite relation between changes in the f-m sound and the interference, will be noticed.

There are a number of ways in which an f-m broadcast station can

Figure 1. Frequency Modulation Interference

interfere with television reception. One of the most common forms of f-m interference occurs because a portion of the f-m broadcast band is at the image frequency of channel 2.

Because of the high image-rejection ratio of all four circuit Du Mont Inputuners, interference of this type is not likely to occur with current Teleset models unless the Teleset is located very close to an f-m station. Image interference is more likely to occur in receivers which were manufactured prior to the use of the four-circuit Inputuner. In these earlier sets, the video i.f. is 26.4 mc. Since the local oscillator frequency is equal to the frequency of the incoming signal (video carrier), plus the video i.f., the oscillator frequency in these receivers, when tuned to channel 2, is 81.65 mc (55.25 + 26.4 mc).

The local oscillator signal beats with all other signals which reach the mixer. The band of frequencies allocated to f-m broadcasting stations extends from 88 to 108 mc. If a strong f-m broadcast signal reaches the mixer, it will beat with the local oscillator signal to produce a third signal whose frequency will be equal to the frequency of the f-m signal, minus the local oscillator frequency. If the frequency of the f-m station is between 103.65 and 108 mc and the television receiver is tuned to channel 2, the beat signal produced will fall within the i-f passband, somewhere between 22 and 26.4 mc. This signal will be passed through the video i-f stages and appear in the picture. The intensity of the interference will depend upon the relative amplitudes of the interfering signal and the television signal. The frequencies involved are shown below:

Channel: 2
Frequency Range: 54-60 mc
Video Carrier: 55.25 mc
Local Osc.: 81.65 mc
Image Frequency: 103.65-108 mc

Other television channels are not affected by f-m broadcasting stations in the manner described above, because their image frequencies fall outside of the f-m broadcast band.

HARMONIC INTERFERENCE

Another type of f-m interference is produced when the r-f and mixer stages of the television receiver are overloaded by a strong f-m broadcast signal. The overloading occurs at the fundamental frequency of the f-m station, and results in the generation of harmonics of the f-m signal in the mixer and r-f stages of the receiver. Since the f-m signal must be quite strong to produce harmonic interference, this condition will usually be encountered in areas close to f-m transmitters.

Of the harmonics generated, the second is the one which causes the difficulty, because it usually falls within one of the high television channels. The second harmonics of f-m broadcast stations fall between 176 mc and 216 mc. This range includes all of the high channels and consequently, any one of the high channels may be affected.

F-m interference can also be caused by two interfering signals which enter the receiver and produce a beat in the r-f or mixer stages, which enters the video i.f.'s along with the video signal of the channel to which the receiver is tuned, and creates an interference pattern similar to that shown in Figure 1.

A typical case of interference of this type would occur if a strong f-m signal at 94.5 mc were present at the input of the receiver. If a strong signal is received on channel 4, its 71.75 mc sound carrier might beat with the f-m signal to produce a heterodyne at 22.75 mc. Since the 22.75 mc heterodyne falls within the video i-f passband, interference would result. This condition actually occurred in Dallas, Texas where channels 4, 5 and 8 are in operation.

In the location at which the interference occurred, the signal on channel 5 was relatively weak, while channel 4 was very strong. An f-m station operating at a frequency of 94.5 mc was located not far from the television receiver. The interference was observed on channel 5 only. Investigation proved that the sound carrier of channel 4 (71.75 mc) and the f-m broadcast signal (94.5 mc) were entering the front end of the receiver. These signals were producing a beat at 22.75 mc which was causing an interference pattern in the picture. Since channels 4 and 8 were quite strong there was no interference when tuned to these channels, although the interfering signal was undoubtedly present.

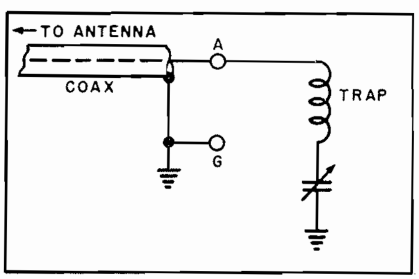


Figure 2. Series Tuned F-M Trap.

In another case of interference caused by two stations a signal falling within the r-f passband was produced. The television receiver was located very close to an f-m station operating at 99.5 mc. The signal received on channel 5 was very strong. When the Teleset was tuned to channel 7, an f-m interference beat appeared in the picture; in addition the signal from channel 5 was observed swinging back and forth, in a manner sometimes referred to as the windshield wiper effect. In this case the interference was produced by the 99.5 mc f-m signal and the 77.25 mc video carrier of channel 5. These signals produced a beat equal to their sum or 176.75 mc. This beat falls within channel 7 and it was strong enough to produce interference.

Since the f-m station was operating at a frequency of 99.5 mc, the possibility that it was combining with the 77.25 mc carrier of channel 5 to produce a beat at 22.25 mc, was considered. It was possible to determine that the interference was being caused by the 176.75 mc signal by observing the picture. Observation indicated that the beat was located approximately 1.5 mc from the video i-f or r-f carrier.

The video carrier frequency of channel 7 is 175.25. When it is combined with a signal at 176.75 mc a 1.5 mc beat is produced. The video i-f carrier of the receiver in question, was 26.4 mc. When the video i-f signal is combined with a signal at 22.25 mc, a 4.15 mc beat is produced. Obviously then, the 176.75 mc signal was causing the interference.

In the above case, an f-m interference pattern was also produced on channel 11. This pattern was found to be the result of the generation of the second harmonic of the 99.5 mc f-m signal. This harmonic was produced in the front end of the receiver by overloading, as described earlier in this article. The insertion of a 99.5 mc trap in the antenna of the receiver eliminated all of the interference encountered.

FM BROADCAST TRAPS

When interference of any of the types so far described is encountered, it can be eliminated by preventing the f-m signal, which is causing the interference, from entering the Teleset. This may be accomplished by inserting a tuned stub or lumped constant trap in the antenna lead of the receiver. Lumped constant traps are compact and effective. Several of them are available through your Du Mont distributor.

One of the simplest traps consists of an inductance and capacitance in series as shown in Figure 2. The trap is connected between the ungrounded antenna lead and ground, and tuned to the frequency of the interfering signal. The part numbers of the series traps available from your Du Mont Distributor are shown in Table 1. Also shown are the Teleset models with which each trap should be used. Complete instructions for the installation of the traps are included with the parts.

Another type of trap which may be used to eliminate f-m interference consists of a parallel resonant circuit connected in series with the transmission line. It may be used with 72 ohm coax or 300 ohm twin-lead. When used with twin-lead two traps are necessary, one for each side of the line. The methods for connecting parallel resonant traps when using 72 ohm coax and 300 twin-lead are shown in figure 3.

Each of the resonant circuits in figure 3 is made up of an air core coil, consisting of 10 turns of #14 enameled copper wire, close wound, with an inside diameter of one-half inch and a 1 to 1.5 mmf variable capacitor. After a trap has been installed it should be tuned to minimize the interference.

TABLE 1

Part No.	Description	Used on Teleset Models
21005881	Straight Bracket Type	RA-103C RA-103D RA-104A RA-110A
21005891	"L" Bracket Type	RA-105A RA-105B RA-106 RA-108A

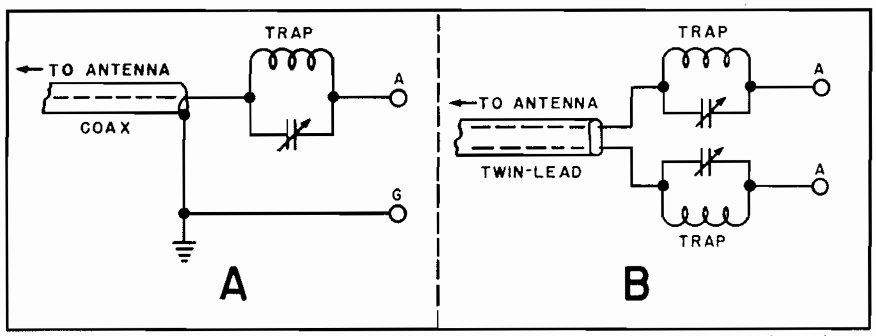


Figure 3. Parallel Tuned F-M Traps. A-72 OHM Unbalanced Line, B-300 OHM Balanced Line.

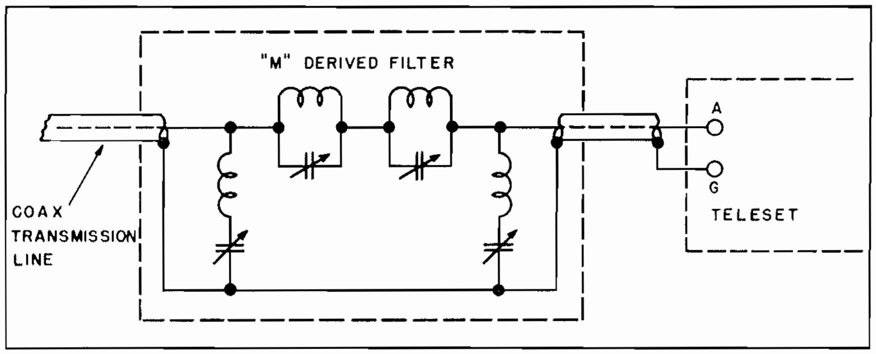


Figure 4. M Derived Band Elimination Filter.

BAND ELIMINATION FILTERS

The insertion of a trap in the antenna lead of a Teleset will cause some attenuation of the desired television signals. In weak signal areas such attenuation must be minimized. The insertion loss of a properly designed "M" derived filter is less than that of a series or parallel resonant trap and, when possible, such a filter should be used in preference to a trap.

The circuit and method of installation of an "M" derived filter is illustrated in Figure 4. When properly adjusted this filter will give adequate attenuation of the entire f-m broadcast band, with minimum attenuation of the desired television signals.

A band-elimination filter of the type shown in Figure 4 is available from your Du Mont Distributor. The filter comes enclosed in a case for convenient mounting on the back panel of the Teleset. It is equipped with a female input connector and a 72 ohm coax output lead with male connector. The part number of the filter is 88 000 301.

SOUND I. F. HARMONICS

F-m interference can also be produced in the television receiver itself. All Du Mont Telesets employ a separate sound i-f channel, which incorporates a discriminator for sound detection. The discriminator is a non-linear device; consequently it generates harmonics of the sound i-f signal. If these harmonics are strong enough they can feed back into the front end of the receiver, beat with the video carrier of the channel in which they fall, and produce an interference pattern in the picture. This pattern may be similar to that shown in Figure 1 or like that shown in Figure 5. The exact appearance of the pattern is determined by the difference in frequency between the harmonic and the video carrier.

If the ninth harmonic (195.75 mc) of the sound i-f signal of a receiver using a 21.75 mc sound i-f frequency, feeds back into the front end of the receiver when it is tuned to channel 10 (193.25 mc), a 2.5 mc beat will be observed in the picture. The appearance of the pattern will be similar to that shown in Figure 1.

If the eighth harmonic (175.2) of the sound i-f of a receiver, having a 21.9 mc i.f., feeds back into the front end, and the receiver is tuned to channel 7 (175.25), a 50 kc beat will be produced. Since the frequency of the beat is quite low, a pattern similar to that shown in Figure 5 will be produced.

Both of the sound intermediate frequencies mentioned above are used in post-war Du Mont Telesets. In the earlier sets the sound i.f. was 21.9 mc. It was changed to 21.75 mc to eliminate the possibility of interference on channel 7 as previously mentioned. This change took place starting with the following chassis serial numbers.

RA-109A—Serial number 0915725
RA-112A—Serial number 12702
RA-113—Serial number 13580

If a beat pattern similar to that shown in Figure 5 is encountered on channel 7, in a Teleset whose serial number is lower than those shown above, the interference can be eliminated by realigning the sound i-f's to 21.75 mc. Additional information which will be found helpful in eliminating channel 7 beats will be found in the Service Notes on pages 109-5H and 109-5i.

Table 2 shows the harmonics of the 21.75 and 21.9 mc i-f's, which fall within television channels. Note that only three harmonics of the 21.75 mc i-f fall within television channels, while four of the harmonics of the 21.9 mc fall within television channels. Actually the only sound i-f harmonic interference which has been encountered with the 21.9 mc i-f has been on channel 7. With the 21.75 mc sound i-f, the channel 7 beat is eliminated although a beat is sometimes encountered on channel 10. The other possible beats shown in Table 2 have not been encountered. Information on remedying the channel 10 beat appeared in the February issue of the Service News.

When beat interference is encountered, one of the sound i-f tubes, or the discriminator tube, should be removed. If removal of a tube eliminates the beat, the interference is probably of the sound i-f harmonic type just described. If the beat is not eliminated by the removal of a tube, the source of the interference is probably external to the receiver.

UNMODULATED RF INTERFERENCE

Figure 6 illustrates the type of interference pattern which is produced by an unmodulated r-f signal. When an unmodulated r-f signal, which falls within the television channel to which the receiver is tuned, enters the receiver, it beats with the video carrier and causes a pattern similar to that shown in figure 6. Some of the sources of this type of interference are as follows:

1. Local oscillator radiation from another TV receiver
2. Local oscillator radiation from an FM receiver
3. A harmonic of the video i.f. of the Teleset itself.
4. An unmodulated signal at the image frequency of the video i.f.
5. Any unmodulated r-f signal whose frequency lies within the passband of the Inputuner.

Of the above causes of interference, local oscillator radiation from another television receiver is the most common. In severe cases it can result in complete loss of reception of one or more channels. Unfortunately the interference cannot always be eliminated. When local oscillator radiation is encountered, the receiver which is affected, its antenna and its transmission line, should be relocated as far as possible from the installation which is causing the interference.

If the interference occurs in a strong signal area, and is originating from just one receiver, some improvement can usually be obtained by inserting an attenuator at the input of the offending receiver. To locate the offending receiver turn on the receiver which is suffering from the interference and tune it to the channel which is affected. Then turn on each of the suspected receivers, one at a time, tuning them to each channel in use and observing the picture on the receiver suffering from the interference. When the offending receiver has been found the technician should proceed to relocate the components of the installation which is affected by the interference. Don't attempt to check a receiver for local oscillator radiation by removing its antenna. In many cases there is sufficient radiation from the chassis itself, to cause interference.

The local oscillator frequencies of a receiver having a video i.f. of 25.75 mc are shown in Table 3. The local

TABLE 2

Channels		21.9 mc Harmonics			
	Freq.	3	4	8	9
3	60- 66 mc	65.7 mc			
6	82- 88 mc		87.6 mc		
7	174-180 mc			175.2 mc	
10	192-198 mc				197.1

Channels		21.75 mc Harmonics		
		3	4	9
3	60- 66 mc	65.25 mc.		
6	82- 88 mc		87.00 mc	
10	192-198 mc			195.75 mc

oscillator frequencies which fall within television channels are indicated. A table like that shown may be made up for the channels in use in a particular area and for each of the popular video i.f's. Such a chart will be helpful in identifying the source of interference. In Table 3 the local oscillator operates above the video carrier, as it does in all Du Mont Telesets. In some receivers the oscillator may operate at a frequency below the video carrier. In others the oscillator is operated above the video carrier on the low channels and below the video carrier on the high channels.

Local oscillator radiation from f-m receivers often causes interference with television reception. The effect on the picture is similar to that shown in Figure 6. The i.f. of most f-m receivers is 10.7 mc. The oscillator frequency is usually below that of the f-m signal being received. The local oscillator thus operates at a frequency equal to that of the f-m signal minus 10.7 mc. Since the f-m broadcast band extends from 88 mc to 108 mc the local oscillator, in an f-m receiver with a 10.7 mc i.f., operates in the range between 77.3 mc and 97.3 mc. These frequencies cover most of channels 5 and 6. When interference is encountered on these channels the possibility of f-m receiver local oscillator radiation should be considered.

Remedies for f-m receiver local-oscillator radiation are generally the same as those for television receiver local-oscillator radiation. In addition to the remedies previously mentioned in connection with tv receivers, a trap may be inserted in the antenna lead of the offending f-m receiver. This procedure is not always effective because the interference may be entering the power line.

A third source of unmodulated interference is the video detector of the receiver itself. Since the video detector is a non-linear device it generates harmonics of the video i-f carrier. These harmonics can feed back into the front end of the receiver and beat with the video carrier, to produce interference.

This type of interference has occured in Du Mont receivers on channel 5. The third harmonic (79.2 mc) of the video i.f. (26.4 mc), produced a 1.95 mc beat with the carrier of channel 5. In receivers using a 26.25 mc video i.f., its third harmonic (78.75 mc) has occasionally produced a 1.5 mc beat on channel 5.

Such a beat has also been encountered on channel 8, as a result of the 7th harmonic (183.75 mc) of the 26.25 mc video i.f. Since the video carrier of channel 8 is 181.25 mc the frequency of the beat is 2.5 mc.

The remedies for channel 5 and channel 8 beats were published in the following issues of the Service News; February, page 13; March, page 17; June, page 28 — and on page 112-51 of the Service Notes.

If interference from an unmodulated i-f source is encountered it is possible to determine whether the interfering signal is being generated in the receiver or outside of it, by tuning the Teleset around the correct point and observing the beat pattern. If varying the tuning causes the pattern to change the interference is probably an i-f harmonic. If little change in the pattern occurs, the source of the interference is probably external.

TABLE 3

Assuming a Video IF of 25.75 mc

Channel	Video Carrier	Loc. Oscillator	Interferes With		
2	55.25 mc	81 mc	Chan.	5	76- 82 mc
3	61.25 mc	87 mc	"	6	82- 88 mc
7	175.25 mc	201 mc	"	11	198-204 mc
8	181.25 mc	207 mc	"	12	204-210 mc
9	187.25 mc	213 mc	"	13	210-216 mc

Figure 5. F-M Interference, Frequency of Beat Approximately 50 KC.

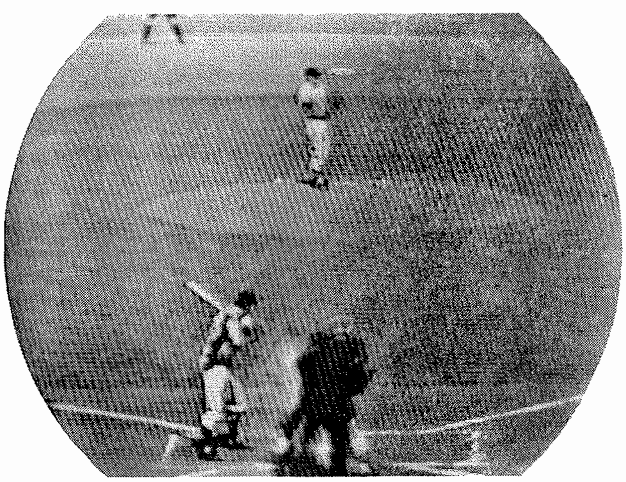


Figure 6.—Interference Produced by Amplitude Modulated or Unmodulated r-f Signal.

TROUBLESHOOTING DU MONT INPUTUNERS

The troubleshooting of Du Mont Inputuners is not difficult if the problem is approached logically. The purpose of this article is to assist the technician in developing a logical approach, and to point out some of the more common Inputuner field troubles.

Inputuner troubles may be segregated into the following three general categories for purposes of discussion.

1. No picture or sound
2. Weak picture and/or sound
3. Intermittents

NO PICTURE OR SOUND

When there is no picture or sound and the Inputuner is suspected, the video i-f stages preceding the sound take-off point should be carefully checked before proceeding to the tuner. This may be accomplished by following the steps of the i-f alignment procedure pertaining to these stages.

After the i-f stages have been carefully checked for gain and alignment, the alignment of the mixer plate transformer should be checked. If the correct alignment curve cannot be obtained, voltage and resistance measurements should be made to determine the source of the trouble.

If the mixer stage appears to be functioning properly, the oscillator may be checked by tuning the receiver to a local channel and connecting a signal generator to pin 6 of the oscillator tube socket. The generator should be tuned to the local oscillator frequency (21.9 mc or 21.75 mc + sound carrier frequency) of the channel to which the receiver is tuned.

If the oscillator is not operating properly, the injection of the signal from the generator will result in normal converter action.

The oscillator may also be checked by measuring the control grid voltage of the oscillator tube and comparing it with that given in the table accompanying this article. If the oscillator is found to be performing normally, the r-f amplifier may be checked by inserting an adapter tube into the r-f amplifier socket, and applying the antenna directly to the cathode of the r-f amplifier. The adapter tube can be made up by soldering a short length of lead to the cathode pin of a 6J6 tube, bringing the lead up the side of the tube and fastening it to the tube with a piece of scotch tape.

Using the procedure so far described, it is possible to localize an Inputuner trouble to the oscillator, mixer, r-f amplifier, or input circuits without removing the tuner from the main chassis. When the fault has been localized in this manner, tubes should be substituted in the inoperative stage. If the difficulty is not a faulty tube, the tuner should be taken off the main chassis and its bottom cover removed. A careful visual inspection will, in most cases, turn up components which have been burned, or are touching one another or the chassis.

The Inductuner cover should be removed and the spiral tuning elements checked to make certain that the wiper arms have not jumped their tracks

TROUBLESHOOTING HINTS CHART

SYMPTOM	PROBABLE FAULT	REMEDY
Low Gain	1. C113 shorted 2. C119 leaky or shorted 3. Improper lead dress in oscillator or r-f amplifier circuit. 4. Insufficient tension on wiper and contact arms in spiral assembly.	1. Replace C113 2. Replace C119 3. Dress C115 up and away from oscillator standoff. Lift C105 away from chassis. Remove C106. If oscillation occurs on high channels, replace C106. 4. Add tension by slightly bending the contact arms.
Microphonics	1. Oscillator circuit components touching each other. 2. Oscillator standoff loose	1. Dress oscillator circuit so that no two parts are touching. Move L105 and C111 away from L110. 2. Tighten oscillator standoff with Phillips-head screwdriver.
Noisy and/or intermittent tuner	1. Loose turns on L109 2. Defective soldered joint near the inside of the oscillator spiral. 3. Defective C119 4. Dirty spiral assembly.	1. Replace L109 2. Resolder inner end of spiral. See January issue of Service News. 3. Replace C119 4. Clean spiral assembly and contact points, and check tension of wiper arms.
Oscillates on high end	1. C106 missing	1. Add C106
Drifting of oscillator	1. Defective C119	1. Replace C119

and that they all stop in the same position on their respective spiral inductors. The wiper and contact arms should be checked for sufficient tension, and the shorting bars checked to make certain that they are off the tracks on the low channels and on the tracks on the high channels. Figure T-1 shows the spiral assemblies. The arrows indicate the shorting bars and contact arms.

The solder joints at the inner ends of the spirals should be inspected. Opening of one or more of these solder joints can result in a dead, intermittent, or low-gain tuner. A procedure for repairing the solder joints at the inner ends of the spirals will be found in the January issue of the SERVICE NEWS.

If visual inspection of the tuner fails to reveal the defective component, voltage and resistance measurements should be made.

In all troubleshooting and repair work on Inputuners no component should be disturbed until it is known to be defective. When replacing a component, the original positioning should be adhered to as closely as possible. Disturbing components or replacing components in other than their original positions will usually affect the alignment of the tuner. Many components cannot be replaced without affecting the alignment, regardless of how rigorously their original positioning is followed. Components which can be replaced without affecting alignment are as follows: All filament circuit components; r-f bypass capacitors C108 and C117; mixer screen bypass capacitor C116; mixer screen resistor R109; a-g-c components L111, C105, C106, C107, C123, R102, R104 and R108; r-f amplifier cathode-bias resistor R101 and cathode-bypass capacitor C104.

The mixer plate transformer may be replaced and the main chassis alignment procedure used to obtain the proper bandpass characteristics. The replacement, repositioning or even the resoldering of C115, C118, L109 and L110 will affect the oscillator frequency. If one of these components is replaced, readjustment of the oscillator may be necessary.

When a Teleset is encountered in which the picture and sound are weak,

VOLTAGE MEASUREMENTS
Four Section Inputuner
RA-109A, RA-112A-113
(All readings to ground, No Signal)

Tube	1	2	3	4	5	6	7
V101	93V	93	Fil.	Fil.	0	0	1.04
V102	Ch. 13-1.5 Ch. 2-1.7V	0	—	—	55	52V	0
V103	150V	—	—	—	—	Ch. 13-3.35V Ch. 2-6.0 V	0

RESISTANCE MEASUREMENTS

Tube	1	2	3	4	5	6	7
V101	20K	20K	—	—	100K	100K	82 ohm
V102	1.1 meg.	0	—	—	58K	180K	0
V103	20K	—	—	—	—	12K	0

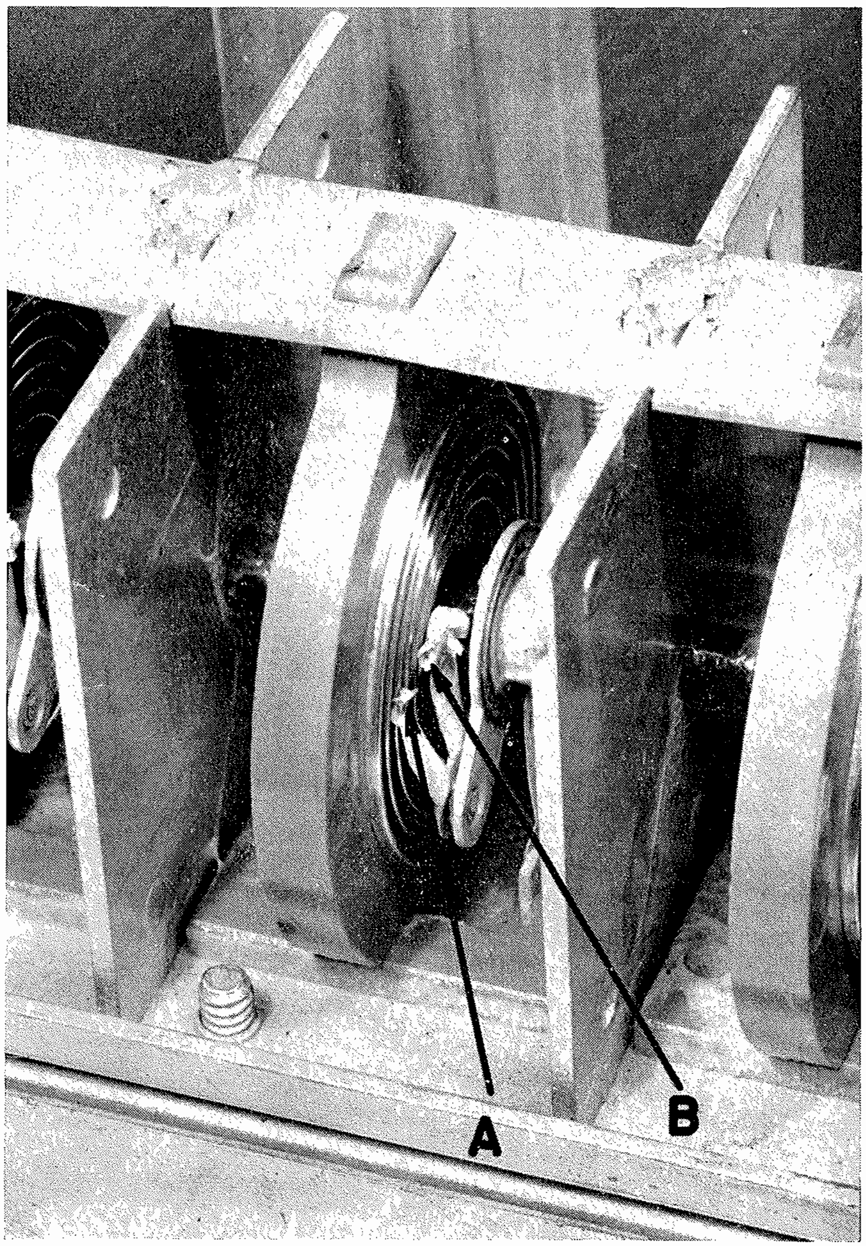


Figure T-1. Inductuner Spiral Section. A—Contact Arm, B—Shorting Bar.

and the tuner is suspected, the procedure previously outlined under "No Picture or Sound" should be followed.

The video i-f stages of the receiver, prior to the sound i-f take-off point, should be checked using the alignment procedure for the main chassis as a guide. Typical tuner defects which result in low-gain are shown in the table accompanying this article.

INTERMITTENTS

Tuner intermittents may be caused by faulty tubes, poor connections, dirty spiral trolley tracks and improper component dress in the oscillator circuit. One general rule to remember with regard to oscillator components is that no two should touch. Many microphonic, oscillation and intermittent conditions result from tuner components touching one another or the chassis. Faults which result in intermittent or microphonic tuner operation are shown in the troubleshooting chart accompanying this article.

TUNER COMPONENTS

Because of the high frequencies at which tuners operate, tubes and components are extremely critical. A minor tube defect which would not show up if the tube were used in an i-f or audio circuit will result in improper tuner operation. Since a conventional tube checker will not accurately determine whether or not a tube will operate satisfactorily in a tuner, the best method of checking Inputuner tubes is by substitution. When a fault has been isolated to a stage the tube should always be checked by substitution before proceeding further.

When replacing a tube, two or three should be tried and the one which gives the best performance chosen.

One rule which should be followed when servicing Inputuners is that exact replacement parts must always be used.

If difficulty is encountered in servicing Du Mont Inputuners, contact your distributor for assistance.

Troubleshooting Hints

Teleset: RA-109A, RA-112A, RA-113 and RA-117A

Symptom: Intermittent flashes and white streaks in picture, usually decreasing in intensity as the Teleset warms up. Irregular, intermittent spikes appear in the composite sync signal, as observed on an oscillograph.

Probable Fault: Intermittent short in the 6J6 r-f amplifier.

Remedy: Replace the 6J6.

Teleset: RA-112A, RA-113 and RA-117A

Symptom: No raster, no high voltage. When damper tube is removed, raster, with heavy horizontal fold-over, appears.

Probable Fault: C296, the .5 mf capacitor is defective.

Remedy: Replace C296.

Teleset: RA-112A, RA-113 and RA-117A

Symptom: Loss of vertical size as shown in Figure M-1. When the Vertical Size and Linearity controls are adjusted the picture can be made to fill the mask, but the vertical linearity is poor and there is packing at the top of the picture, as shown in Figure M-2.

Probable Fault: C294, the 30 mf capacitor bypassing the boosted B+ line to the vertical saw generator, is open.

Remedy: Replace C294.

Teleset: All Current Models

Symptom: Vertical fold-over at bottom of picture. Cannot be corrected with size or linearity control. Positive voltage on grid of vertical output tube.

Probable Fault: The .1 mf coupling capacitor at the grid of the vertical sweep amplifier is leaky or shorted. The symbol number of this capacitor is C258 in the RA-109A, C268 in the RA-112A, RA-113 and RA-117A.

Remedy: Replace the above capacitor.

DIRECTOR'S CORNER—(Cont'd)

anxious to increase his knowledge and do a good job servicing Telesets, there is almost no reason why he should not attend.

Competition is becoming increasingly keen in all phases of our industry. The service people who are going to survive and thrive will be those best mentally equipped. Here is an easy chance to increase your technical know-how.

We will be glad to accept applications from all authorized Dealers and Service Companies. Just drop us a note telling us about when you can make it and we'll advise you the closest open date available.

Why not "Come on to our School"?

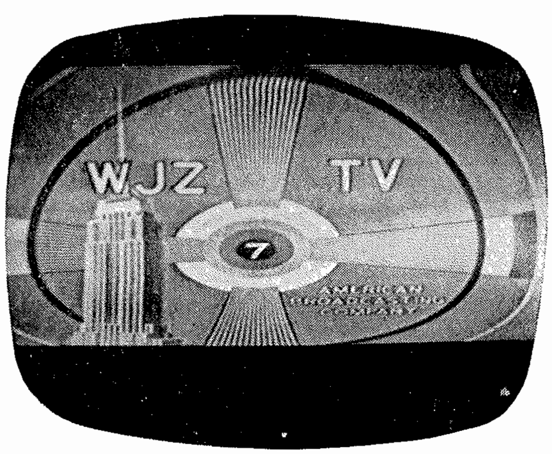


Figure M-1

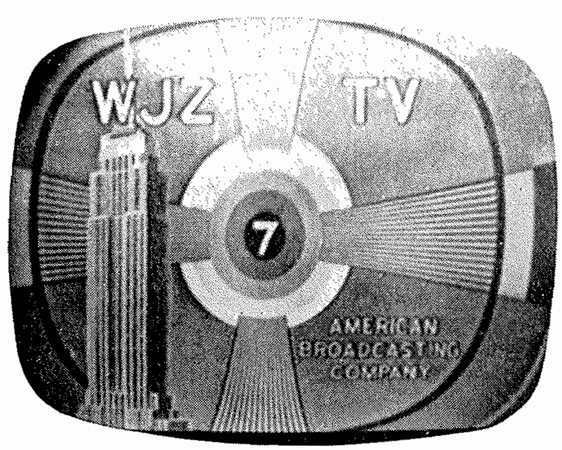


Figure M-2

DUMONT
First with the Finest in Television
SERVICE NEWS

Service News

A PUBLICATION OF THE TELESET SERVICE CONTROL DEPARTMENT
OF ALLEN B. DU MONT LABORATORIES, INC., EAST PATERSON, N. J.

Volume 1 | OCTOBER, 1951 | Number 9

DIRECTOR'S CORNER

BY

Harold J. Schulman

I am wondering whether the Service Industry is not missing the boat in a very important field — Public Relations.

Critics of Service seem to have a voice powerful enough to reach into national magazines and city council rooms. I believe it is time for the servicemen, through their service organization or association, to show themselves in public for what they really are: hard working, conscientious, and ambitious people, trying to master and do a good job on complex instruments produced by a relatively infant industry.

Just recently, I had occasion to speak before an audience of women shoppers at a large department store in New York. The interest in TV service shown by these homemakers is just impossible to describe. They kept me on the platform long beyond the time allotted, firing question after question.

"Does the set really have to go to the shop to be repaired?", "Will the little spot that glows after I turn my set off hurt my picture tube?", "Why does the man charge for two hours labor to replace a small part?", etc., etc.

These and many other questions are on our customers' minds. You may answer them all day long in your store or in the customer's home, but it's not the same as when it comes from a speaker on a platform.

A world of good can be accomplished if service companies, or associations, or even individual servicemen would offer volunteer speakers to address social clubs, business men's

(CONTINUED ON PAGE 64)

USING THE OSCILLOGRAPH FOR TELEVISION SERVICING

By Walter Boiko

> This is the first of a series of articles prepared in response to numerous requests from readers. Part I deals with the adjustment of the oscillograph controls. Subsequent articles will discuss the use of the instrument in troubleshooting.

The oscillograph is one of the most useful instruments available for servicing television receivers.

The purpose of this article is to provide a guide for the technician who wishes to learn to use the oscillograph and to help those who are now using the instrument to obtain maximum value from it.

While comparatively little knowledge of the oscillograph is necessary in order to use the instrument for servicing television receivers, a thorough knowledge of television receiver circuits is essential. To use the oscillograph you must know:

1. How to observe signals at the vertical sweep frequency.
2. How to observe signals at the horizontal sweep frequency.
3. Where and when to observe these signals.
4. How to analyze the signals observed.

Before discussing the use of the oscillograph, a review of some of its fundamentals will prove helpful.

The basic television receiver provides a good analogy of the oscillograph. The simplest type of oscillograph suitable for use in servicing television receivers, may be divided into six sections, as shown in the block diagram of Figure A-1.

As in the television receiver, the oscillograph includes a free running horizontal oscillator, called the time base generator, which is synchronized by applied signals. Unlike the horizontal oscillator in a television receiver the frequency of the oscillograph's horizontal oscillator is variable, so that signals of various frequencies may be observed on the instrument's CRT.

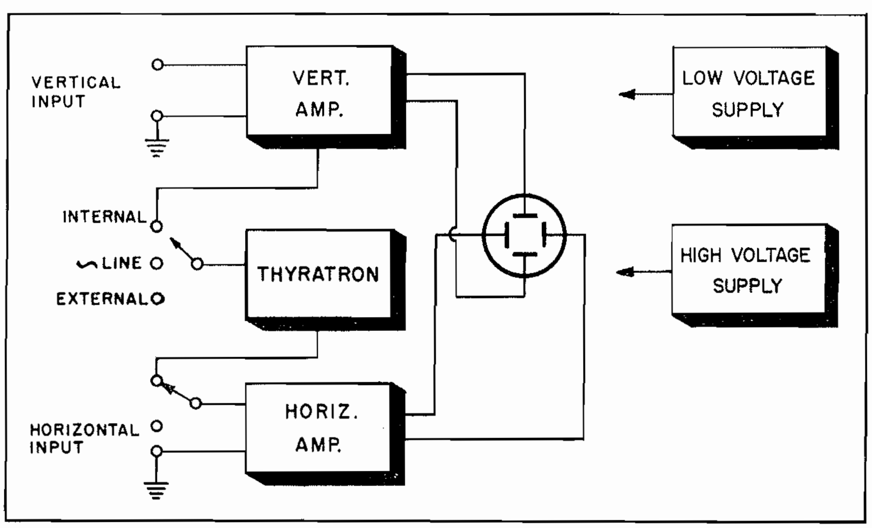


Figure A-1. Block Diagram of Simple Oscillograph.

Figure A-2. Front Panel Controls of the Du Mont Model 304 Oscillograph.

The horizontal oscillator in an oscillograph is usually of the thyratron sawtooth type. The output of the oscillator is a linear sawtooth signal. This signal is fed to the horizontal amplifier whose output is applied to the horizontal deflection plates of the CRT.

The oscillograph does not possess a vertical oscillator, as does the television receiver. It does however, possess a vertical amplifier whose purpose is to increase the amplitude of the signal to be observed in order to provide sufficient vertical deflection of the electron beam in the CRT.

The signal to be observed is applied to the vertical amplifier. Variations in the amplitude of the signal thus cause the beam to move in the vertical plane. The output of the horizontal oscillator is applied to the horizontal amplifier, causing the beam to move horizontally across the face of the CRT. Since the horizontal movement of the beam is linear with respect to time, the signal applied to the vertical amplifier is plotted graphically against time.

The oscillograph is therefore an instrument capable of plotting a signal graphically against a linear time base. The oscillograph has also been described as a time-calibrated voltmeter.

While it is not necessary to thoroughly understand the operation of oscillograph circuits in order to use the instrument, a thorough understanding of the functions of the front panel controls shown in Figure A-2 is required.

The frequency of the thyratron time-base generator is determined by a resistor and capacitor in its plate circuit.

The frequency range of the oscillator is varied by means of a switch and potentiometer which enable the user to connect different values of capacitance and resistance in its plate circuit. On some oscillographs the front panel controls accomplishing this are labeled "Sweep Range" and "Sweep Vernier," while on other instruments they are labeled "Coarse Frequency" and "Fine Frequency." The Sweep Range control is calibrated in cycles per second. The limits of each of the frequency ranges available are usually indicated. The control should be set to the position whose frequency limits include that of the signal to be investigated. The Sweep Vernier control provides a fine adjustment of the thryatron frequency.

In order to obtain a stationary pattern on the CRT screen, the frequency of the sweep generator must be synchronized with that of the signal to be observed. This is accomplished by applying a synchronizing signal to the grid of the thryatron. The frequency of this synchronizing signal must be equal to or a multiple of the frequency of the signal to be investigated.

Figure A-3 illustrates the input circuit of the thyratron. The "Sync Selector" switch enables the thyratron input circuit to be synchronized with any one of three signal sources, as shown in Table 1.

All oscillographs do not provide for the use of the 60 cycle line voltage as a synchronizing signal source.

The "Sync Amplitude" control varies the amplitude of the synchronizing voltage. In the circuit of Figure A-3 the thyratron is synchronized by the positive portion of the sync signal.

In some oscillographs, such as the Du Mont 224A or 304H, the Sync Amplitude control permits the user to select the positive or negative portion of the synchronizing signal. This is accomplished by the sync amplifier circuit shown in Figure A-4. Since the cathode and plate voltages of the sync amplifier are 180° out of phase with each other, the center arm of the Sync Amplitude control (R28) may be adjusted to secure a positive or negative voltage. Oscillographs incorporating this feature have a polarity designation on the front panel Sync Amplitude control. This is shown in Figure A-2.

The Sync Amplitude control should be adjusted to apply just enough sync voltage to the grid of the thyratron to secure a stable pattern on the face of the CRT. Too much voltage on the grid of the thyratron will usually result in a distorted or unstable waveform.

The waveforms in practically all of the circuits in a television receiver may be observed by synchronizing the oscillograph with the vertical sweep frequency (60 cps) or with the horizontal sweep frequency (15,750 cps), depending upon the circuit involved. If you have not previously used the oscillograph for television servicing you should learn to set up the instrument for observation of waveforms at these frequencies, by practicing on a properly operating television receiver. The following paragraphs give a brief step-by-step procedure for examining a 60 cycle waveform. To examine a 15,750 cps waveform, the same procedure may be used with the exception of the setting of the Sweep Range and Sweep Vernier controls.

Referring to the front panel controls of the Du Mont 304H oscillograph, and assuming that we wish to observe a signal at the vertical sweep frequency of 60 cycles, the oscillograph controls should be adjusted in the following manner:

1. Allow a 30-second warm-up period after turning the instrument on and rotating the Intensity control clockwise.
2. Center the Vertical and Horizontal Positioning controls in their range.
3. When a trace appears set the Intensity and Focus controls for suitable brightness and sharpness.
4. Center the trace on the screen by adjusting the Vertical and Horizontal Positioning controls.
5. Connect the Vertical Input terminals of the oscillograph to the circuit to be investigated.
6. Set the Sync Selector switch in the Internal position.
7. Set the Sweep Range control on the marker between 50 and 250 cycles.
8. Rotate the Sweep Vernier or Fine Frequency control slowly until the signal is almost stationary on the screen; then rotate the Sync Amplifier control clockwise just enough to obtain a stationary pattern.
9. Set the Vertical and Horizontal Amplifier controls to secure a trace of suitable height and width.
10. Readjust the Horizontal and Vertical Positioning controls to center the trace on the screen.

When observing signals at the vertical frequency (60 cps) the pattern on the oscillograph is usually more stable when the sync selector switch is in the line position. This is true only if the power line frequency at the transmitter is in phase with the power line frequency at the serviceman's shop. If a stable pattern is not obtained with the Sync Selector switch in the Line position, the switch should be placed in the Internal Position.

Signals at the horizontal frequency may be observed on the oscillograph by placing the Sweep Range control at the marker between 6K and 30K. The Sync Selector switch should be in the Internal Position so that the thyratron may be synchronized by a signal whose frequency is equal to the horizontal sweep frequency (15,750 cps). It is also possible to synchronize the thyratron by applying a signal to the External Sync terminal on the front panel of the instrument. If this is done, the Sync Selector switch should be in the External Sync position.

One of the common mistakes which servicemen make when using the oscillograph to observe signals at the horizontal sweep frequency is placing the Sync Selector switch in the Line position. Obviously a stationary pattern cannot be obtained when the Sync Selector switch is in this position.

GETTING ACQUAINTED WITH THE OSCILLOGRAPH

The oscillograph is very valuable when attempting to isolate a defective stage of a television receiver. The

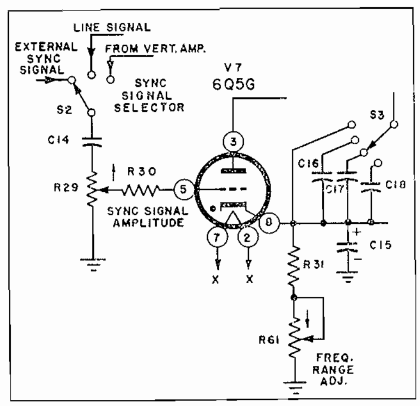


Figure A-3

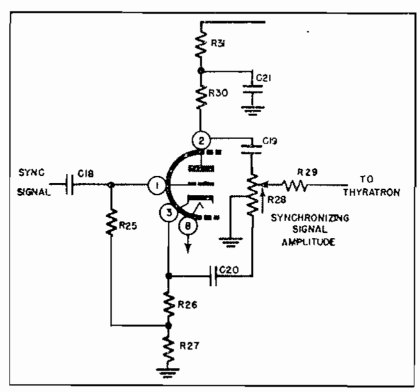


Figure A-4

TABLE 1

	Synchronizing Signals	Sync. Selector
1.	The signal applied to the vertical input terminals	Internal
2.	The 60 cycle reduced line voltage signal	Line
3.	An external signal applied to the "external sync" terminal on the front panel	Ext. Sync

majority of Du Mont Teleset schematics show the waveforms at important points in the receiver circuit. These waveforms are taken with an oscillograph connected to a receiver which is operating normally. The technician should become familiar with these waveforms so that he can make use of them when troubleshooting with the oscillograph.

One way to obtain this familiarity is to practice on a normal operating receiver. The vertical input terminals of the oscillograph should be connected to the points indicated on the schematic and the waveform displayed on the instrument's CRT drawn and compared with that shown on the schematic.

All oscillographs do not have the same frequency characteristics. For example, Figure A-5 illustrates the horizontal sync pulse as photographed on two oscillographs — one having a frequency response of 1 mc and the other of 30 kc. It is therefore important that the waveforms be drawn exactly as they appear on the instrument used, since its characteristics may alter the waveshapes slightly. In this way you will avoid being misled by slight waveform changes resulting from differences in oscillograph response characteristics.

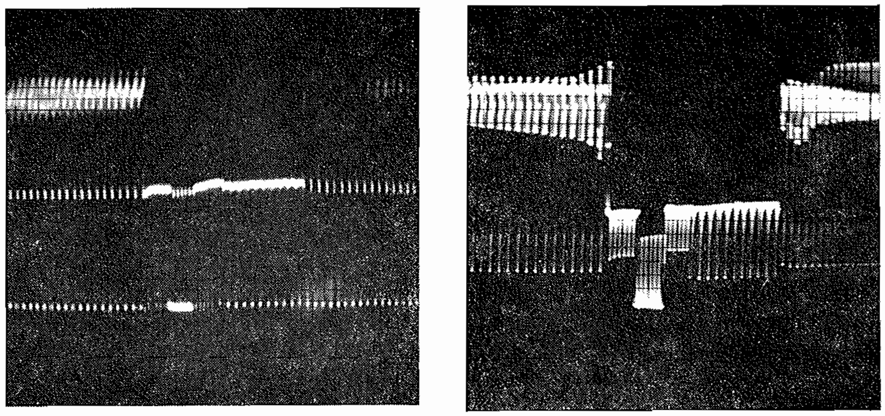


Figure A-5. Left: Sync Signal Displayed on 1 mc Oscillograph.
Right: Same Signal on 30 kc Oscillograph.

In troubleshooting a television receiver the defective stage is isolated by observing the waveforms in suspected stages. If a waveform as observed on the oscillograph does not coincide with that shown on the schematic, voltage and resistance measurements are made to locate the exact component causing the trouble. The experienced technician can usually go further than this by analyzing abnormal waveforms and by calibrating the oscillograph and measuring the peak-to-peak amplitudes of the waveforms observed. In many cases he can locate a faulty component without making voltage and resistance measurements.

In the next article the use of the oscillograph in troubleshooting television receivers will be discussed in greater detail.

TUBE SUBSTITUTIONS

The shortage of certain critical tubes, during the past year, resulted in the shipment of Telesets having a tube complement other than shown on our schematic diagrams. These tube substitutions were subjected to exhaustive tests to assure performance equal to or better than the original. Some of the substitutions were such that the original tube and its substitute are directly interchangeable. Other substitutions require either a wiring or a socket change.

Telesets in which a tube substitution has been made are identified by a code number stamped on the rear of the chassis. In order to assist the serviceman, an explanation of the tube substitution code numbers follows:

Code 1

6CB6 was substituted for the 6AH6

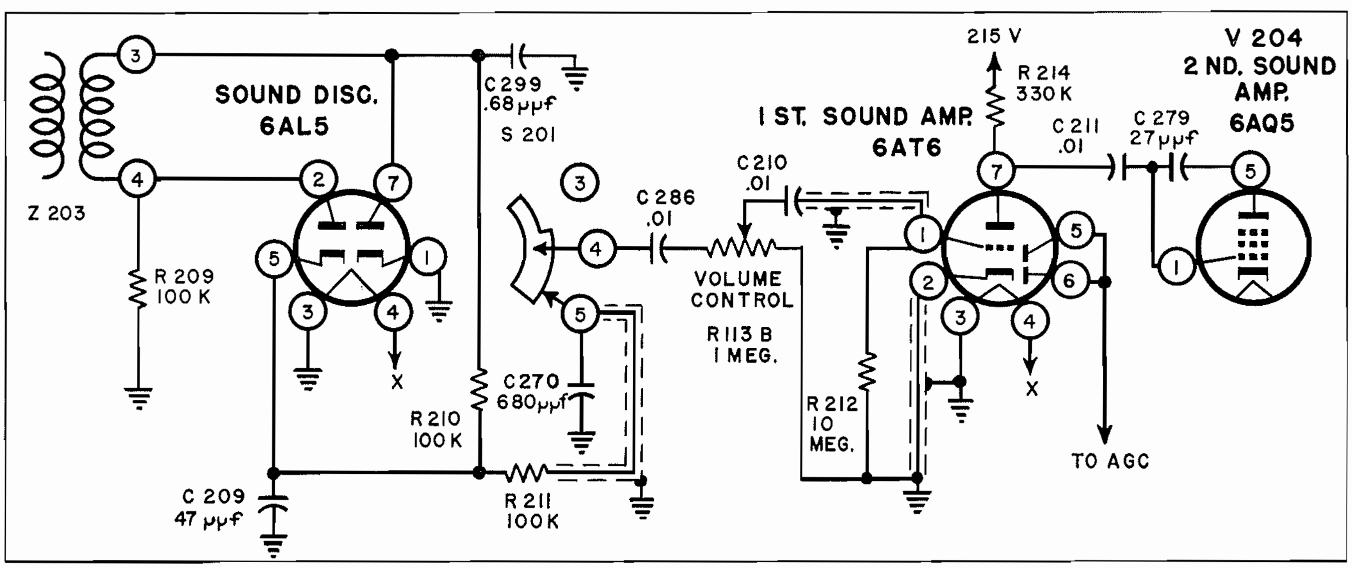


Figure S-1. Circuit Changes for Code 8.

in the video amplifier (V210, RA-112A — RA-113). This substitution required the rewiring of V210 — pins 2 and 7 were interchanged, the plate circuit was removed from the 305 volt source and connected to the 200 volt source.

Code 2

Substitutions contained in Codes 1, 4 and 5.

Code 3

Substitutions contained in Codes 4 and 5.

Code 4

Two 6BA6s were substituted for the two 6AU6s in the a-g-c biased video i-f stages.

Code 5

6BC5 has been substituted for the 6AU6 in the first sync clipper (V219, RA-112A — RA-113).

Code 6

Tube substitutions contained in Code 5, plus the substitution of a 6AC7 for the 6AH6 in the video amplifier (V210, RA-112A — RA-113). Refer to RA-112A — RA-113 schematic diagram, 3rd edition for wiring changes.

Code 7

Substitutions contained in Codes 6 and 8.

Code 8

A 6AL5 and a 6AT6 were substituted for the 6T8 in the Sound Discriminator and 1st Sound Amplifier (V203, RA-112A — RA-113). The circuit changes are shown in Figure S-1.

Code 9

A 6BC6 tube was substituted for the 6BC5 in the 4th video i.f. This substitution required the addition of a jumper between pins 7 and 8 of the tube socket.

MODIFYING THE RA-105 AGC

During warm humid weather, difficulty is sometimes encountered with the a-g-c circuits of early production RA-105 Telesets. The symptoms observed are fading of the picture and sound. A check of the components and circuits involved usually indicates that they are operating normally.

When the above conditions are encountered, the circuit changes described below, and illustrated in Figure B-1 should be made. These changes were incorporated in all RA-105 chassis manufactured after March, 1949.

1. Remove R218, the 1.2 meg one-half watt resistor connected to pin 5 of V204.
2. Disconnect the blue lead connected to terminal strip A (Figure B-1). Disconnect the other end of this lead and remove it from the cable through which it passes.
3. Remove R244, the 220K resistor connected to pin 5 of V209.
4. Reconnect R244 to terminal strip B as shown in Figure B-1.

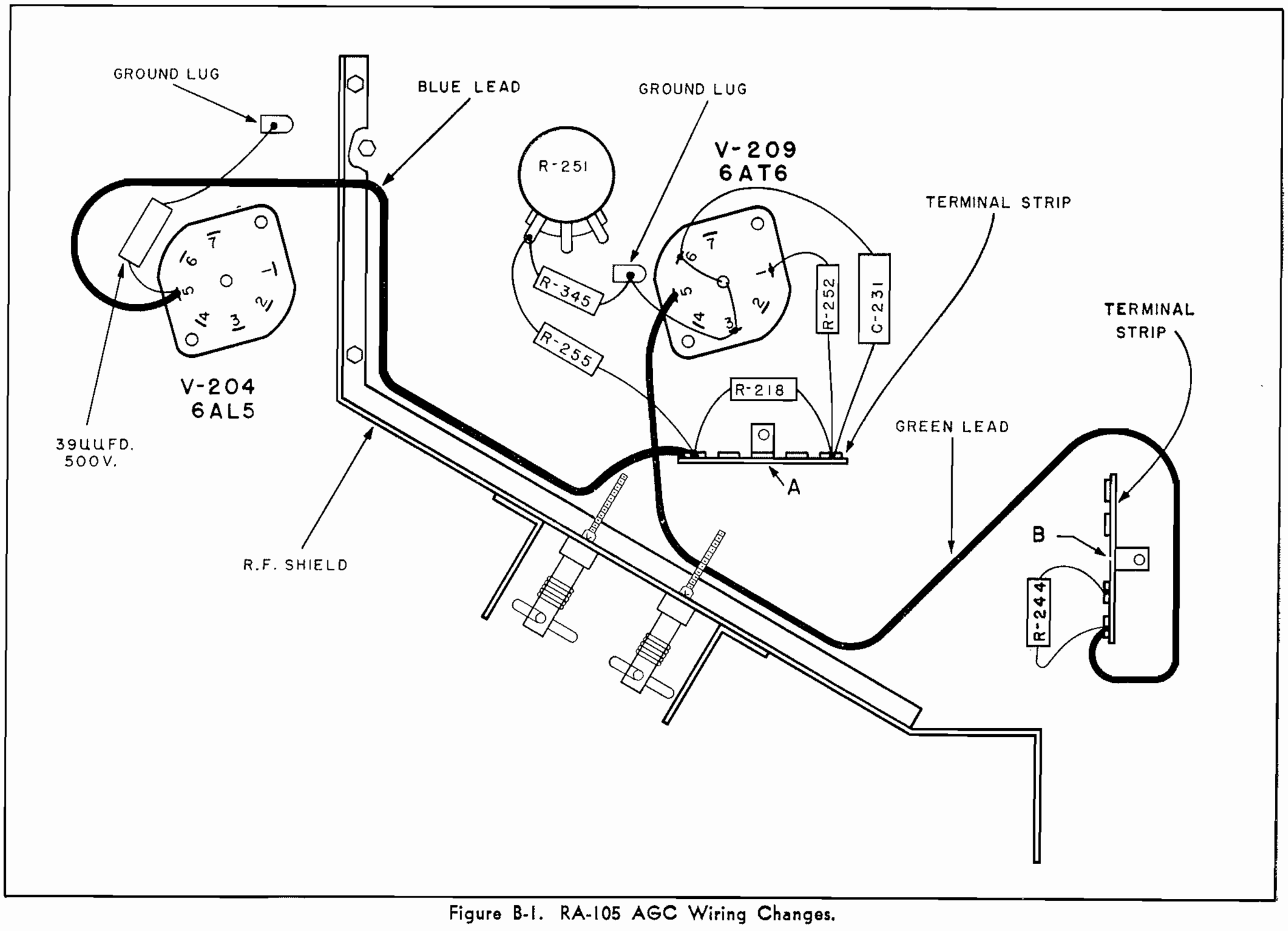


Figure B-1. RA-105 AGC Wiring Changes.

5. Disconnect the green lead from terminal strip A and reconnect it to pin 5 of V209.

6. Disconnect the other end of the green lead and reconnect it to terminal strip B, as shown in Figure B-1.

7. Remove R255 (4.7 meg), R345 (390 ohm), R252 (1.2 meg), and C231 (.05 mf).

8. Connect the blue lead, removed in step 2, to pin 5 of V204, run it through the hole in the r-f shield, as shown in Figure B-1, and connect it to terminal strip A. Do not solder lead to pin 5 of V204.

9. Connect a 470K, one-half watt, resistor (R218) between the end terminals of terminal strip A, as shown in the figure.

10. Connect a second 470K, one-half watt, resistor (R255) from the a-g-c potentiometer (R251) to terminal strip A, as shown in Figure B-1.

11. Connect a 560 ohm, one-half watt, resistor (R345) from the a-g-c potentiometer (R251) to the ground lug shown in Figure B-1.

12. Connect a 39 mmf capacitor from pin 5 of V204 to ground as shown in the illustration.

13. Connect a 220K, one-half watt resistor (R252) from pin 1 of V209 to terminal strip A as shown.

14. Connect a .1 mf, 200V, capacitor (C231) from pin 6 of V209 to terminal strip A.

Parts Required

R218	02 032 090	470K ½W
R252	02 032 050	220K ½W
R255	02 032 090	470K ½W
R345	02 031 740	560 ohm ½W
C231	03 013 910	.1 mf 200V
	03 017 030	39 mmf 500V ceramic

TROUBLESHOOTING HINTS

Teleset: RA-103D, RA-104A, RA-110A, RA-106A and RA-108A

Symptom: Low high voltage or no high voltage.

Probable Fault: Carbonized corona shield stand-off insulator. These insulators are sometimes cracked when the screw holding the insulator to the shield is drawn too tight. Moisture enters the crack producing high-voltage leakage which eventually carbonizes the insulator.

Remedy: Replace the defective insulator.

Teleset: RA-109A, RA-112A, RA-113, RA-116A and RA-117A

Symptom: High voltage fuse blows out repeatedly. A check of the high voltage circuits indicates normal operation.

Probable Fault: Intermittent short in the 5U4G, low voltage rectifier. An intermittent tube will usually produce a bright flash when struck with a pencil or similar object.

Remedy: Replace the defective tube.

Teleset: RA-111A, RA-112A, RA-113 and RA-120A

Symptom: Adjustment of horizontal hold control changes the width of the picture but has no effect on the horizontal sweep frequency. Negative voltage on pin 2 of the horizontal a-f-c and saw-generator tube, V214.

Probable Fault: C244 the .05 capacitor at the plate of the horizontal a-f-c tube is shorted.

Remedy: Replace C244 and realign the horizontal oscillator transformer, Z210.

Teleset: RA-112A and RA-113

Symptom: Microphonic noise in picture and sound.

Probable Fault: The stator plate of trimmer capacitor C118 in the oscillator circuit of the tuner is loose.

Remedy: Apply a hot soldering iron to the top of the stator terminal, as shown in Figure T-1A. The chassis should be turned upside down and a small amount of additional solder applied — if necessary — so that solder will run down through the center of the rivet and form a rigid joint between the stator and the terminal, as shown in Figure T-1B.

Teleset: RA-112A, RA-113 and RA-117A

Symptom: Loss of horizontal sync.

Probable Fault: C241 at the grid of the horizontal a-f-c tube, V214, is leaky.

Remedy: Replace C241. Since leakage resistances as high as 300 megs. will cause this symptom, the most dependable method of checking the capacitor is by substitution. Use only an exact replacement part.

Teleset: RA-117A

Symptom: Low sensitivity. The symptom may occur on the high band and the low band simultaneously, or on one and not the other.

Probable Fault: The Allen-head screws in the fiber form on which the r-f coils of the Inputuner (L114 and L115) are mounted are loose, and the form is not rotating properly. L114

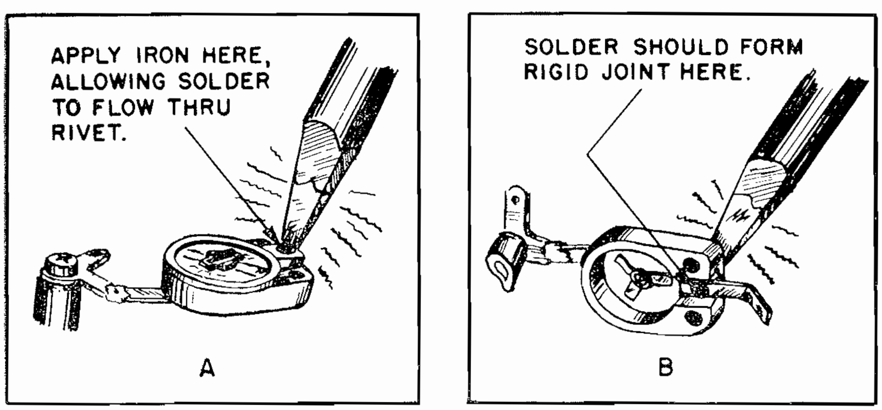


Figure T-1

and L115 are mounted on a small fiber form which is free to rotate and is coupled to the gear train by a small metal shaft. Two Allen-head screws fasten the form to the metal shaft so that it rotates with the shaft.

Remedy: Remove the tuner from the main chassis and take off the tuner bottom-cover plate. Remount the tuner on the main chassis. Tune the Teleset to a high channel station, rotate L114 and L115 until optimum sound and picture are obtained and tighten the Allen-head screws. When tightening the Allen-head screws, care should be exercised to avoid stripping the threads or cracking the fiber form. Check the tuner on all available channels. It may be necessary to make a slight re-adjustment of the coils to secure optimum performance on all channels. When the adjustment has been completed, remove the tuner, replace the bottom cover and remount the tuner on the main chassis.

PRODUCTION CHANGES

RA-109A

Change No. 46 (ECN-5167)

Reason:
To improve vertical linearity.
Procedure:
Remove R297, near V220, and replace with a 3K, 5% ½W resistor.
Parts Required:

SYMBOL	PART NUMBER	DESCRIPTION
R297	02 030 590	Res F C 3K 5% ½W
	02 040 590	
	02 050 590	

The first chassis so modified is:
RA-109A — No. 0962214 Coded "ZZ"

Change No. 47 (ECN-5190)

Reason:
To reduce the possibility of picture wobble due to interaction between the sound and picture. The wobble is caused by coupling through the B+ line which permits low audio frequencies to enter the video circuits. The change consists of the addition of a B+ bypass capacitor.
Procedure:
Connect C259, a 30 mf capacitor from pin 4 of V207 to the ground lance on the Inputuner mounting plate. The negative capacitor lead should be connected to ground. Cover lead to pin 4 of V207 with spaghetti. The capacitor is held in place by a clamp attached to one of the Inputuner mounting screws.

C259	03 019 340	Cap E 30 mf 450V
	35 000 260	Mounting clamp, capacitor

Change No. 48 (ECN-4942)

Reason:
Same as RA-112A — RA-113 — RA-120A, Change No. 53
The first chassis so modified is:
RA-109A — No. 0961734 Coded "ZZ"

Change No. 49 (ECN-4941)

Reason:
To eliminate the pattern of wavy lines sometimes observed when receiving Channel 10. This interference is caused by the ninth harmonic of the sound i-f carrier producing a 2.5 mc beat with the Channel 10 video carrier. Refer to September issue of Du Mont Service News Figure 1, page 49 for illustration of the interference.
Procedure:
1. Move the ground end of the lead connected to pins 4, 5 and 10 of V206, to the ground lance to which pin 8 of V206 is connected.
2. Connect C242 between pin 5 of V204, and the ground lance to which the lead from pins 4, 5 and 10 of V206 was originally connected.
3. Connect C252 between pin 3 of V206 and the ground lance to which pin 8 of V206 is connected.
4. Connect C248 between the junction of C209 and R209, and the ground lance to which C209 is connected.

Parts Required:

SYMBOL	PART NUMBER	DESCRIPTION
C242	03 020 080	Cap M 47 mmf 10% 500V
	03 015 300	
	03 012 730	
C248	Same as C242	
C252	Same as C242	

The first chassis so modified is:
RA-109A — No. 0961734 Coded "ZZ"

RA-112A

Change No. 55 (ECN-4867)

Reason:
To reduce "snow" on weak signals. The a-g-c delay voltage is increased, resulting in an increase in signal level at the grid of the first i-f stage when receiving weak signals. This enables the signal to override the snow caused by tube noise in the i-f amplifiers.
Procedure:
Remove R265, near V203, and replace with an 8.2 meg, 10% ½W resistor.
Parts Required:

SYMBOL	PART NUMBER	DESCRIPTION
R265	02 032 240	Res F C 8.2 meg 10% ½W
	02 042 240	
	02 052 240	

The first chassis so modified is:
RA-112A — No. 1260552 Coded "AL"

Change No. 56 (ECN-4869)

Reason:
With the substitution of a 6CB6 for the 6AK5 in the Inputuner mixer stage, it has been necessary to change the mixer circuit to maintain the high-band sensitivity of the tuner.
Procedure:
The video if input circuit is modified to use a twinex tuner link.
Parts Required:

PART NUMBER	DESCRIPTION
89 003 915	Inputuner assembly

The first chassis so modified is:
RA-112A — No. 1260552 Coded "AL"

RA-112A - RA-113

Change No. 57 (ECN-4845)

Reason:
Same as RA-117A, Change No. 20.
The first chassis so modified are:
RA-112A — No. 1260551 Coded "AL"
RA-113 — No. 1355006 Coded "AJ9"

RA-117A

Change No. 23 (ECN-4874)

Reason:
Same as RA-112A — RA-113, Change No. 52.
The first chassis so modified is:
RA-117A — No. 1718614 Coded "K"

Change No. 24 (ECN-5148)

Reason:
Same as RA-112A — RA-113 — RA-120A, Change No. 53.
The first chassis so modified is:
RA-117A — No. 1723653 Coded "L"

Antenna Installation Booklet

Television and f-m antenna installation is the subject of an interesting and authoritative booklet published by the National Fire Protection Association. Entitled, "Is Your Antenna Safely Installed," the booklet describes the proper methods of installing antennas to insure that they will be safe from "damage by wind, ice loading, lightning and other hazards." Common installation mistakes which lead to injury and property damage are illustrated and remedies given in each case. The construction practices described are in accordance with the provisions of the National Electrical Code and the Underwriters' Laboratories.

All technicians who are in any way connected with antenna installation and maintenance should be familiar with the material contained in this informative booklet. Copies may be secured by sending 25 cents to the National Fire Protection Association, 60 Batterymarch Street, Boston, Massachusetts.

AGC NEEDS CHECK WHEN STATIONS INCREASE POWER

A number of TV stations have recently been authorized to increase their effective radiated power. In many installations such a power increase will result in the need for readjustment of the a-g-c control.

If a customer complains of horizontal pull when his receiver is tuned to a station which has just increased its power, try carefully turning the a-g-c adjustment clockwise. This will usually eliminate the difficulty.

DIRECTORS CORNER (Cont.)

groups, or audiences assembled in stores or anywhere else, for that matter.

We all talk about educating the consumer about service. Who is better qualified than the articulate responsible serviceman himself? Speaking to customers over the phone, or on a service call, he is just another serviceman. Place him on a platform or a stage and the magic of the spotlight transforms him into a respected authority.

In this way many doubts can be dispelled, fears allayed, and misconceptions corrected. The concerted voice of intelligent, legitimate service people can drown out the noise of those who dwell only on the mal-practices of the minority. Let that voice be heard.

PHONO EQUALIZING NETWORKS

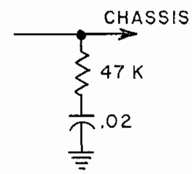
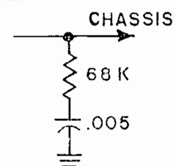
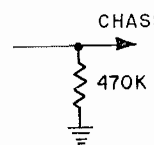
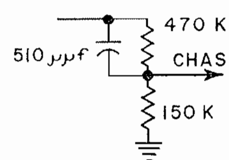
To obtain the best quality of reproduction from recordings, the pickup cartridge used must operate into a properly designed load.

In Du Mont Telesets this load is provided in the form of an RC equalizing network connected in the grid circuit of the tube into which the pickup operates.

If a cartridge is replaced with another type, results will not be satisfactory unless the RC network is changed.

The table below lists the cartridges and networks used in Du Mont Telesets.

In all Telesets, with the exception of the RA-120, the networks are mounted on small brackets attached to the cabinet. In the RA-120 the network is located on the phonograph.

Teleset		Cartridge	Network
Hampshire	RA-101	Astatic Nylon (199) IJ	
Westminster I	RA-101		
Devonshire	RA-101		
Plymouth	RA-101		
Revere	RA-101		
Sherwood	RA-101		
Savoy (early)	RA-103C		
Winthrop (early)	RA-103C		
Savoy (late)	RA-103C	Webster-Chicago V42-2	None
Winthrop (late)	RA-103C		
Colony	RA-105A		
Wellington	RA-104A	Astatic LQD-IJ	
Tarrytown	RA-113	Webster Electric AI-8	
Bradford (early)	RA-108A	Sonotone WX7530	None
Bradford (late)	RA-108A	Sonotone WX7530X	
Sherbrooke (early)	RA-109A	Sonotone WX7580	
Westminster II	RA-116A	Sonotone WX7580	
Sherbrooke (late)	RA-109A	Webster Electric A7-8	
Tarrytown	RA-120		

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First with the Finest in Television
SERVICE NEWS

Service News

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Volume 1 NOVEMBER, 1951 Number 10

DIRECTOR'S CORNER

BY

Harold J. Schulman

As manufacturers, we are vitally concerned with the serviceability of our Telesets. We recognize that there is a direct relationship between cost of service and customer acceptance.

Obviously, a set that is physically easier to service will cost less to service, when service is required.

Since we recognize that our industry can grow and thrive only if the service industry grows and thrives with it, we are presently engaged in an energetic drive to incorporate every available servicing aid in our future designs.

Fortunately, service-industry spokesmen have been very helpful with their suggestions. This makes our job that much easier.

Such items as above-chassis test points, careful placement of components, easy accessibility of adjustments, unblocked small-tube layouts, and other suggestions are being carefully considered.

From what we can already see on the drawing board, we believe that the next chassis we introduce will be one of the easiest chassis on the market to service.

While we can't give you the details now, we can promise you some pleasant surprises.

At Du Mont, the Service Department is constantly looking for ideas that will aid the serviceman in his daily tasks. Whether it's in chassis design, circuit diagram, service bulletins, or any of the many other activities that make the service world go round, we are on the lookout for constructive ideas that will help maintain our sets in the field at the lowest cost to the consumer, consistent with a fair return to the serviceman.

Interchanging Du Mont Inputuners

Several design changes have been made in the Inputuners used in RA-109A, RA-112A and RA-113 receivers since these Telesets first went into production. The purpose of the changes was to improve the performance of the tuners, based upon experience gained from the observation of thousands of units already in the field.

Each time an important change was made a new part number was assigned to the tuner. Tuners, intended for use in the same Teleset model but having different part numbers, can be interchanged; usually with minor wiring changes in the main chassis. Information for making these changes is given in the following paragraphs. It is generally advisable to use an exact duplicate when replacing a tuner, however, when an exact replacement is not available another tuner designed for use with the Teleset may be used.

RA-109A Tuners

Four Inputuners have been used in the RA-109A. Three of these tuners (89 003 011, 89 003 013 and 09 003-015) are of the skip-band type— they skip the frequencies between the f-m band and Channel 7. The fourth (89-003 002) is of the non-skip-band type — it tunes through the range between the f-m band and Channel 7.

The skip-band tuners (89 003 011, 89 003 013 and 89 003 015) are directly interchangeable; that is, they may be interchanged without physical or electrical modifications to the tuner or the main chassis. While it is possible to substitute a non-skip-band tuner for a skip-band unit, it is not recommended. To substitute a skip-band tuner for a non-skip-band tuner the tuner mounting bracket must be changed, and the grid circuit of the first video i-f stage, shown in Figure T-1, must be changed to the circuit as shown in Figure T-2. A procedure for making these changes is given below.

1. Disconnect all tuner leads and remove the tuner.
2. Disconnect all leads from the terminal strip and the ground lance on the tuner mounting bracket, and remove the bracket.
3. Replace the tuner mounting bracket using part number 35-010 291 and rewire all leads removed from the terminal strip and ground lance in step 3.
4. Mount the skip-band tuner on the mounting bracket and reconnect all tuner leads with the exception of the twinex output lead.
5. Disconnect and remove Z205.
6. Drill a ¼ inch hole in the main chassis between Z205 and the tuner, ½ inch from Z205.
7. Replace Z205 with part number 20 005 211 and mount L215 (part number 21 006 781) in the ¼ inch hole.
8. Connect R237, a 2.7K ½ watt resistor (part number 02 030 580), from pin 4 of Z205 and pin 1 of V208 to the junction of C226 and R383, (Figure T2).
9. Connect the tuner twinex output lead across L215 and ground the end of L215 to which the tinned twinex lead is connected.
10. Connect the ungrounded end of L215 to pin 2 of Z205.
11. Realign the mixer output transformer, L215 and Z205.

RA-112A and RA-113 Tuners

Six Inputuners have been used in RA-112A and RA-113 Telesets. For purposes of discussion they may be divided into four groups as shown below:

Group #1 .... 89 003 915

Group #2 .... 89 003 912
89 003 913

(NOTE: 89 003 913 stamped either 3913 or 3914)

Group #3 .... 89 003 902
89 003 911

Group #4 .... 89 003 901

Tuners in the same group are directly interchangeable. To interchange tuners in different groups the coupling circuit in the grid of the first video i-f stage must be modified. When changing a tuner all tuner lead connections, with the exception of those of the mixer output leads, are the same. After a tuner change has been made the mixer output transformer and the first video i-f stage should be aligned. The modifications which are required when changing RA-112A and RA-113 tuners are described below:

To Substitute Tuners in Group 1 for Group 2

1. Disconnect all tuner leads and remove the tuner.
2. Disconnect the ground lead from C301.
3. Mount the substitute tuner. Connect the tuner twinex output lead across C301, with the tinned wire to the side of C301 which was originally grounded, as shown in Figure T3. Connect all other tuner leads as they were originally connected.
4. Realign the mixer output transformer, Z204 and C301.

To Substitute Tuners in Group 2 for Group 1

1. Disconnect all tuner leads and remove the tuner.
2. Ground the free side of C301.
3. Mount the substitute tuner. Connect the tuner output lead to the junction of C301 and Z204-3 as shown in Figure T4. Connect all other tuner leads as they were originally connected.
4. Realign the mixer output transformer, Z204 and C301.

NOTE. C299 (20 mmf capacitor, part number 03 055 510) is not required if proper i-f bandpass can be obtained without it.

To Substitute Tuners in Group 1 for Group 3

1. Disconnect all tuner leads and remove the tuner.
2. Disconnect and remove L213.
3. Disconnect and remove Z204.
4. Mount new Z204 (part number 20 005 351).
5. Connect C213, a 100 mmf capacitor (part number 03 055 680) between Z204-4 and pin 1 of V205.
6. Mount a capacitor standoff in the chassis hole from which L213 was removed. The standoff consists of a mounting spring (part number 35 001 040) and a post (part number 35 001 541).
7. Mount C301, an 8-50 mmf variable capacitor (part number 03-017 500) on the standoff in step 6. Use a locknut (part number 61 010 510) to hold C301 in place.
8. Connect the stator of C301 to Z204-3.
9. Mount the substitute tuner. Connect the tuner twinex output lead across C301, with the tinned wire to the free side of C301 as shown in Figure T3. Connect all other tuner leads as they were originally connected.
10. Realign the mixer output transformer, Z204 and C301.

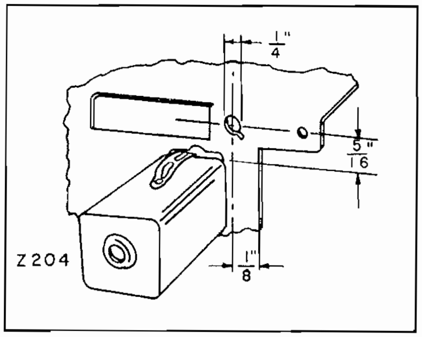

Figure T-7.

To Substitute Tuners in Group 2 for Group 3

1. Disconnect all tuner leads and remove the tuner.
2. Disconnect and remove L213.
3. Disconnect and remove Z204.
4. Mount new Z204 (part number 20 005 351).
5. Connect C213, a 100 mmf capacitor (part number 03 055 680) between Z204-4 and pin 1 of V205.
6. Mount a capacitor standoff in the hole from which L123 was removed. The standoff consists of a mounting spring (part number 35 001 040) and a post (part number 35 001 541).
7. Mount C301, an 8-50 mmf variable capacitor (part number 03-017 500) on the standoff in step 6. Use a locknut (part number 61 010 510) to hold C301 in place.
8. Ground the rotor of C301 and connect C301 stator to Z204-3.
9. Mount the substitute tuner. Connect the tuner output lead to the junction of C301 and Z204-3, as shown in Figure T4. Connect all other tuner leads as they were originally connected.
10. Realign the mixer output transformer, Z204 and C301.

NOTE: C299 (20 mmf capacitor, part number 03 055 510) is not required if proper i-f bandpass can be obtained without it.

To Substitute Tuners in Group 3 for Group 1 or 2

1. Disconnect all tuner leads and remove the tuner.
2. Remove C301 and its standoff post.
3. Remove C213.
4. Remove Z204.
5. Mount new Z204 (part number 20 005 211).
6. Mount L213 (part number 21-006 781) in the hole from which C301 was removed.
7. Connect Z204-4 to pin 1 of V205.
8. Connect one end of L213 to ground and the other end to Z204-2.
9. Mount the substitute tuner. Connect the tuner twinex output lead across L213 with the tinned wire to ground, as shown in Figure T5. Connect all other tuner leads as they were originally connected.

10. Realign the mixer output transformer, Z204 and L213.

To Substitute Tuners in Group 1 for Group 4

1. Disconnect all tuner leads and remove the tuner.
2. Remove Z204.
3. Connect R332, a 2.7K ½ watt resistor (part number 02 030 580), between the junction of R218, C214 and pin 1 of V205.
4. Drill a ¼ inch hole in the chassis near Z204, as shown in Figure T7.
5. Mount a capacitor standoff in the hole drilled in step 4. The standoff consists of a mounting spring (part number 35 001 040) and a post (part number 35 001 541).
6. Mount C301, an 8-50 mmf variable capacitor (part number 03-017 500), on the standoff in step 5. Use a locknut (part number 61 010 510) to hold C301 in place.
7. Mount new Z204 (part number 20 005 351).
8. Connect C213, a 100 mmf capacitor (part number 03 055 680), between Z204-4 and pin 1 of V205
9. Connect the stator of C301 to Z204-3.
10. Mount the substitute tuner. Connect the tuner twinex output lead across C301, with the tinned lead to the free end of C301 as shown in Figure T3. Connect all other tuner leads as they were originally connected.
11. Realign the mixer output transformer, Z204 and C301.

To Substitute Tuners in Group 2 for Group 4

1. Disconnect all tuner leads and remove the tuner.
2. Remove Z204.
3. Connect R332, a 2.7K ½ watt resistor (part number 02 030 580), between the junction of R218, C214 and pin 1 of V205.
4. Drill a ¼ inch hole in the chassis near Z204, as shown in Figure T7.
5. Mount a capacitor standoff in the hole drilled in step 4. The standoff consists of a mounting spring (part number 35 001 040) and a post (part number 35 001 541).
6. Mount C301, an 8-50 mmf variable capacitor (part number 03-017 500) on the standoff in step 5. Use a locknut (part number 61 010 510) to hold C301 in place.
7. Mount new Z204 (part number 20 005 351).
8. Connect C213, a 100 mmf capacitor (part number 03 055 680), between Z204-4 and pin 1 of V205.
9. Connect the rotor of C301 to ground and the stator to Z204-3.
10. Mount the substitute tuner. Connect the tuner output lead to the junction of C301 and Z204-3, as shown in Figure T4. Connect all other tuner leads as they were originally connected.
11. Realign the mixer output transformer, Z204 and C301.

NOTE: C299 (20 mmf capacitor, part number 03 055 510) is not

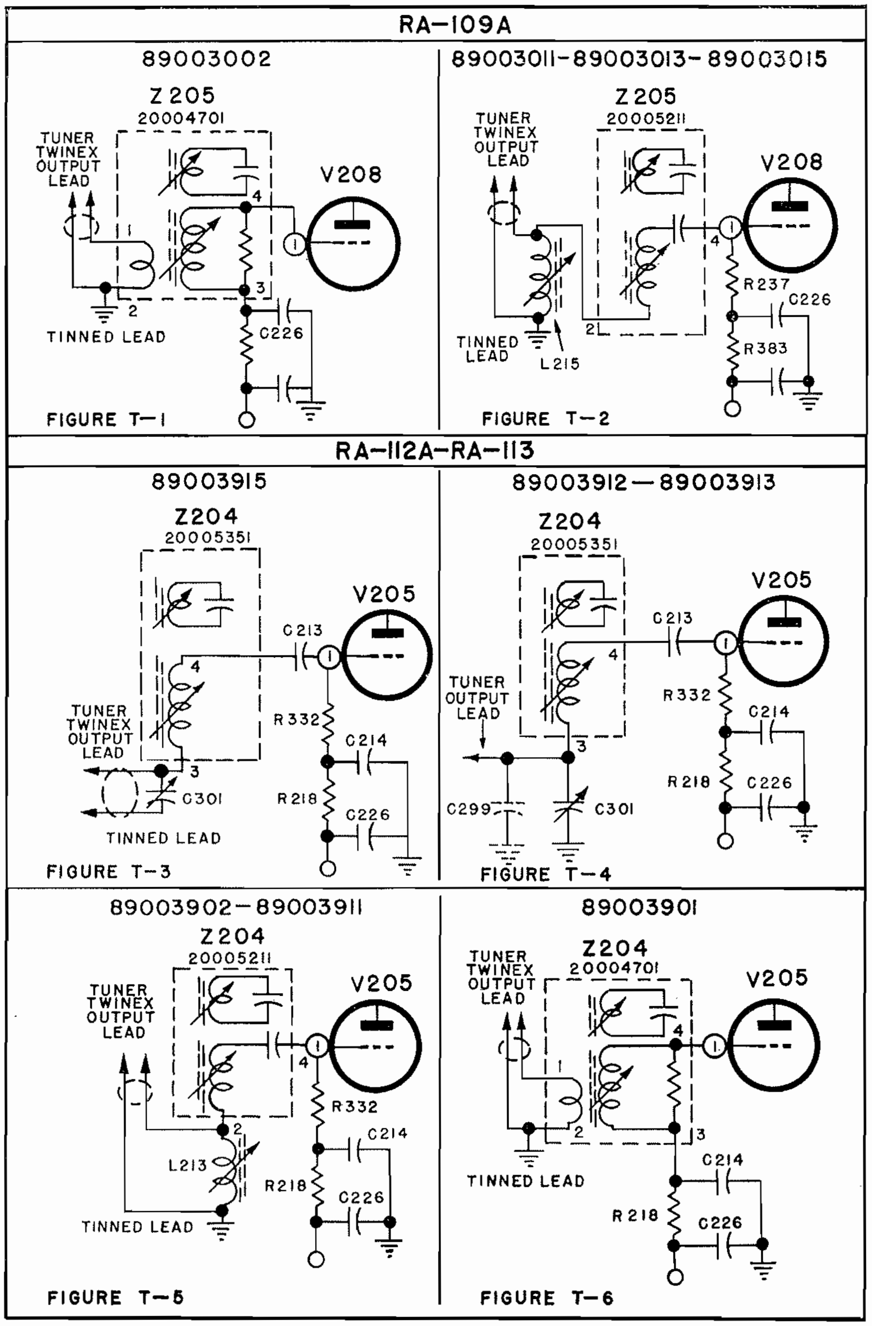

FIGURE T–1 FIGURE T–2 FIGURE T–3 FIGURE T–4 FIGURE T–5 FIGURE T–6 required if proper i-f bandpass can be obtained without it.

To Substitute Tuners in Group 3 for Group 4

1. Disconnect all tuner leads and remove tuner.
2. Remove Z204.
3. Connect R332, a 2.7K ½ watt resistor (part number 02 030 580), between the junction of R218, C214 and pin 1 of V205.
4. Drill a ¼ inch hole in the chassis near Z204, as shown in Figure T7.
5. Mount L213 (part number 21-006 781) in chassis hole drilled in step 4.
6. Mount new Z204 (part number 20 005 211).
7. Connect Z204-4 to pin 1 of V205.
8. Connect one end of L213 to ground and the other end to Z204-2.
9. Mount the substitute tuner. Connect the tuner twinex lead across L213, with the tinned lead to ground as shown in Figure T5. Connect all other leads as they were originally connected.
10. Realign the mixer output transformer, Z204 and L213.

To Substitute Tuners in Group 4 for Groups 1, 2 or 3

1. Disconnect all tuner leads and remove the tuner.
2. Remove Z204.
3. Remove R332.
4. Remove C213. (Only tuners in Groups 1 and 2 have this capacitor.)
5. Remove C299. (Only tuners in Group 2 have this condenser.)
6. Disconnect and remove either L213 (Group 3 only) or C301 (Groups 1 and 2 only).
7. Mount new Z204 (part number 20 004 701).
8. Connect Z204-4 to pin 1 of V205.
9. Connect Z204-3 to the junction of R218 and C214.
10. Connect Z204-2 to ground.
11. Mount the substitute tuner. Connect the tuner twinex lead across Z204-1 and Z204-2, with the tinned lead going to ground, as shown in Figure T6. Connect all other tuner leads as they were originally connected.
12. Realign the mixer output transformer and Z204.

USING THE OSCILLOGRAPH FOR TELEVISION SERVICING

By Walter Boiko

PART II

In Part I the adjustment of the oscillograph controls to observe signals in a TV receiver was discussed. This article covers the use of the instrument in troubleshooting.

The utility of the oscillograph is greatly increased if a crystal probe and a voltage calibrator are available. To observe the signals in the r-f and i-f stages of a TV receiver the signal must be detected before it is applied to the vertical input terminals of the oscillograph. The crystal probe performs this function.

A suitable probe was described in the April-May issue of the SERVICE NEWS. The probe described is particularly useful because it includes a switch which enables the user to connect the oscillograph to the circuit being investigated, either directly or through the crystal detector. This feature is a worthwhile timesaver since it eliminates the need for constantly changing the oscillograph input leads when following the signal through the receiver.

Using the Probe

As previously mentioned a crystal probe must be used in conjunction with the oscillograph to observe the signals in the r-f and i-f stages of a TV receiver. To observe the signals in these stages the output leads of the probe should be connected to the vertical input terminals of the instrument, the ground lead of the probe connected to the chassis, and the positive lead of the probe connected to the circuit to be investigated.

The usual procedure in troubleshooting the r-f and i-f stages of a receiver is to observe the signal at the grid and then the plate of each stage. The probe detects with the same polarity at all times and the 180° phase shift, which occurs between the input and output of each stage, is not observed on the oscillograph screen — a point which often confuses the beginner.

Probe Loading

When the probe is connected to a high-Q tuned circuit it loads the circuit, changing its response character-

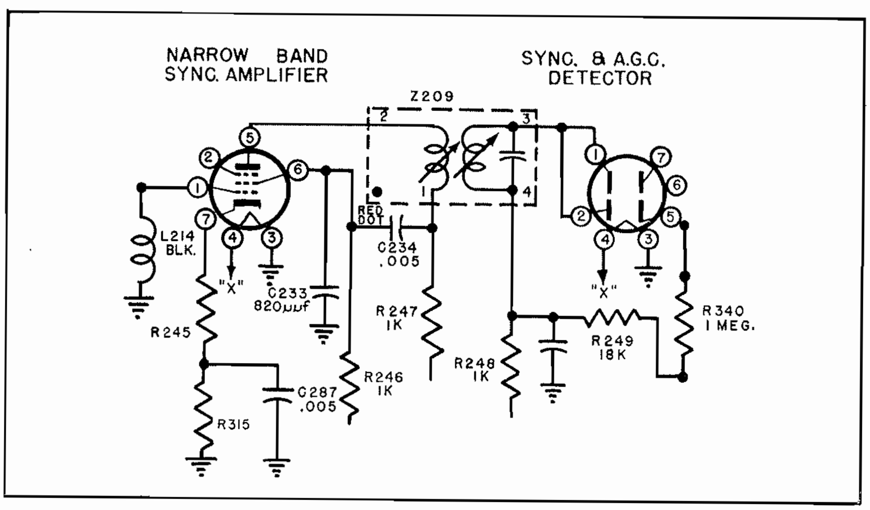

Figure A-1.

istics. If this point is not kept in mind, the information appearing on the oscillograph screen can be misleading.

An example of the effect of probe loading occurs in the narrow-band sync amplifier (Figure A-1) of current production Du Mont Telesets. The narrow-band sync transformer, Z209, is sharply tuned. When a probe is applied directly to the primary or secondary of the transformer, the waveforms observed are distorted, as shown in Figure A-2. The loading can be minimized by connecting a small capacitor (approximately 1 mmf) in series with the positive input lead of the probe. A short length of miniature 75-ohm twin lead, connected as shown in Figure A-3, can serve as a capacitor for this purpose. The series capacitor should be used when checking the signal at the primary or secondary of the NBS transformer.

Another example of the effect of circuit loading occurs in the horizontal oscillator (Figure A-4) of RA-111A, RA-112A, RA-113 and RA-117A Telesets. When adjusting the horizontal oscillator transformer, the oscillator signal is observed on an oscillograph connected between terminal C of the transformer and ground. Since the signal at this point in the circuit has already been detected (by the sync detector) the crystal in the probe is not used. If the ungrounded vertical input terminal of the oscillograph is connected directly to terminal C of the transformer, a distorted waveform similar to that shown in Figure A-5a will be obtained. The distorted waveform is identical to that which is obtained when the transformer is improperly adjusted, and may lead the unsuspecting technician to assume that readjustment is required. The loading effect can be eliminated by clipping the positive probe lead to the body of R260, the 8.2K resistor connected between terminals A and C of Z210. This minimizes loading of the circuit, eliminates the waveform distortion, and enables the technician to secure the proper waveform, as shown in Figure A-5b.

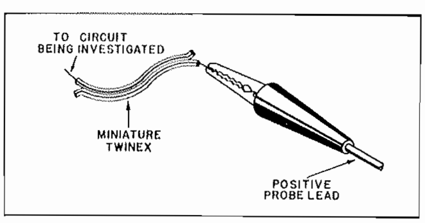

Figure A-3.

Calibration

The oscillograph may be used to measure the peak-to-peak amplitudes of the signals at desired points in a television receiver. A voltage calibrator, such as the Du Mont Model 264B, or some other means of calibrating the oscillograph, is required.

The Du Mont Model 264B Voltage Calibrator is essentially a 60-cycle square-wave generator whose output may be varied from .01 to 100 volts. A direct-reading calibrated dial and four-step attenuator are provided. To measure the peak-to-peak amplitude of a signal, the signal is applied to the vertical input of an oscillograph and the height of the trace noted. The signal is then removed from the oscillograph and the output of the voltage calibrator substituted. The con-

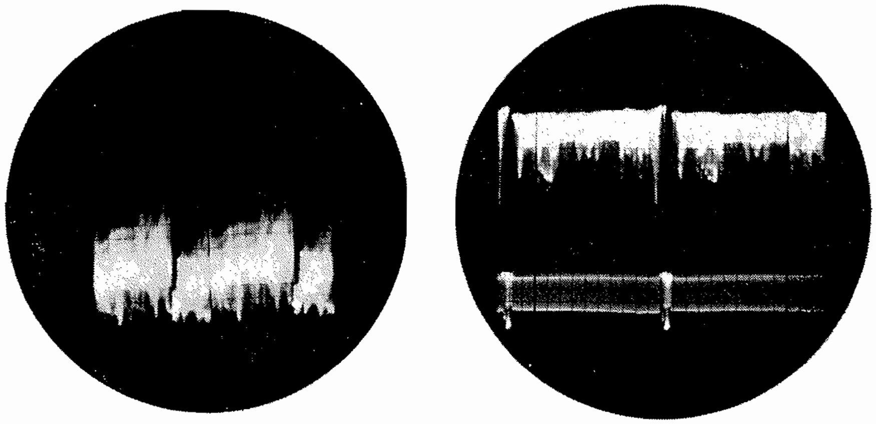

Figure A-2. A, Left—Waveform at NBS transformer distorted by probe loading. B, Right—Normal NBS waveform.

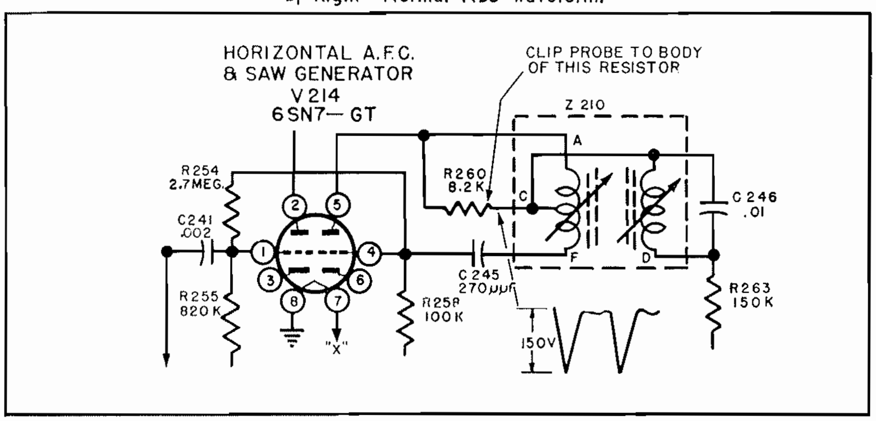

Figure A-4

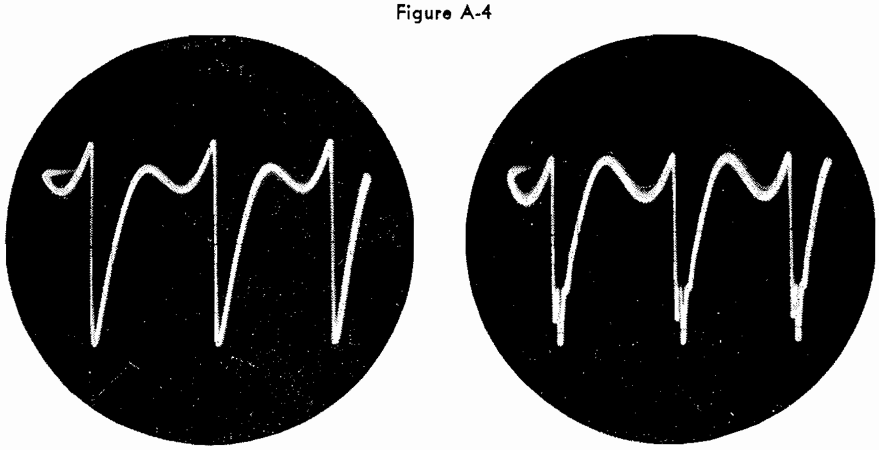

Figure A-5. A, Left—Waveform at horizontal oscillator transformer distorted by loading. B, Right—Normal waveform at horizontal oscillator transformer.

trols of the calibrator are adjusted to produce a trace having the same height as that of the trace produced by the signal being investigated. The output voltage of the calibrator is read from the dial and attenuator. This voltage corresponds to that of the signal being investigated.

The voltage calibrator is set up as shown in Figure A-6. The output leads of the calibrator are connected to the vertical input terminals of the oscillograph and the output of the test probe is connected to the input of the calibrator. The test probe is applied to the Teleset circuit at the desired point and the Output-Multiplier switch, on the calibrator front panel, is placed in the Signal-Output position. With the switch in this position the output of the probe is applied directly to the vertical input terminals of the oscillograph. The following procedure is used to measure the peak-to-peak voltage of the signal.

1. With the Output-Multiplier switch in the Signal-Output position, adjust the oscillograph in the normal manner to obtain a stationary trace of suitable size. Do not disturb oscillograph controls during the balance of the procedure.
2. Measure the height of the trace using the calibrated scale provided on the face of the CRT.
3. Turn the Output-Multiplier switch to a suitable range. With the switch in any one of the multiplier positions a square wave, generated in the calibrator, is available at the calibrator's output terminals and the output of the probe is disconnected. Now adjust the Peak-to-Peak Volts control until the square wave observed on the oscillograph is the same height as the signal being investigated.
4. Read the calibrated Peak-to-Peak Volts dial and multiply by the multiplier — indicated by the Output Multiplier knob — to find the peak-to-peak amplitude of the signal being investigated.

When selecting the range in step 3 the proper Output-Multiplier switch position is that which results in a correct Peak-to-Peak Volts control setting, as near the high end of the control as possible.

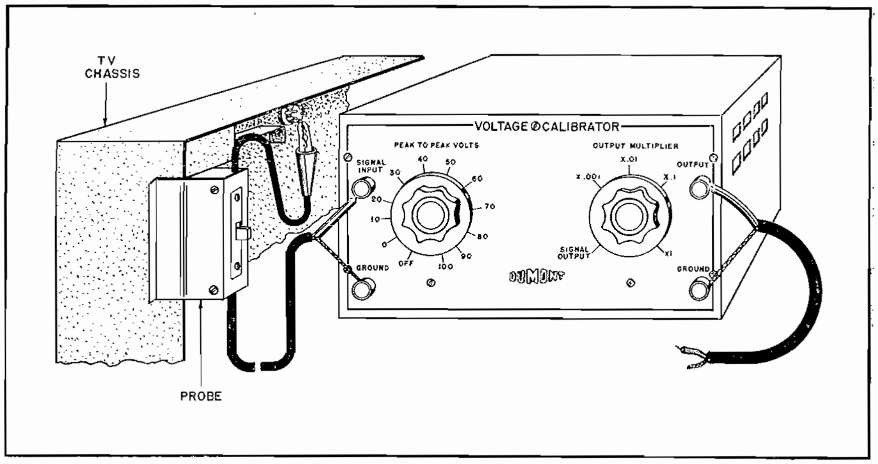

Figure A-6.

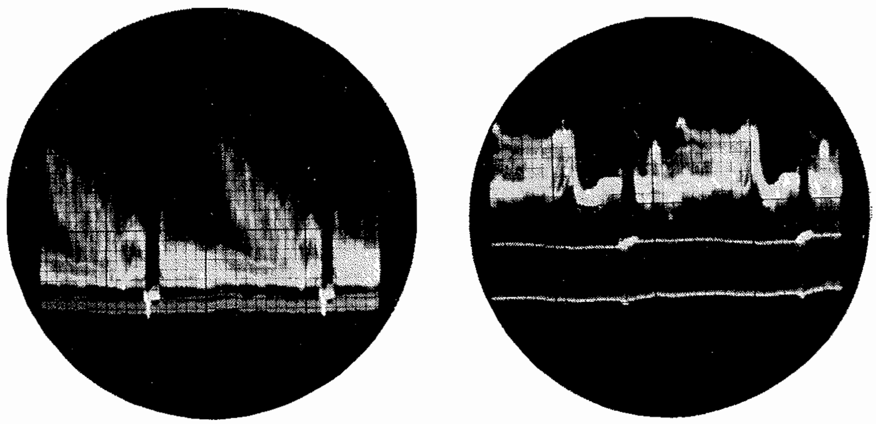

Figure A-7. A, Left—Composite video signal exhibiting sync compression. B, Right—Normal composite video signal.

Troubleshooting

In troubleshooting a television receiver with an oscillograph, the waveforms of the signals in suspected stages are examined and compared to waveforms which are known to be correct. When a distorted waveform is discovered it is analyzed to determine which components or adjustments could be the cause of the distortion. The components which may be at fault are then checked with a suitable voltmeter and ohmmeter, or by substitution.

The procedure to be followed in troubleshooting can best be described by giving actual examples. Several typical receiver faults and the methods used to locate the defective components are described in the following paragraphs.

Sync-Pulse Compression

Compression of the sync pulses accompanying the composite video signal is a common fault occurring in television receivers. It results in poor horizontal and/or vertical stability.

Sync compression is a reduction in the relative amplitude of the sync signals with respect to other information in the composite video signal. An oscillograph pattern of a composite video signal (oscillograph synchronized at vertical sweep frequency) exhibiting sync compression is shown in Figure A-7a. A normal pattern is shown in Figure A-7b. Note the difference in the amplitude of the sync pulses in these signals.

Compression of the vertical and/or horizontal sync signals can be caused by the following.

1. Improper alignment of one or more video i-f stages.
2. Overload resulting from insufficient a-g-c voltage.
3. Improper adjustment of the narrow-band sync transformer.
4. A defective component affecting the frequency response or ampli-

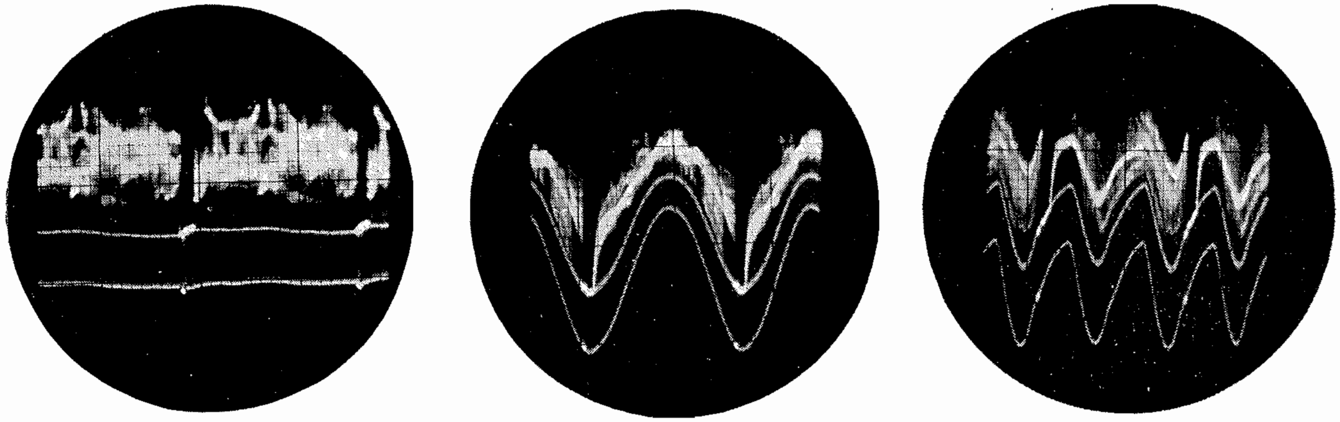

Figure A-8. Left—Normal video signal. Center—Video signal with 60-cycle hum. Right—Video signal with 120-cycle hum.

tude linearity of one of the stages through which the signal passes.

When a case of horizontal and/or vertical instability is encountered a check should be made for sync compression. This may be accomplished by examining the output of the sync-detector stage with the oscillograph controls adjusted to observe one or two vertical fields.

If sync compression is observed at the output of the sync detector, the stage in which the compression is taking place may be isolated by working toward the front end of the receiver, checking the signal at the plate and grid of each stage. When compression is observed at the plate but not the grid of a stage, the compression is obviously occurring in that stage. Voltage and resistance measurements, and an alignment check in i-f stages, should then be made to determine the exact cause of the trouble.

Hum

The oscillograph is useful when attempting to locate the cause of hum in the video signal. The first step is to determine whether the frequency of the hum is 60 cycles or 120 cycles. This can be accomplished by setting the oscillograph controls to observe two fields (30-cycle sweep) and examining the signal at the output of each video i-f stage, each video amplifier stage and at the grid of the picture tube. A normal signal, a signal containing 60-cycle hum and a signal containing 120-cycle hum are shown in Figure A-8. Note that there is one cycle of hum per field when the frequency of the hum is 60 cycles, and

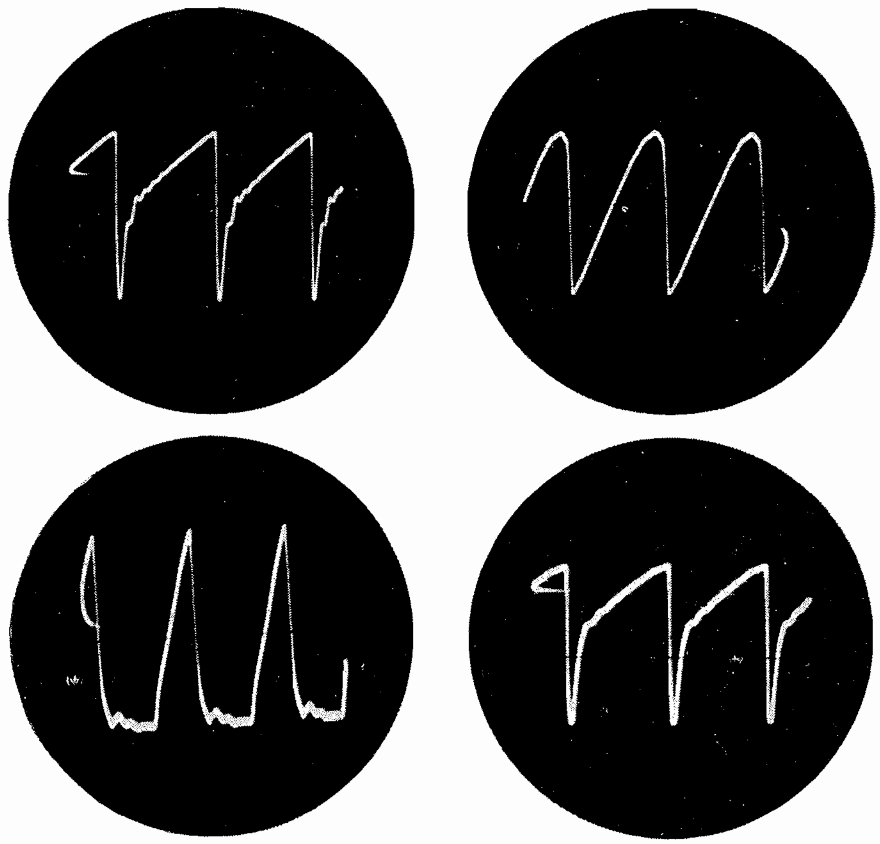

Figure A-9. A, Upper left—Waveform at grid of horizontal sweep amplifier showing effect of an open linearity-coil bypass capacitor. B, Upper right—Waveform at same point showing effect of a shorted drive control potentiometer. C, Lower left—Same waveform showing effect of a change in the time constant of the differentiating network. D, Lower right—Normal waveform at grid of the horizontal sweep amplifier of an RA-109A Teleset.

two when the hum is 120 cycles. The frequency of the hum may be identified in this way.

60-cycle hum is usually the result of coupling between the filament supply and the signal circuits. The most common cause is filament-to-cathode leakage in one of the r-f, video i-f, or video-amplifier tubes, or the picture tube. To locate the faulty stage, connect the ground terminal of oscillograph to the Teleset Chassis, set the instrument for 30-cycle sweep, and connect the vertical-input terminal to the cathodes of each of the suspected tubes in turn. The cathode at which the largest 60-cycle signal appears will usually be that of the faulty tube. The above applies only to tubes using cathode bias.

60-cycle hum can also enter the r-f and video i-f stages through the a-g-c line. The a-g-c line should be checked in the manner described above. If 60-cycle hum is discovered on the line, the tubes in the a-g-c, sync detector and associated stages should be checked.

120-cycle hum is usually the result of a filter capacitor failure. The B+ lines should be checked using the method described for 60-cycle hum. The amplitude of the hum at various points in the B+ voltage-divider circuit will give some clue as to the location of the faulty component. Voltage, resistance and substitution checks may then be used to identify the defective component.

Some 120-cycle hum and 60-cycle ripple — from the vertical-sweep circuits — normally appears in the B+ circuits. In order to avoid being misled the technician should familiarize himself with normal conditions by examining the B+ circuits of a properly operating receiver.

Horizontal Non-Linearity

The oscillograph is also useful in locating the cause of foldover and other forms of horizontal non-linearity.

Horizontal non-linearity results from improper operation of one of the stages between the horizontal oscillator and the deflection coils. By examining the waveforms in these stages it is usually possible to isolate the fault to a few components.

While a complete discussion of the procedure used to troubleshoot the horizontal sweep circuits is beyond the scope of this article, an example of the manner in which the waveform at one point in the circuit may be interpreted to secure a clue to the fault, will serve as a guide.

Three examples of the manner in which the signal at the grid of the horizontal deflection amplifier is effected in cases of non-linearity are illustrated in Figure A-9.

Figure A-9a illustrates the appearance of the waveform when the linearity-coil bypass capacitor is open. The ripple on the waveform is due to improper filtering of the damper circuit and is thus a clue to the location of the fault. Some ripple of this type is normal in RA-109A, RA-112A and RA-117A Telesets, as shown in Figure A-9d, and does not affect the picture. This type of fault sometimes occurs in earlier chassis such as the RA-103 and RA-105.

Figure A-9b illustrates the effect of a shorted drive control potentiometer on the waveform at the grid of the 6BG6. This waveform results in the appearance of a white vertical line in the picture. Note the absence of the negative pulse which results in a reduction in the amplitude of the signal and delays the conduction of the 6BG6, producing the white line in the picture.

A change in the time constant of the horizontal differentiating network produces the waveform shown in Figure A-9c. The fault may be isolated by observing the waveforms at the grid of the sawmaker and the plate of the horizontal oscillator. A normal waveform at the plate of the horizontal oscillator and a distorted waveform at the grid of the sawmaker would indicate that the faulty component was located between these points, or in the differentiating network.

Only a few of the uses of the oscillograph have been described. They are representative of the application of the oscillograph to troubleshooting and when the technician has mastered them he will find little difficulty in expanding his ability to use this valuable instrument.

PRODUCTION CHANGES

RA-113

Change No. 58 (ECN-4867)

Reason:
Same as RA-112A, Change No. 55, described in October issue.
The first chassis so modified is:
RA-113 — No. 1358054 — Coded "AL"

RA-112A - RA-113

Change No. 59 (ECN-5213)

Reason:
To minimize the Christmas Tree effect illustrated in Figure S-1, which sometimes occurs when a Teleset is turned on. This condition is due to multiple triggering of the horizontal sweep oscillator and is accompanied by audible singing in the flyback transformer. It disappears when the horizontal hold control is reset. In a normal Teleset multiple triggering may occur for a fraction of a second after the Teleset is turned on. In a Teleset in which the BTO transformer is not properly adjusted the Christmas tree effect may last for several minutes or more.

Changing the value of C245 to 220 mmf greatly reduces or entirely eliminates multiple triggering by increasing the adjustment tolerance of the BTO transformer.

Procedure:
Remove C245 near Z210 and replace with a 220 mmf 5% 500V condenser. Realign Z210.

Parts Required:

SYMBOL	PART NUMBER	DESCRIPTION
C245	03 021 450	Cap M 220 mmf 5% 500 volts

The first chassis so modified are:
RA-112A — No. 1263751 — Coded "AM"
RA-113 — No. 1361515 — Coded "AM"

RA-117A

Change No. 25 (ECN-4867)

Reason:
Same as RA-112A, Change No. 55, described in October issue.
The first chassis so modified is:
RA-117A — No. 1723653 — Coded "L"

Change No. 26 (ECN-5213)

Reason:
Same as RA-112A - RA-113, Change No. 59
The first chassis so modified is:
RA-117A — No. 1724882 — Coded "M"

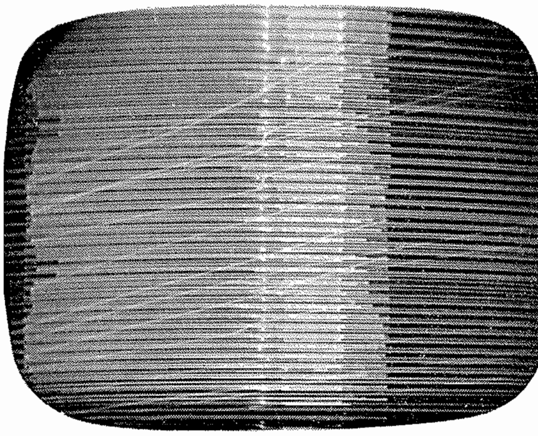

Figure S-1

DUMONT
First with the Finest in Television
SERVICE NEWS

Service News

A PUBLICATION OF THE TELESET SERVICE CONTROL DEPARTMENT OF ALLEN B. DU MONT LABORATORIES, INC., EAST PATERSON, N. J.

Volume 1 DECEMBER, 1951 Number 11

DIRECTOR'S CORNER

BY

Harold J. Schulman

A sense of humor is a priceless gift. To people in TV service work however, it is an absolute necessity!

How else but with a rich sense of humor will you be able to cope with and appreciate some of the things that go on in our business.

We had a school teacher register a serious complaint because she wasn't receiving "all the channels." When the serviceman investigated, he found that she was receiving seven channels (New York) but she wanted to know where the other five were. Her salesman had said that her set could get twelve stations!

When the serviceman patiently explained that at present the F.C.C. allows no more than seven channels in a given area, this customer reared up and shouted: "Now don't sass me, young man, I'm a high school teacher and know better than that."

It is difficult to believe that there are still people who are so unaware of the TV facts of life.

We remember another incident which occurred during the early days of TV, when it was a badge of distinction to own a television set.

A customer complained that his wife was bothering him to get his antenna removed from the attic and placed on the roof, at no charge of course.

Was her reception bad? No! Did she understand the durability of the attic antenna, since it was not exposed to the deteriorating effects of weather? Yes!

Then why did the lady want the antenna removed to the roof? Because — if the antenna remained in the attic, how would people in the neighborhood

(CONTINUED ON PAGE 77)

ALIGNMENT TECHNIQUE

by Dick Jones

Many technicians regard television receiver alignment as a difficult task to be avoided whenever possible. However with the proper test equipment and the right technique a receiver can be aligned in less than an hour.

Alignment procedures for Du Mont Telesets are included in the service information covering each model. The purpose of this article is to describe the proper technique to be used, and to point out some of the pitfalls to be avoided, when aligning a Teleset.

Test Equipment Required

Without adequate test equipment it is impossible to align a receiver properly. Inadequate test equipment is one of the main reasons for the difficulties which many technicians encounter in alignment. Good test equipment is always a worthwhile investment. This is particularly true when the equipment is to be used for alignment purposes.

To align Du Mont Telesets the following instruments are required:

1. An oscillograph with a vertical amplifier possessing good 60-cycle response and a vertical deflection sensitivity in excess of .01 rms volts per inch. The Du Mont type 304H and the older 208B are excellent instruments for this purpose.
2. An Alignment Signal Generator capable of providing a steady, consistent signal. The instrument's sweep deviation should be variable, with a maximum of 10 mc or more. An accurately calibrated marker signal should also be available. The Simpson Model 479 and the Hickock Model 610A are very satisfactory instruments for alignment work.
3. A crystal probe. A suitable crystal probe is described in the April-May issue of the Service News. Several satisfactory commercial crystal probes are available.

Bench Set-up

The test equipment and the Teleset chassis should be connected to a common ground. This can be accomplished by connecting the ground terminals of the instruments, and the chassis, to the grounded shield of a BX cable or a water pipe, using heavy copper braid. A more satisfactory arrangement is to equip the test bench with a metal top, ground the chassis and instruments to the bench top and connect the top to a good ground.

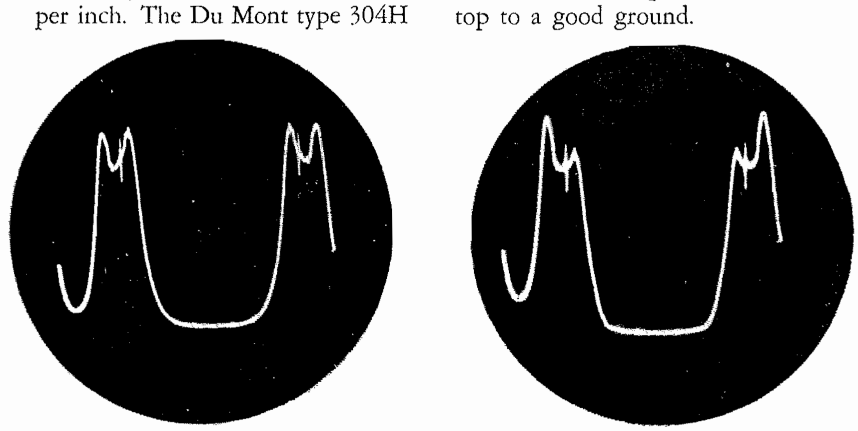

Figure A-1. Left, normal curve with 60-cycle oscillograph sweep. Right, same curve showing the effects of hand capacity.

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Carl J. Quirk .... TECHNICAL SUPERVISOR
Joseph J. Roche .... EDITOR

The signal generator cable should be terminated with the load resistance recommended by the manufacturer of the instrument. The recommended termination resistance is usually approximately 72 ohms, in which case a 68 ohm ½ watt resistor may be used.

The input leads of the probe should be kept as short as possible (3-4 inches) to prevent stray pickup. If these precautions are taken the waveforms appearing on the oscillograph during alignment will not be affected by hand capacity (see Figure A-1) and stray pickup. The bench setup affects the results obtained and it should be made carefully to avoid difficulties later.

Adjusting the Oscillograph and Signal Generator

The sweep generator usually includes a 60-cycle sine-wave sweep output for application to the horizontal amplifier of the oscillograph. This sine-wave signal may be used to provide the oscillograph horizontal sweep, or the internal sawtooth sweep of the oscillograph may be used. When the sine-wave sweep is used two traces are obtained, as shown in Figure A-2. By adjusting the Phase Control of the sweep generator these two traces may be superimposed on one another to obtain what appears to be a single trace.

In practice we have found that the Phase Control does not always give the desired result. The use of the oscillograph internal sweep is therefore recommended. The Phase Control and the generator horizontal-sweep terminals may be ignored when the oscillograph internal sweep is employed.

Most sweep generators sweep up and down the frequency spectrum in 1/60 of a second. Thus they sweep the band of frequencies twice in each cycle. One of these sweeps is from the low end of the band to the high end, and the other is in the opposite direction. When the sweep signal is applied to an i-f stage two curves are produced, as shown in Figure A-3. The curves produced are identical except for the fact that the high frequency side of one appears on the left while the high frequency side of the other appears on the right.

Either curve may be used, however, the side of the curve which represents the video i-f carrier must be determined. It can be identified by applying a marker signal at the video i-f carrier frequency and noting its position. It is usually desirable to use the curve with the video carrier (high frequency side) on the right since that is the way in which the curves are shown in the alignment procedures.

The polarity of the curve is determined by the polarity of the crystal in the crystal probe. Either a positive or a negative curve is satisfactory.

The deviation and sweep center frequency calibrations of most signal generators are not sufficiently dependable. When adjusting the signal-generator sweep deviation you should be guided by the appearance of the curve on the oscillograph screen. Frequency checks should always be made with the marker.

Adjust the sweep-generator center frequency so that both curves appear on the oscillograph, as shown in Figure A-3. When making these preliminary adjustments use the maximum sweep deviation available and adjust the sweep center frequency to obtain two evenly-spaced curves. Failure to use sufficient sweep deviation, or to set the sweep center frequency properly will cause the curves to run together, as shown in Figure A-4.

Identify the proper curve using the marker, in the manner previously described. The oscillograph horizontal amplifier and the positioning controls may then be adjusted so that only the desired curve, as shown in Figure A-5, appears on the oscillograph screen. The oscillograph and sweep generator are now properly adjusted for video i-f alignment.

Alignment Technique

The procedure which should be used when aligning one of the overcoupled video i-f stages of current production Du Mont Telesets is discussed in the following paragraphs.

If the stage to be aligned has a trap, a rough adjustment of the trap should be made before the stage is aligned. The primary of the first sound i-f transformer acts as a sound trap, and it should be adjusted before alignment of the video i-f stage feeding it is attempted. These rough adjustments may be made by setting the marker to the sound i-f and adjusting the trap, or sound i-f transformer, until the dip in the response curve coincides with the marker.

After the trap has been adjusted the bandpass of the stage should be checked by setting the marker to first one and then the other peak of the curve, noting the frequency difference between the peaks. The frequencies at which the peaks fall is not important at this point. If the frequency

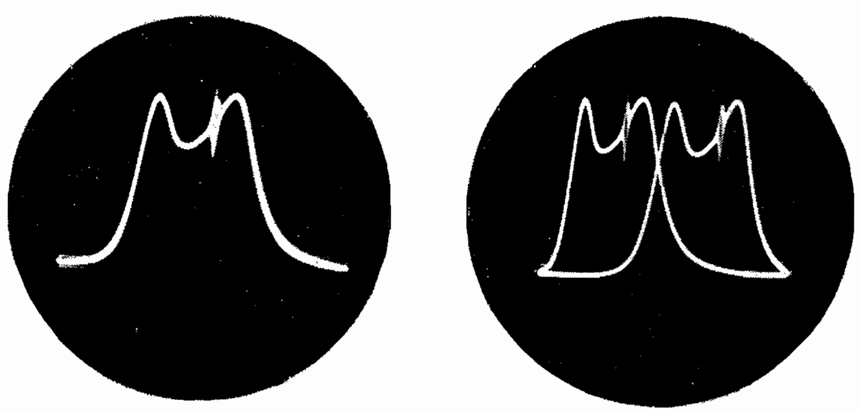

Figure A-2. Curves obtained with sine-wave oscillograph sweep obtained from generator. Left, phase control properly set. Right, phase control improperly set.

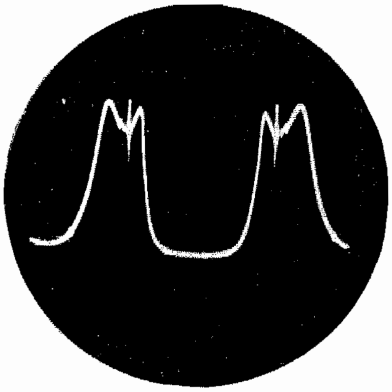

Figure A-3. Curves obtained with oscillograph sweep set at 60 cps.

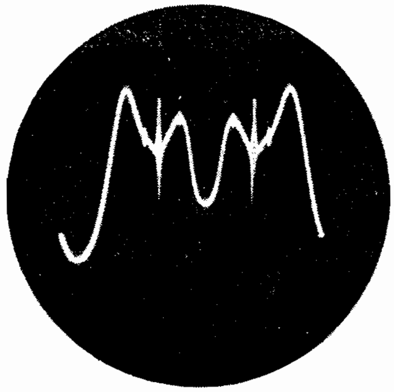

Figure A-4. Curves run together indicating that sweep deviation is not great enough, or the sweep center frequency is not properly set.

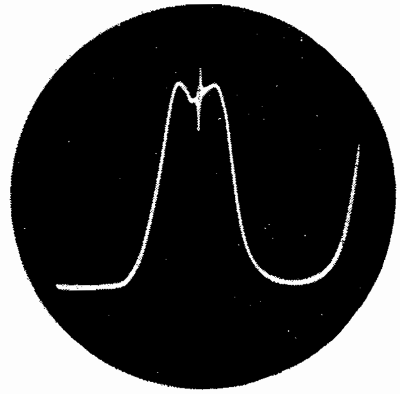

Figure A-5. Single curve obtained by adjusting the oscillograph sweep and positioning controls.

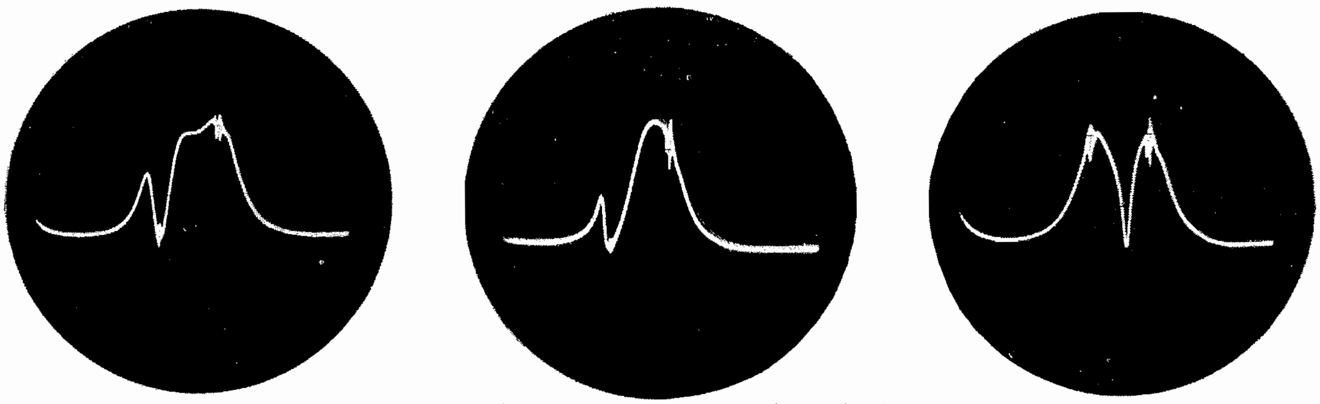

Figure A-6. Left, normal curve. Center, trap properly set, bandpass improperly set. Right, bandpass proper, trap improperly set.

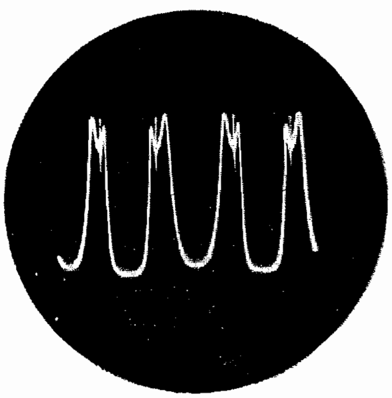

Figure A-7. Sweep frequency of the oscillograph too low, readjust to 60 cps.

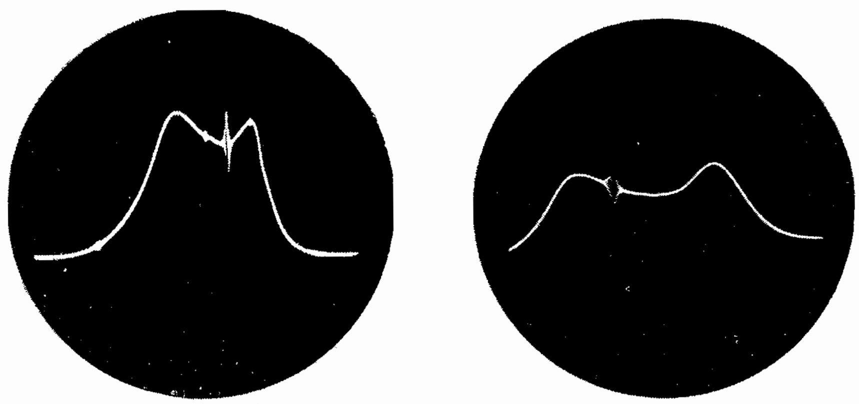

Figure A-8. Left, normal curve for stage without a trap. Right, oscillograph sweep frequency set properly, horizontal-amplifier gain too great, vertical gain too low.

difference between the peaks does not correspond to that shown in the alignment procedure a rough adjustment of the bandpass should be made. This is accomplished by varying the coupling capacitor. In some Telesets this capacitor is adjusted by sliding a small wire in or out of the bottom of the i-f transformer. In other Telesets the capacitor consists of a piece of twinex and is adjusted by spreading or compressing the parallel leads.

When the bandpass is approximately correct the top and bottom slugs of the transformer should be varied, until the frequencies of the peaks of the response curve correspond to those shown in the alignment procedure. Both slugs should affect the shape of the curve. If adjusting a slug does not change the curve, either the slug is far out of adjustment or the transformer is defective. When this condition is encountered turn the slug completely through its range. If no effect on the curve is observed, the transformer is probably defective.

After the slugs have been set the bandpass should be rechecked. When the bandpass is correct, touch up the curve again using the slugs.

The effects of the bandpass and trap adjustments on a curve are illustrated in Figure A-6.

Be careful of overloading. If you

suspect that the stage being aligned is overloaded reduce the generator output, noting whether or not there is a significant change in the shape of the curve with change in amplitude.

Use as little marker signal as necessary to obtain sufficient indication.

If you encounter oscillation when aligning a stage, pull out the tube in the preceding stage. If the oscillation persists, check the stage being aligned for a defective component or improper lead dress.

When the entire alignment procedure has been completed a finishing touchup should be made while observing a test pattern. This consists of a slight readjustment (½ turn) of one or two slugs, to compromise between smear and trailing whites; definition and ringing. Usually one or two lines of ringing in a good test pattern are permissable because most televised scenes do not have sufficient contrast to produce ringing under this condition.

If you are having trouble obtaining the proper curves, check the following:

a. sweep deviation
b. sweep overload
c. marker overload
d. frequency of oscillograph sweep
e. horizontal gain of oscillograph
f. vertical gain of oscillograph
g. crystal probe
h. traps
i. ground connections
j. cable terminations
k. outside interference
l. i-f cans
m. receiver oscillation

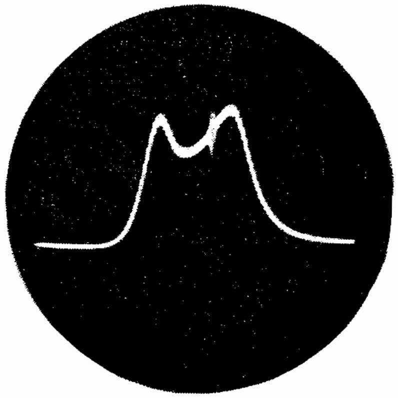

Figure A-9. Stray horizontal-sweep-signal pickup. Remove the horizontal-oscillator tube.

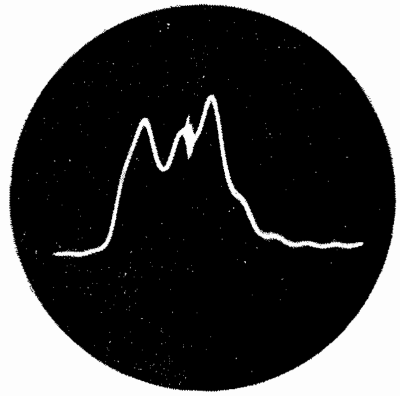

Figure A-10. Marker is being modulated by 400 cps. Turn off signal-generator modulation.

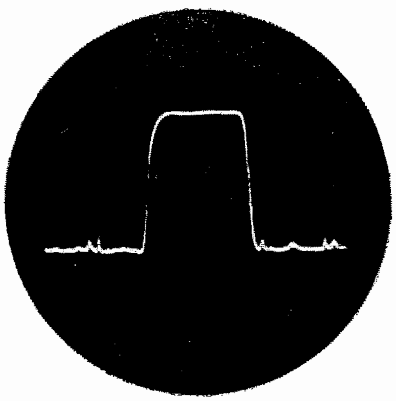

Figure A-11. Stage being aligned is overloaded. Reduce amplitude of sweep signal.

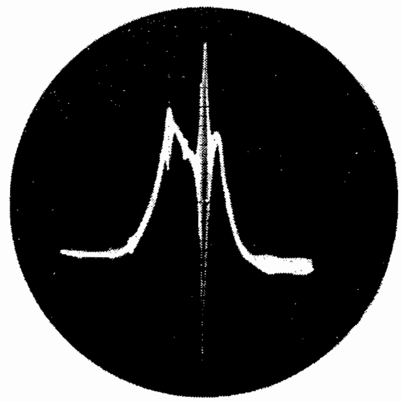

Figure A-12. Marker amplitude too great.

In Figures A-7 through A-12 a number of curves encountered during alignment are illustrated. The technician should find these helpful in clearing up difficulties encountered when aligning a Teleset.

AMATEUR TVI

More cases of television interference have been blamed on the radio amateur than on any other possible source. It is not unusual for an owner of a TV receiver, when confronted with interference, to place the blame on a nearby amateur without further investigation.

An outstanding example of this attitude occurred recently when 85 customers, whose receivers were affected by TVI, blamed a radio amateur located in their neighborhood. Investigation of the complaints proved that of the 85, only five were caused by the ham. The amateur personally installed high pass filters in the antenna input circuits of the five receivers affected and eliminated the problem.

In most of the cases in which the ham was involved the work, including materials, was done at no charge to the owner of the receiver. It is interesting to note that the F.C.C. does not expect the radio amateur to correct the receiver difficulty at his own expense.

When a set owner or TV serviceman lodges a complaint against a ham, the F.C.C. mails a special bulletin, #48-1804, to the television receiver owner. The bulletin describes various types of interference and the sources from which each originate. It also discusses how the type of interference may be identified. An F.C.C. engineer studies the information received from the complainant and indicates, in the bulletin, the probable source of the difficulty.

The bulletin includes information directed to the serviceman, suggesting a method of approaching interference problems.

The F.C.C. also mails a bulletin to the radio amateur. This bulletin tells the amateur how he may minimize harmonic radiation from his equipment, and describes the construction of suitable high pass filters for use in TV receivers. The following is a direct quotation from this bulletin: "The amateur is not required to purchase a high pass filter for the TV receiver. However, if the amateur has a high pass filter which could be installed in the receiver temporarily to demonstrate the effectiveness of the filter in reducing interference no difficulty should be experienced in having the owner of the receiver make a permanent installation at his own expense."

From the above it is evident that the responsibility for eliminating interference rests with the owner of the TV set as well as with the amateur. If the serviceman and the ham cooperate in straightening out the difficulty there should be no reason to report to the F.C.C.

A brief review of the manner in which signals from a radio amateur station can enter a TV receiver and cause interference may prove helpful. Table I illustrates the harmonic relationships between the radio amateur bands and the present TV channels.

The fundamental frequencies of the amateur bands do not fall within the limits of any of the TV channels. Interference is caused by the harmonics of the amateur frequency. These harmonics can be generated in two ways, as follows:

1. If the amateur signal is strong enough it will enter the receiver, overload the front end stages and produce harmonics. The number and strength of the harmonics generated depends upon the strength of the fundamental frequency. The number of harmonics in turn determines how many of the channels, harmonically related to the fundamental, will be affected.
2. Harmonics may be generated in the amateur's transmitter and be radiated to the TV receiver.

The TV serviceman is responsible for the elimination of interference which occurs as a result of the fundamental generating harmonics in the TV receiver. This can usually be accomplished by inserting a high pass filter in the transmission line at the antenna terminals of the receiver. Such a filter may be obtained from the Spare Parts Sales Section of the Teleset

TABLE 1

Amateur Band	Harmonics x2	x3	x4	x5	x6	x7	x8	x9	x10
3.5	7	10.5	14.0	17.5	21.0	24.5	28.0	31.5	35.0
7.0	14	21	28	35	42	49	**56**	**63**	**70**
14.0	28	42	**56**	**70**	**84**	98	112	126	140
21.0	42	**63**	**84**	105	126	147	168	**189**	**210**
27.0	**54**	**81**	108	135	162	**189**	**216**	243	
28.0	**56**	**84**	112	140	168	**196**	224		
50.0	100	150	**200**						

The above chart gives the relationship of the amateur band harmonics to the TV channels. Harmonics which fall within assigned TV channels are underlined.

Service Control Department. The part number is 88 000 331.

The filter should be installed as close to the antenna terminals of the receiver as possible. If the receiver is located close to the transmitter, it may be necessary to install the filter between the antenna terminal and the Inputuner proper.

It is also possible for a strong 28-mc signal to enter the i-f stages of a receiver. This will seldom occur unless the receiver is located very close to the transmitter. When interference of this type occurs it is usually necessary to shield the TV chassis.

In summing up the above information, it is suggested that the following procedure be used in cases of interference believed to be originating from amateur transmitters:

1. Do not assume that the interference is being caused by an amateur until a thorough investigation has been made. Contact the amateur involved and conduct tests to determine whether or not his equipment is causing the interference.
2. If the tests indicate that the interference is coming from the amateur's transmitter, install a high pass filter at the receiver.
3. If the filter reduces the interference but does not eliminate it, the filter should be inserted between antenna input and the input to the tuner.
4. If the filter does not affect the interference, contact the ham and make further tests to determine whether or not harmonics generated in his transmitter are producing the interference.
5. If the amateur's transmitter is radiating harmonics, inform him of the fact and tell him what has been done at the receiver in an attempt to eliminate the interference. In the vast majority of cases the amateur will take steps to remedy the condition when approached in a friendly manner.

DIRECTOR'S CORNER (CONT.)

know she had a television set?

I'm sure that your memory can produce numerous incidents that bring a smile.

That's the important thing, to be able to grin and bear it.

Your daily routine includes a good share of requests that are unreasonable, unjust or impossible. You have other problems that are technical, financial or personal. It is easy to become upset and so emotionally involved that an unhealthy and unbusinesslike attitude is developed. This reflects unfavorably in your service work and your handling of customers.

It is necessary to achieve some measure of objectivity and develop an active sense of humor to restore your emotional balance.

Be sincere in your efforts to provide Du Mont Teleset owners with prompt efficient service, but don't lose your perspective.

TROUBLESHOOTING HINTS

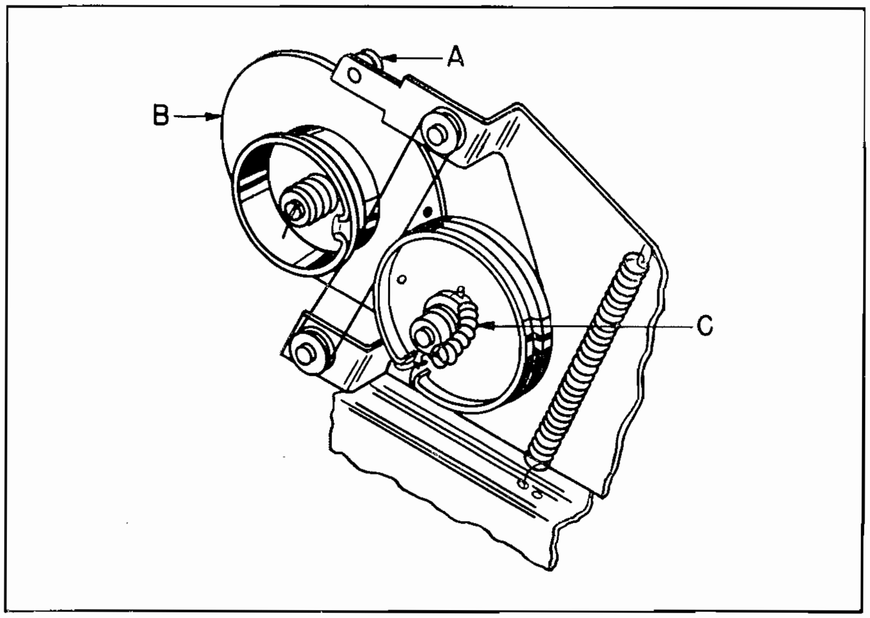

Figure T-1

Teleset: RA-109A

Symptom: Hum and sync buzz in the sound.

Probable Fault: C250A, the 30 mf 450 volt B+ filter capacitor, is defective.

Remedy: Replace C250.

Teleset: RA-112A, RA-113 and RA-117A

Symptom: Vertical foldover in lower half of picture. Vertical hold control adjustment very critical. After careful setting of the vertical hold control picture will roll occasionally.

Probable Fault: C271, the .01 mf 5% 400V condenser in the vertical BTO circuit is leaky.

Remedy: Replace C271.

Teleset: RA-112A, RA-113 and RA-117A

Symptom: Horizontal pull. The a-g-c and Narrow-Band-Sync adjustments will not correct the trouble. The plate and screen voltage of the sync clipper, V219, is higher than normal.

Probable Fault: R304, the 2.4 5% 2W B+ bleeder resistor, is open.

Remedy: Replace R304.

Teleset: RA-103D, RA-104A and RA-110A

Symptom: The dial pointer jumps across sections of the dial. Observation of the cam follower idler wheel, A in Figure T-1, shows that it is rising off the cam, B. Proper pointer action requires that the idler wheel be on the cam at all times.

Probable Fault: The dial cord, originally installed with the proper tension, has tightened up with age.

Remedy: Lessen the tension of the dial cord spring (C) until the idler wheel stops rising off the cam.

Teleset: RA-103D, RA-104A and RA-110A

Symptom: No vertical hold — horizontal hold control setting critical. Plate voltage of sync clipper V213 is low.

Probable Fault: C252, the .1 mf 20% 400V coupling capacitor at the grid of the vertical buffer, is leaky.

Remedy: Replace C252.

Teleset: RA-116A

Symptom: Tape Recorder "wow"

Probable Fault: A lubricated rather than an unlubricated magnetic recording tape is being used.

Remedy: Clean the capstan by holding a cloth moistened with carbon tetrachloride against the capstan, with the machine operating. Change the tape to an unlubricated type.

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RA-109A

RA-112A

RA-113

RA-116A

RA-117A

RA-119A

DUMONT
First with the Finest in Television
SERVICE NEWS

Service News

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Volume 2 JANUARY, 1952 Number 1

DIRECTOR'S CORNER

BY

Harold J. Schulman

This is the year of the fringe. While we all look forward to an early thaw of the F.C.C. freeze, it will be at least a year before new local markets are available.

It will therefore be mostly a battle of who can put the most sets the furthest out in the quickest time — and make them stick.

As weapons in this battle, we are supplying the hottest chassis this side of the equator, having an over abundance of sensitivity and an extremely low noise figure.

However, just as in any battle, it's not only the weapons that count, it's the men behind the guns who are the key factors in victory or defeat.

As Service Technicians, you have an unprecedented opportunity to raise your standing in your profession. By becoming skilled in the specialized art of squeezing the last drop of performance out of a fringe set you will become more valuable to your employer and yourself.

The fringe can be extended and made more usable if you will devote the time and energy required to learn the tricks of the trade. It is important that you understand proper installation techniques, including selection of antennas and transmission lines, impedance matching, location and height.

A mobile test truck with an extensible antenna is ideal for such purposes.

Proper use of this knowledge may result in just that extra bit of gain needed to sell a set a bit further out than the other guy can.

(CONTINUED ON PAGE 8)

TROUBLESHOOTING HORIZONTAL INSTABILITY

By Walter Boiko

Horizontal sync instability is a common trouble occurring in television receivers. Troubles of this type are difficult to locate unless a systematic method of approach is used.

The purpose of this article is to point out some of the causes of poor horizontal stability and to describe the techniques used to troubleshoot receivers in which this condition occurs.

The causes of horizontal instability may be divided into the following three categories:

1. Non-standard transmission of the television signal.
2. Troubles occuring in stages through which the sync signal passes before reaching the a-f-c circuits.
3. Defective components in, or misadjustment of, the a-f-c circuits.

Normally the a-f-c circuit is suspected in cases of poor horizontal stability. As indicated above the difficulty can be caused by conditions outside of the horizontal a-f-c circuits. Therefore, the first step in troubleshooting a receiver having poor horizontal stability is to determine whether the fault is due to a defect in the a-f-c circuits or to a condition outside of these circuits.

This may be accomplished by observing the waveform of the sync signal at the input of the a-f-c circuits. If the waveform is not normal it may be reasonably assumed that the cause of the horizontal instability is due to conditions outside of the a-f-c circuits.

After it has been ascertained that the fault is not in the a-f-c circuits, it is necessary to determine whether the condition is due to the transmitter or to an earlier stage of the receiver.

Before discussing the procedure to be used, a review of the transmitter and receiver conditions which affect the operation of the a-f-c circuits will prove helpful.

Transmitter Difficulties

Conditions at the station, which have been encountered in the past and which have been known to affect the horizontal stability of television receivers are as follows:

1. Non-conventional time-constant in the a-f-c circuit of the sync generator
2. Hum in the signal
3. Transmission of an improperly shaped sync pulse

Many station sync generators incorporate reactance tube a-f-c systems similar to the one used in the Du Mont Model RA-109A Teleset. The time constant and the amount of hum, in the a-f-c circuit in the transmitter's sync generator, can influence the horizontal sync stability of receivers using reactance tube a-f-c systems. For optimum receiver horizontal sync stability, the time constant of the filter network in the grid circuit of the reactance tube in the receiver, should be approximately the same as that used in the a-f-c circuit of the transmitter. When there is a large difference between the time constant of the station's a-f-c circuit and the receiver's a-f-c circuit, slight horizontal jitter at the top of the picture may result.

Hum in the station sync generator can modulate the horizontal sync pulses sufficiently to cause poor horizontal sync stability in the receiver. One severe case which was actually observed

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Joseph J. Roche .... EDITOR

resulted in a sync signal waveform similar to that produced by a heater-to-cathode short, as shown in Figure H-1. The hum was attributed to the station when it failed to appear on other channels.

Receivers using the pulse-width a-f-c system, such as the Du Mont Models RA-112A, RA-113 and RA-117A, are not as susceptible to the above mentioned transmitter troubles as are receivers using reactance tube a-f-c circuits. This is true because the pulse-width system is based primarily on the width of the pulse — not its amplitude.

During a television program the station may use more than one sync generator. Therefore, the condition just described may occur intermittently. For example, a slight horizontal jitter may be noticed when a station is televising film-slide advertisements, or remote programs, and not appear during local studio programs.

Another transmitter difficulty is the transmission of extraneous signals. A characteristic trouble in the stabilizing amplifiers of some transmitters is the development of a spike on the front porch of the horizontal sync signal, as shown in Figure H-2.

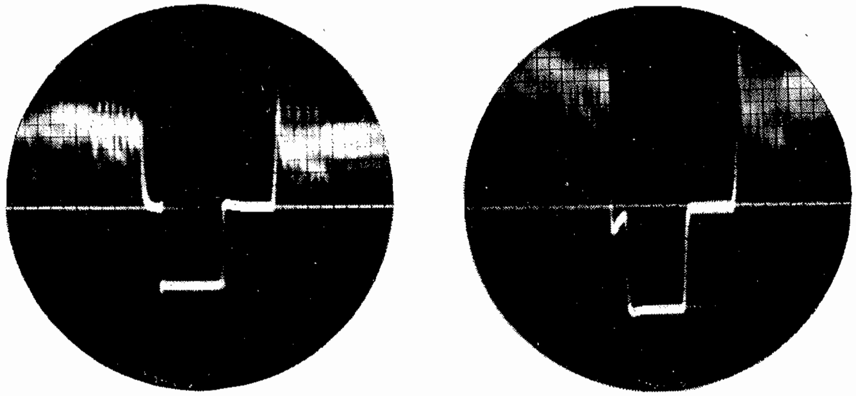

Figure H-2. Left, normal horizontal sync pulse. Right, sync pulse with spike on front porch.

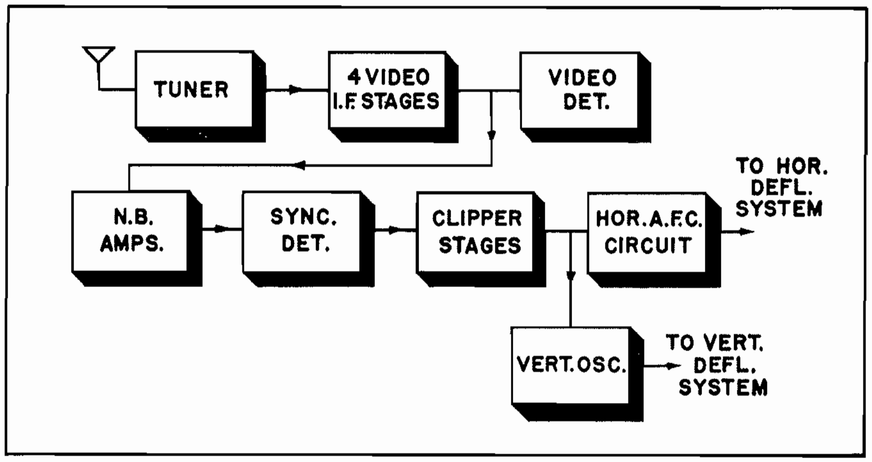

Figure H-3. A partial block diagram of a TV receiver showing the stages through which the sync signal passes.

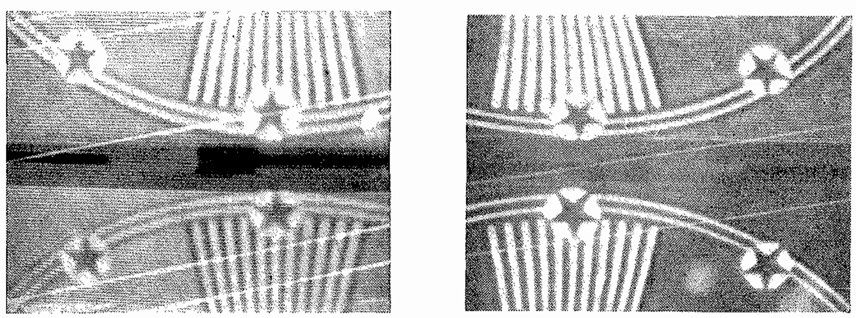

Figure H-4. Left, normal appearance of the vertical blanking interval. Right, vertical blanking interval showing effects of sync compression.

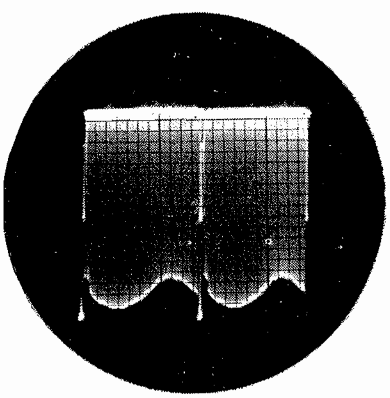

Figure H-1. Output of the first sync clipper showing 60 cycle hum in the sync signal. Normal waveform is shown in Figure H-5.

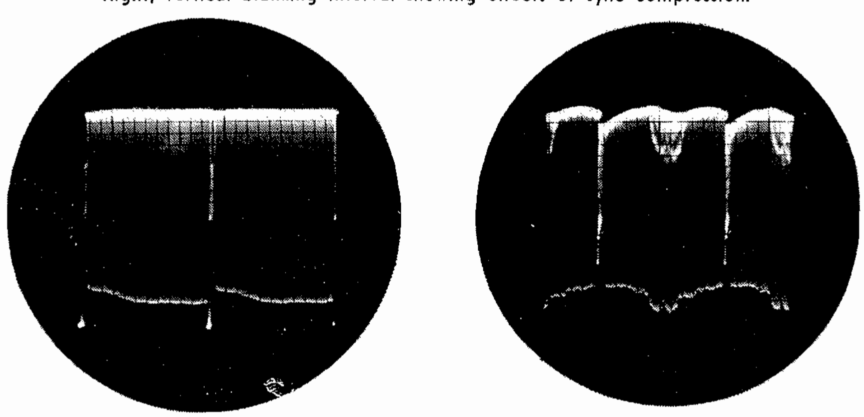

Figure H.5. Left, normal waveform at the plate of the first sync clipper. Right, waveform at plate of first sync clipper showing video in the sync.

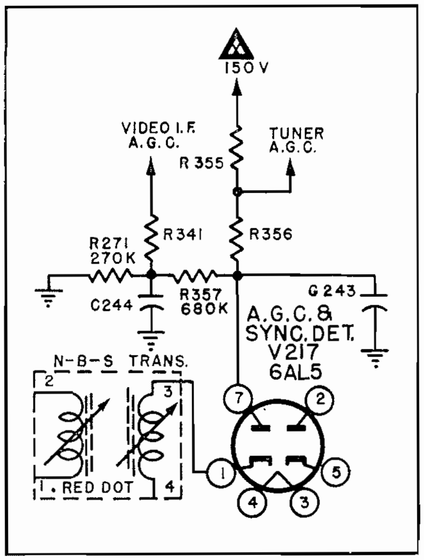

Figure H-6. Partial schematic of the RA-109A a-g-c circuit. R271 and R357 may be interchanged to increase the video i-f a-g-c voltage.

This type of extraneous signal causes the receiver horizontal oscillator to fire prematurely and produces a slight horizontal displacement of the top portion of the picture. Unfortunately this spike is not visible in the video i-f waveform, unless an oscillograph with a vertical-amplifier frequency response of 10 mc or more is used.

While there is very little that the serviceman can do about transmitter conditions, he can save much of his own time by recognizing such difficulties when he encounters them.

When investigating complaints due to transmitter conditions, all of the pertinent details should be noted and brought to the attention of the TV station engineers, so that they may take steps to remedy the fault.

Troubles in Receiver Stages Preceding the A-F-C Circuit

The composite video signal must pass through a number of stages in the receiver before it reaches the a-f-c circuits as shown in the block diagram of Figure H-3.
Trouble in any one of these stages can affect the horizontal sync stability.

Some of the more common troubles, in stages preceding the horizontal a-f-c circuits, which affect the operation of the a-f-c circuits, are listed below.

1. Sync compression
2. Overload
3. Loss of gain
4. Distortion of the sync signal
5. Hum

Sync compression may be caused by: improper alignment of one or more video i-f stages; overload resulting from insufficient a-g-c voltage; improper adjustment of the narrow-band sync transformer; a defective component affecting the frequency response or amplitude linearity of one of the stages through which the signal passes.

Practical illustrations of sync compression and the methods used to isolate the causes are discussed in the November issue of the Service News.

The effects of sync compression on the vertical and/or horizontal blanking intervals, as observed on the face of the picture tube, provide a means of detecting the existence of the condition.

Since sync compression normally affects both the vertical and horizontal sync, either the vertical or horizontal blanking intervals may be examined to determine whether or not sync compression is taking place. The vertical blanking interval is generally used for this purpose because it is easier to display on the picture tube. Before checking the vertical blanking interval the brightness and contrast should be adjusted for a normal picture. When the vertical blanking interval is visible on the screen, the brightness control should be advanced slightly so that the sync interval may be observed as a darker area within the blanking interval. If advancing the brightness control does not cause the sync interval to appear as a black area within the blanking interval, sync compression exists.

The normal appearance of the vertical blanking interval and its appearance, when sync compression exists, is illustrated in Figure H-4.

The above method of detecting the existence of sync compression cannot be used when complete loss of horizontal sync is encountered. In such cases an oscillograph should be used in the manner outlined in the November issue of the Service News.

Overloading

Another cause of horizontal sync instability is overloading. It results in a slight horizontal movement of part or all of the picture.

When overloading occurs video information enters the sync circuits and poor horizontal stability results. This effect may be detected by examining the signal at the output of the first sync clipper. A normal signal, and a signal indicating the presence of video in the sync, are shown in Figure H-5.

In most cases resetting the a-g-c control will eliminate the condition described above. In severe cases the horizontal instability may persist. Another solution to the problem is the use of an attenuator pad in series with the antenna lead in. If both strong and weak signals are received this solution is not satisfactory because the weak signals will be attenuated as well as the strong ones.

A third approach to the problem is to increase the a-g-c voltage. This can be accomplished in RA-109A Telesets by interchanging two of the resistors in the a-g-c voltage-divider network shown in Figure H-6. R357, the 680K resistor, and R271, the 270K resistor, should be interchanged to increase the amount of a-g-c voltage applied to the video i-f stages. In some cases a further improvement can be secured by changing the first and second i-f amplifier tubes to 6BA6's. This results in some loss of gain and is not advisable in locations where weak as well as strong signals are received.

Loss of Gain

A reduction of the amplitude of the sync signal, in any of the stages through which the sync signal passes, may also cause poor sync stability. Usually both the horizontal and vertical sync are affected. This condition may or may not be accompanied by signal distortion.

In checking for loss of gain, a suitable voltage calibrator should be used in conjunction with the oscillograph to measure the peak-to-peak value of the horizontal sync signal at the input of the a-f-c circuit. If the amplitude of the sync signal is below normal, the fault can be isolated by working back towards the front of the receiver with the oscillograph.

A practical example of the above condition results from misadjustment of the narrow-band sync transformer. Misadjustment of the transformer reduces the amplitude of the signal at the grid of the first sync clipper and produces a distorted waveform at the plate of the second sync clipper, as shown in Figure H-7.

Hum

Hum in one of the stages through which the signal passes before reaching the horizontal a-f-c circuits is another cause of poor horizontal sync stability. It results in an "S" shaped distortion of the picture.

A discussion of the technique used to isolate the cause of hum will be found in the November issue of the Service News. In RA-112A, RA-113 and RA-117A chassis particular attention should be paid to the negative voltage supply, since it is added to the operating voltages of the horizontal saw generator and control tube. When the negative supply is suspected the negative 50 volt line should be examined with an oscillograph. The signal on the line under normal conditions and when a filter failure has occurred, is shown in Figure H-8. The horizontal sweep signal appears on the line when a filter has failed. This condition distorts the waveforms at the plate of the second sync clipper, as shown in Figure H-9.

Locating the Fault

When using an oscillograph to locate the cause of horizontal sync trouble, the stability of the waveforms should be noted. When an unstable waveform is encountered, make sure that the oscillograph is properly adjusted. A jittery waveform in the sync circuits usually indicates the presence of some type of intermittent condition. The cause can usually be isolated by checking the inputs and outputs of the stages through which the signal passes. The B+ supply should also be checked.

A suggested procedure for isolating horizontal sync trouble follows:

1. Check reception on all channels to determine whether the transmitter is causing the trouble. If the condition occurs on a strong station only, check for overload.
2. Check for sync compression by observing the vertical and/or horizontal blanking interval or by examining the signal at the input of the NBS amplifier.
3. Examine the signal at the output of the second sync clipper on an oscillograph. Check the signal for the presence of video information or hum, insufficient horizontal sync pulse amplitude and jitter. If the signal is not normal the fault may be isolated by working towards the front of the receiver examining the signal at the input and output of each stage. When hum is encountered check the B+ and negative supply lines.

The next issue will include a discussion of horizontal a-f-c circuit faults which cause poor horizontal sync stability.

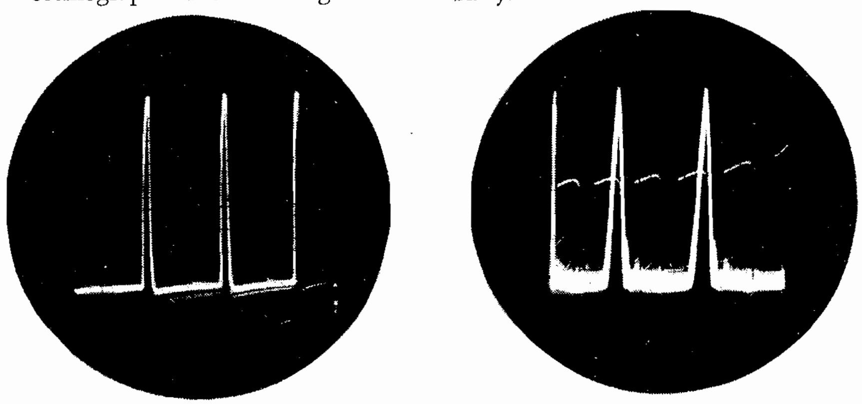

Figure H-7. Left, normal waveform at the plate of the second sync clipper. Right, waveform at the plate of the second sync clipper showing video in the sync due to overloading, loss of gain in earlier stages or misadjustment of the NBS transformer.

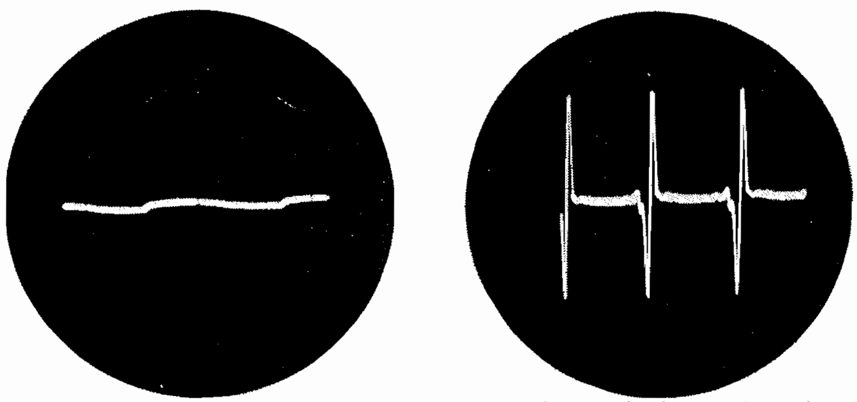

Figure H-8. Left, normal waveform on the —50 volt line. Right, horizontal signal on the —50 volt line indicating a filter failure.

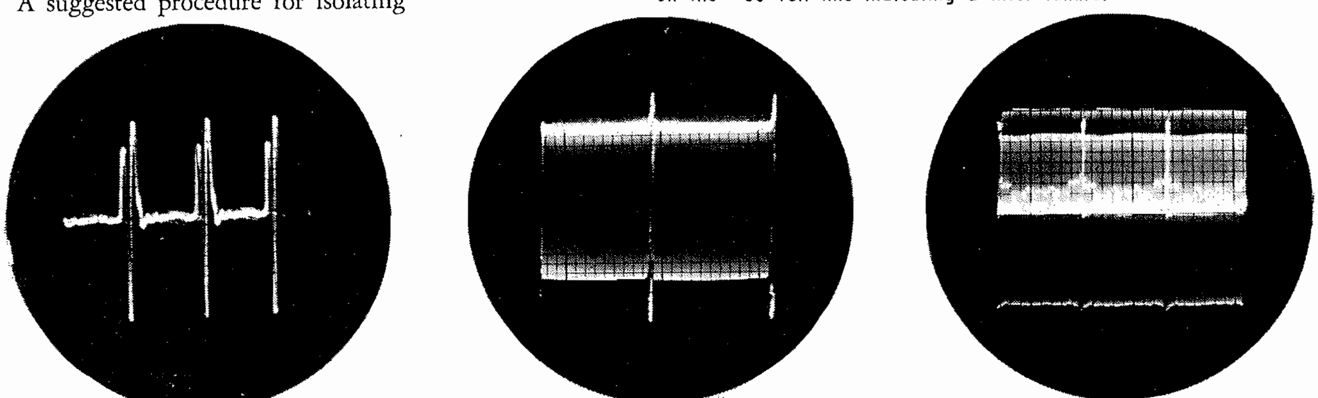

Figure H-9. Waveforms at plate of second sync clipper. Left, effect of hum on the negative supply line, oscillograph adjusted to observe the horizontal sync signal. Normal waveform appears in Figure H-7. Center, normal waveform with oscillograph adjusted to observe two vertical fields. Right, effect of hum, oscillograph adjusted to observe three vertical fields.

IDENTIFYING INPUTUNERS

Shown below are the part numbers of the Inputuners used in Du Mont Telesets. Following each part number is a description of the tuner's distinctive physical differences. The technician will find this information helpful in identifying tuners.

Teleset	Part No.	Description
RA-101	7027	Motor-driven Inputuner with slide rule dial.
RA-102	7033A1	Manual-drive Inputuner with colored markings on lucite dials, brass dial pan. Tubes in tuner are in a horizontal position.
RA-103C	7033A2	Similar to 7033A1, but with brown lamacoid and lucite counter-clockwise dials. No dial pan, wire pointer. Tubes in tuner are in a horizontal position.
RA-103C	89000602	Brown lamacoid and lucite clockwise dials. Tubes in tuner are in a vertical position.
RA-103D-104A-110A	89001701	Square dial. Coaxial cable enters the rear of the tuner.
RA-103D-104A-110A	89001702	Square dial. Coaxial cable enters front end of the tuner. Large brass gear behind dial mounting plate. Bottom coupled.
RA-103D-104A-110A	89001703	Square dial. Coaxial cable enters front end of the Inputuner. Large white-metal gear behind dial mounting plate. Bottom coupled.
RA-105A	89000601	Large brown dial. Coaxial cable enters at the rear of the tuner.
RA-106A	89000503	Inputuner less dial. Coaxial cable enters at the rear of the tuner.
RA-105B-108A	89002302	Large brown dial with small center space. Center of dial begins with small number 50. Coaxial cable enters the front end of the tuner. Bottom coupled.
RA-105B-108A	89002303	Large brown dial with large center space. Center of dial begins with channel 2. Coaxial cable enters the front end of the tuner. Bottom coupled.
RA-109A	89003002	4-gang, 6-turn tuner with slide-rule-dial assembly. Slotted screw in i-f link. Used in Telesets with serial number from 091 to 092-1325.
RA-109A	89003011	4-gang, skip-band tuner with slide-rule-dial assembly. No aviation or telephone band on dial. Uses i-f link number 21005911. Small casting under gears.
RA-109A	89003013	Same as 89003011, except i-f link number is 21006791, 6BC5 is used in place of 6AK5. Stamped "3013."
RA-109A	89003015	Same as 89003013, except i-f link number is 21008411; 6CB6 is used in place of 6BC5. Stamped 3015.
RA-109A (caboose)	89003041	Four-gang skip-band tuner with slide-rule dial assembly. No aviation or telephone band on dial. Mixer transformer connected to i-f stage mounted on tuner. 6CB6's used in mixer and i-f stage. I-f stage output is coax link.
RA-111A	89003301	4-gang, 6-turn tuner with dial-drive assembly.
RA-112A-113	89003901	4-gang, 6-turn Inputuner with square dial assembly. Small wheel behind pointer. Overhead spring. The i-f link adjustment screw protrudes about one-half inch out of the top of the can. Used in RA-112A Telesets with serial numbers 121 to 122399. Used in RA-113 Telesets with serial numbers 131 to 132399. Uses twinex lead from i-f link.
RA-112A-113	89003902	4-gang, 6-turn Inputuner with square dial assembly. Small wheel behind pointer. Overhead spring. I-f link-adjustment screw does not protrude from top of can and is recessed for an Allen wrench. Used in RA-112A Telesets, serial number 122400 to 126288. Used in RA-113 Telesets beginning with serial number 132400 to 135322. Uses twinex lead from i-f link.
RA-112A-113	89003911	4-gang, skip-band tuner with square dial assembly, large wheel behind pointer. Used in RA-112A Telesets beginning with serial number 126289 and up. Used in RA-113 Telesets from serial number 135-323 and up. Uses twinex lead from i-f link.
RA-112A-113	89003912	Same as 89003911 except for single blue lead from i-f link instead of twinex.
RA-112A-113	89003913	Stamped "13" on rear. Uses 6BC5 I-f link number is 21007101.
RA-112A-113	89003915	Same as 89003913, except i-f link number is 21008401, uses twinex lead from i-f link. 6CB6 is used in place of 6BC5. Stamped 3915.
RA-116A	89003011	4-gang, skip-band tuner with slide-rule assembly. No aviation or telephone band on dial. Small casting under gears.
RA-116A	89003013	Same as 89003011 except i-f link number is 21006791. 6BC5 is used in place of 6AK5. Stamped 3013.
RA-117A	89002941	3-gang, 3-turn tuner and dial assembly.
RA-119A	89003021	Same as 89003011 except slide-rule dial assembly mounted at 90° right angle.
RA-119A	89003022	Same as 89003013 except slide-rule dial assembly mounted at 90° right angle.
RA-119A	89003023	Same as 89003015 except slide-rule dial assembly mounted at 90° right angle.

ADJACENT CHANNEL INTERFERENCE

By Jerry Roth

The FCC television station allocations place transmitters operating on adjacent channels a minimum of 75 miles apart. The purpose of this separation is to prevent the possibility of interference between adjacent channel stations. In practice, due to increased TV receiver sensitivity, as well as improvements in antenna design, the 75-mile separation has proved inadequate and an increasing number of cases of interference has resulted.

At the present time the FCC is considering a new TV station allocation plan. Among other things this plan will increase the distance between adjacent channel TV transmitters, to minimize the adjacent-channel interference problem.

It is interesting to note that channels 4 and 5 are separated by 4 mc and will not interfere with one another.

Types

There are two basic types of adjacent channel interference. One type occurs as a result of the video carrier of the adjacent channel on the high side of the desired station. The other is the result of the sound carrier of the adjacent channel on the low side of the desired station. Depending upon the location either or both adjacent-channel signals may enter the television receiver. These adjacent channel signals will be hetrodyned along with the desired signal and appear in the receiver video i-f system.

A typical case of adjacent-channel sound interference can occur in the following manner. Let us assume that a Teleset in a strong channel 2 area is tuned to a channel 3 station about 50 miles away.

Since the video carrier frequency of channel 3 is 61.25 mc, the local oscillator frequency in current Du Mont Telesets will be 87.5 mc (61.25 mc plus the 26.25 mc video i-f frequency). Channel 2 covers the range of 54-60 mc and its sound carrier is at 59.75 mc.

Under the conditions stated, the strong channel 2 signal will enter the receiver along with the desired frequencies of channel 3 and appear at the mixer grid, to beat with the local oscillator. The only important channel 2 frequency that will cause interference is the 59.75 mc sound carrier.

At the mixer, the local oscillator will beat with the channel 3 video carrier producing a 26.25 mc i-f signal. The channel 2 sound carrier will also beat with the local oscillator and produce a 27.75 mc i-f signal (see Figure A-1). The 1.5 mc difference between these two i-f frequencies will be rectified by the video i-f detector, and show up in the picture as a 1.5 mc f-m beat.

An illustration of adjacent channel sound interference is shown in Figure A-2. This is a mild case. The adjacent-channel interference is sometimes strong enough to blank out the

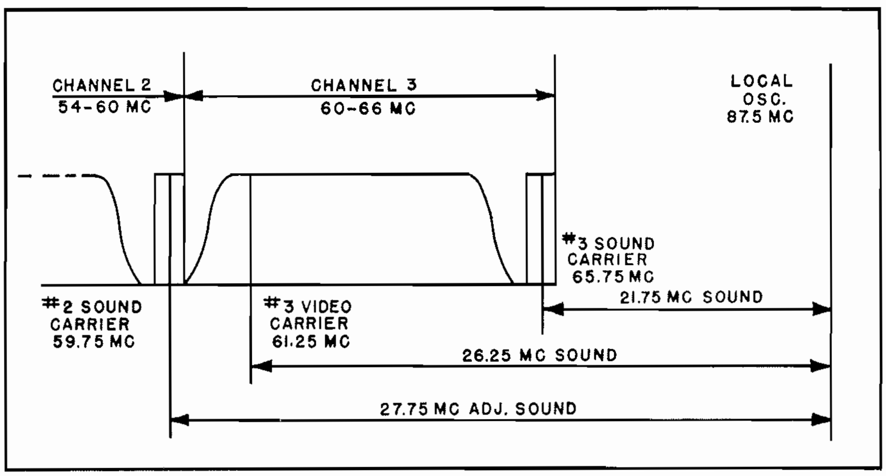

Figure A-1. Frequency relationship between stations producing adjacent-channel sound interference.

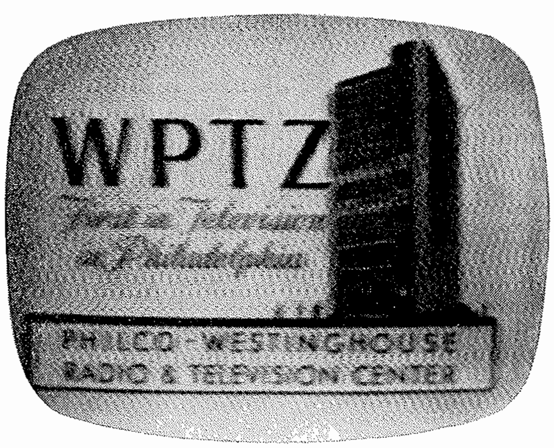

Figure A-2. 1.5 f-m beat interference produced by the adjacent-channel sound carrier.

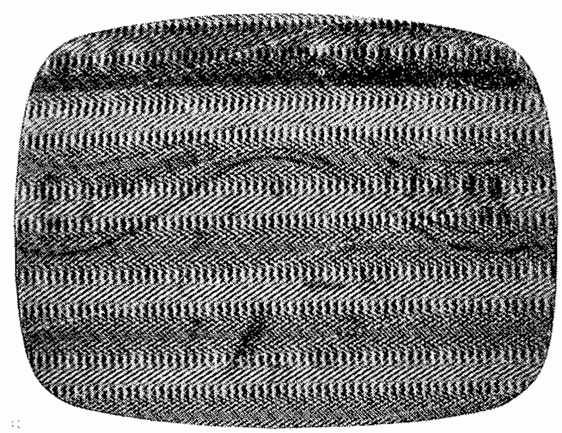

Figure A-3. Interference produced by adjacent-channel sound carrier during constant tone transmission.

desired signal. When this occurs the desired channel's picture will be visible only when the adjacent channel station is off the air.

When the adjacent channel station is transmitting program material the adjacent-channel sound interference usually looks like f-m interference. However, when the adjacent channel station is transmitting a test pattern, with a constant tone sound transmission, the interference will appear as shown in Figure A-3. Obviously, when the test pattern transmission is ended and regular programing begins, the interference will again appear as shown in Figure A-2.

All current Du Mont Telesets are designed to minimize this type of interference. Two adjacent-channel sound traps of the absorption type, inductively coupled to the mixer and video i-f input stages, are provided. The simplified schematic in Figure A-4 shows the adjacent-channel sound traps in the RA-117A.

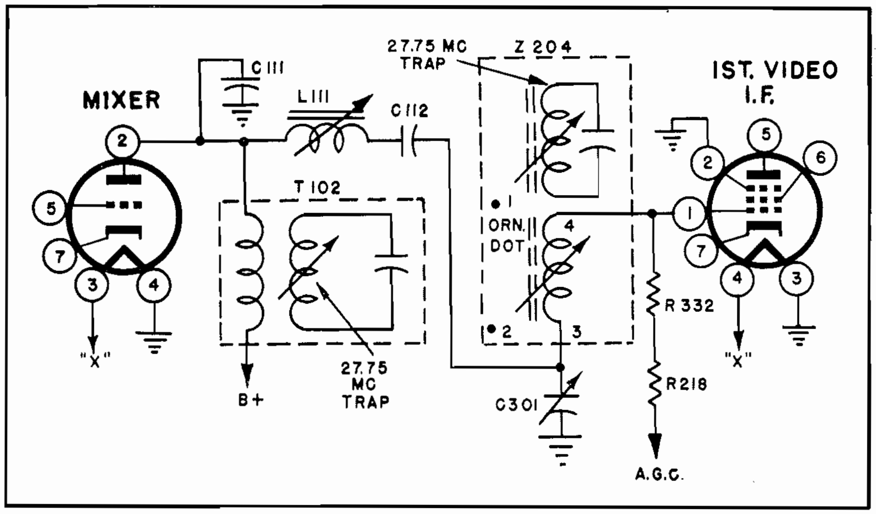

Figure A-4. RA-117A adjacent-channel sound traps.

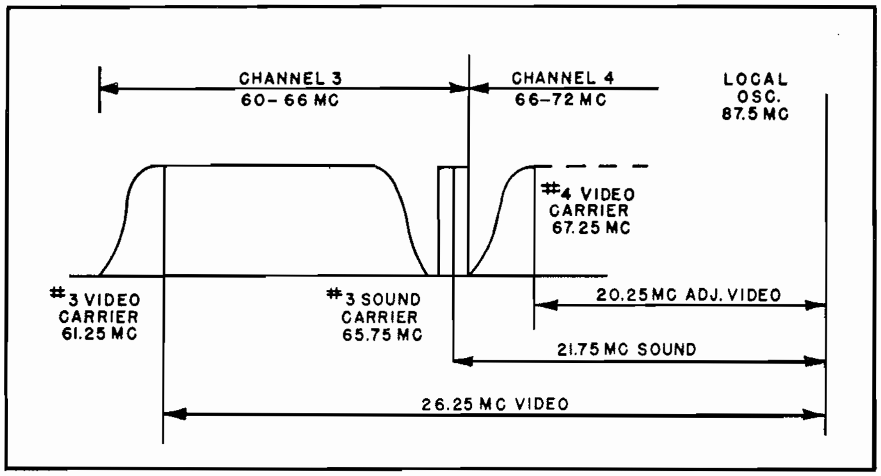

Figure A-5. Frequency relationship between stations producing adjacent-channel video interference.

Adjacent Channel Video

The second type of adjacent-channel interference results when the strong station is on the high side of the desired channel. A typical case of this type of interference can occur when a Teleset in a strong channel 4 area is tuned to a channel 3 station 50 miles away.

The video carrier of channel 3 is 61.25 mc, the local oscillator is at 87.5 mc (61.25 mc plus 26.25 mc video i.f.). The video carrier of channel 4 is 67.25 mc.

At the mixer, the local oscillator will beat with the channel 3 video carrier producing a 26.25 mc i-f signal. It will also beat with the 67.25 mc video carrier of the adjacent channel and produce a 20.25 mc i-f signal. See Figure A-5. If the i-f signal produced by the adjacent-channel video signal is strong enough it will cause interference to appear in the picture.

In mild cases of adjacent channel video interference the sync and blanking pulses of the interfering station are visible in the picture. The pulses will appear as dark bars swinging back and forth in the background of the channel 3 picture. In extreme cases considerable channel 4 video information will become visible along with the sync and blanking pulses. This condition will show up as a channel 4 picture drifting back and forth in the background of the channel 3 picture. A mild case of adjacent-channel video interference is illustrated in Figure A-6.

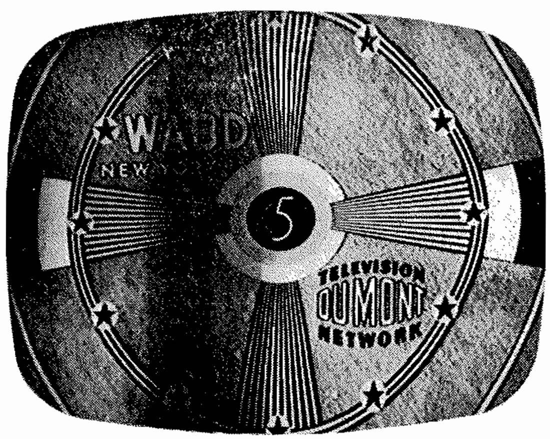

Figure A-6. Interference produced by the adjacent-channel video carrier.

Provisions have been made in Du Mont Telesets to minimize the effects of adjacent-channel video interference.

In current Du Mont Telesets this is accomplished in the coupling circuit between the third and fourth video i-f stages, shown in the simplified schematic of Figure A-7.

At the accompanying-channel sound i-f (21.75 mc) and at the adjacent video i-f (20.25 mc) L212 and C283 function as a series resonant trap. At these frequencies the coupling circuit presents a very low impedance to ground. If either of these frequencies appears in the output of the third video i-f stage they will be greatly attenuated by the coupling network. Thus the possibility of adjacent-channel video interference is greatly reduced.

Above 21.75 mc L212, C282 and C283 function as a parallel resonant circuit providing a high impedance to ground. The desired video i-f signal is developed across this impedance and appears at the input of the fourth video i-f stage.

The important thing is to be able to recognize adjacent-channel interference when it is encountered. Except in very severe cases, readjustment of the traps is all that is necessary to eliminate it.

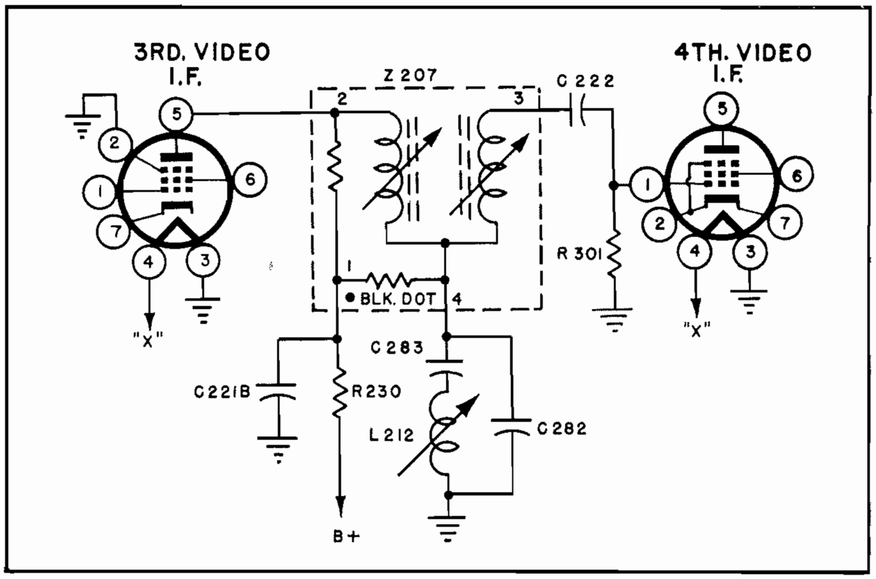

Figure A-7. RA-117A adjacent-channel video interference rejection circuit.

A number of early model Du Mont Telesets were not equipped with adjacent-channel sound and video traps. Traps for these early models are available from your Du Mont Distributor. Information on their installation will be found in the Service Notes for the model in question.

Troubleshooting Hints

Teleset: RA-103D, RA-104A and RA-110A

Symptom: Picture appears overloaded regardless of the setting of the contrast and brightness controls. After 15 minutes operation the picture becomes normal.

Probable Fault: One of the 6 X 4 rectifiers in the negative voltage supply is gassy.

Remedy: Replace the 6 X 4.

Contributed by Morris Strol, Friendly T. V., Inc., Flushing, L. I., N. Y.

Teleset: RA-112A, 113 and RA-117A

Symptom: Horizontal white streaks across picture in presence of ignition and other noise pulses.

Probable Fault: C232, in D.C. restorer circuit open.

Remedy: Replace C232.

Contributed by Lauren Long of Thomson-Diggs Co., San Francisco, California.

Teleset: RA-109 FAS

Symptom: Weak sound — Little tuning eye deflection.

Probable Fault: T402 misaligned.

Remedy: Realign T402.

Teleset: RA-112A, 113, RA-117A, and RA-120A

Symptom: Binding between the steel control spring and the brass horizontal hold control shaft.

Probable Fault: Steel Spring wound too tightly around horizontal hold control shaft.

Remedy: Use a small amount of either graphite or vaseline lubricant between the steel spring and the horizontal hold control shaft.

Teleset: RA-112A, 113 and RA-120A

Symptom: Horizontal "S" distortion of the picture. Excessive 60 cycle ripple in negative line of power supply.

Probable Fault: Heater-cathode leakage in 6BG6, V215.

Remedy: Replace V215.

Contributed by Crist-Kissell Co., 112 S. Fountain Avenue, Springfield, Ohio.

Teleset: RA-109A, RA-116A and RA-119A

Symptom: Intermittent sync or complete loss of sync. A-g-c voltage checks normal.

Probable Fault: R283C (1975 ohm B+ bleeder resistor) increases in value or opens up.

Remedy: Replace R283.

Contributed by George Barnes of Radio Distributing Co., South Bend, Indiana.

DIRECTOR'S CORNER (Cont'd)

Only by the increased sale of TV receivers can the serviceman be assured of steady work and income. If the TV industry is to sell 4,500,000 sets in 1952, last year's fringe must become this year's local market — and a new fringe, further out than last year's, must be developed.

Our new chassis is perfectly capable of exploring these extended markets. But the man who can show his boss or service customer how to exploit this sensitivity to its fullest will be most valuable indeed. Why shouldn't this man be you?

DUMONT
First with the Finest in Television
SERVICE NEWS

Service News

A PUBLICATION OF THE TELESET SERVICE CONTROL DEPARTMENT OF ALLEN B. DU MONT LABORATORIES, INC., EAST PATERSON, N. J.

Volume 2 FEBRUARY, 1952 Number 2

DIRECTOR'S CORNER

BY

Harold J. Schulman

Du Mont recognizes, probably more than any other manufacturer, the importance of service in the continued acceptance and sale of its product.

Every activity and policy of our Service Department aims at facilitating the servicing of our Telesets in the field. We are out to gain friends in the service fraternity — and we make no bones about it either.

Many of you were kind enough to offer suggestions on improvements you would like to see in new models we offer. Well, those of you who have already seen our new RA-160-162 chassis no doubt recognized many of the ideas you submitted.

The logical layout of parts, the front glass removal, the ease of operation, the straightforward alignment, and our many other features have received enthusiastic approval wherever displayed at service meetings.

Just as our advertising theme to consumers stresses pride in ownership, we would like to feel that there is a pride in servicing a product so well designed to servicemen's specifications.

And to help you in this, we will forward shortly a service manual that we believe will be the most comprehensive service manual ever put out by a manufacturer on a television set.

We are asking that you study this manual carefully, so you can properly evaluate all the features we are incorporating in this manual.

Check the schematic diagram and see if it isn't the cleanest, most helpful schematic in the business. Study the parts layout illustrations. Read the first

(CONTINUED ON PAGE 15)

TROUBLESHOOTING
HORIZONTAL A-F-C CIRCUITS

BY WALTER BOIKO

In the previous article on horizontal sync instability, the importance of observing the sync-signal waveform at the input of the a-f-c circuit was stressed. When it has been determined that the stages preceding the a-f-c circuit are operating normally, the defective stage of the a-f-c system may be isolated.

This article deals with the reactance-tube a-f-c system. The pulse-width a-f-c system will be discussed in a separate article.

Reactance-Tube A-f-c System

A block diagram of the basic reactance-tube a-f-c system, as used in the RA-109A, is shown in Figure A-1. It consists of the following stages:

1. Sync discriminator
2. Reactance tube
3. Horizontal oscillator

Each of these stages performs a definite function, and when troubleshooting the system, the operation of each stage should be checked to determine whether or not it is performing properly. Methods for checking each of these stages, followed by a brief troubleshooting procedure, are given in this article.

Horizontal Oscillator

The horizontal oscillator generates the signal which is used to produce the horizontal sweep and the CRT high voltage. In addition, the oscillator generates a sine-wave voltage in its grid circuit which is coupled into the sync-discriminator circuit to compare the oscillator frequency with that of the incoming horizontal-sync signal.

The presence of high voltage on the CRT is a positive indication that the oscillator is operating. Since the oscillator grid signal is applied to the discriminator for control purposes, the waveform at this point should be checked whenever poor horizontal stability is encountered. To observe this

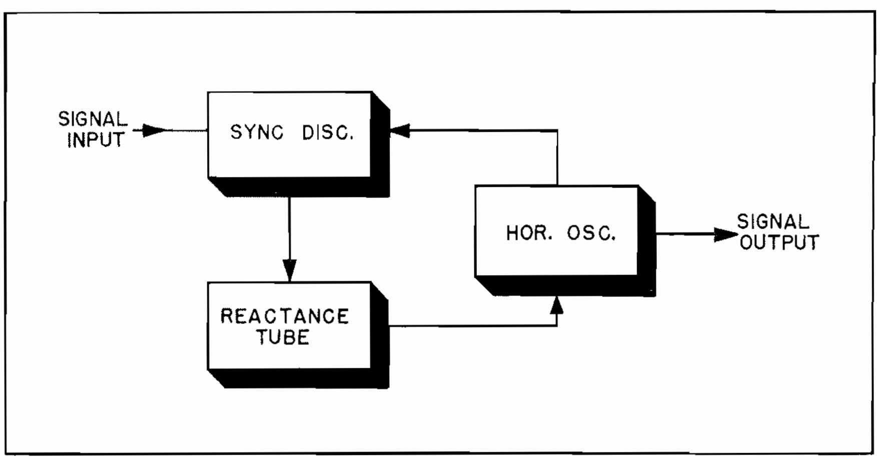

Figure A-1. Block diagram of the stages of a reactance-tube automatic-frequency-control system.

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Carl J. Quirk ... TECHNICAL SUPERVISOR
Joseph J. Roche ... EDITOR

waveform, the vertical input of an oscillograph should be connected between the control grid of the oscillator and ground. The waveform observed should closely resemble the one shown in Figure A-2. If this check indicates that the oscillator is operating properly, the sync discriminator should be checked as described below.

Sync Discriminator

The sync discriminator compares the operating frequency of the horizontal oscillator with that of the incoming horizontal-sync pulses and produces a d-c voltage when the two frequencies do not correspond. This "error voltage" is positive when the oscillator frequency is lower, and negative when the oscillator frequency is higher than that of the sync pulses.

The operation of the sync discriminator stage can be checked by determining whether or not it is producing the proper error voltage. Connect a VTVM between the output of the discriminator and ground, as shown in Figure A-3. Tune the receiver to a strong signal and rotate the horizontal-frequency control clockwise and counterclockwise to tune the oscillator frequency above and below that of the incoming horizontal-sync signal. If the discriminator is operating properly, this will produce a d-c error voltage which will be indicated by the VTVM. The error voltage should vary between +1 and —4 volts. The voltage is predominantly negative because the reactance-tube negative bias is in series with the sync-discriminator load resistors as shown in Figure A-3.

If the above procedure indicates that the discriminator is not producing an error voltage, a check should be made to determine whether or not the oscillator sine-wave signal is being coupled to the plates of the discriminator. This may be accomplished by connecting the vertical input of an oscillograph between ground and each end of the oscillator-transformer discriminator winding in turn. The antenna should be disconnected from the receiver and the oscillograph controls set to observe a signal at the horizontal frequency (15,750 Cps). The signal observed at each end of the winding should resemble that shown in Figure A-4.

The antenna should then be reconnected to the receiver and the horizontal-oscillator tube removed. The horizontal-sync pulse, as shown in Figure A-5, should then appear at each end of the discriminator winding. If the waveforms shown in Figures A-4 and A-5 are not present, the components in the discriminator stage should be checked to determine which is at fault.

Noise-Immunity Network

The purpose of the noise-immunity network, shown in Figure A-6, is to prevent rapid changes in the d-c error voltage when noise or vertical-sync pulses enter the discriminator circuit. A check should be made to determine

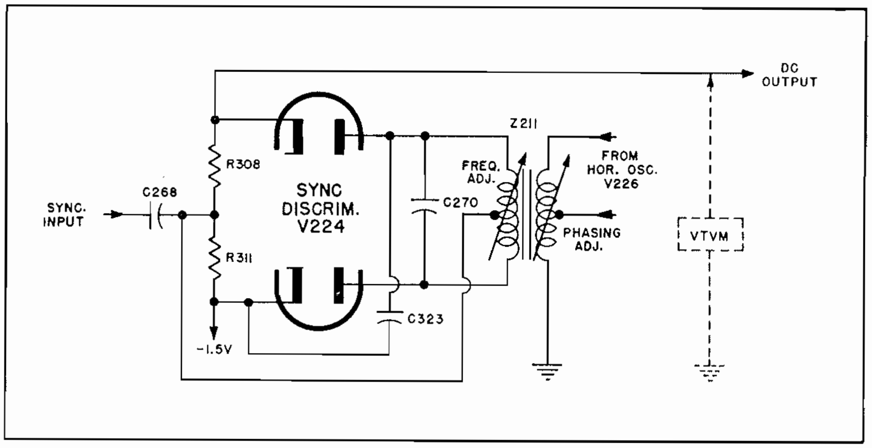

Figure A-3 Simplified circuit diagram of the sync discriminator. A VTVM should be connected as shown to check the operation of the circuit.

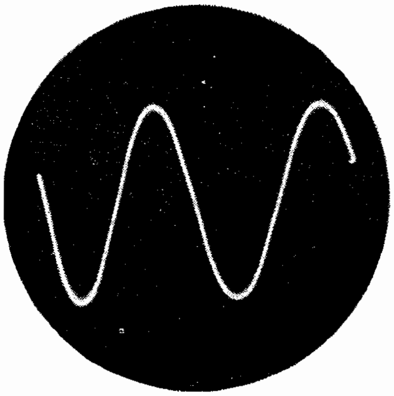

Figure A-2. Sine-wave signal which is produced by the horizontal oscillator and coupled to the sync discriminator where its frequency is compared to that of the incoming sync pulse.

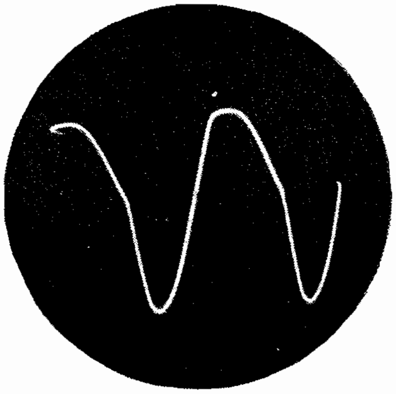

Figure A-4. Waveform which is present at the ends of the oscillator-transformer discriminator winding when the antenna has been removed from the receiver to eliminate the incoming sync pulse.

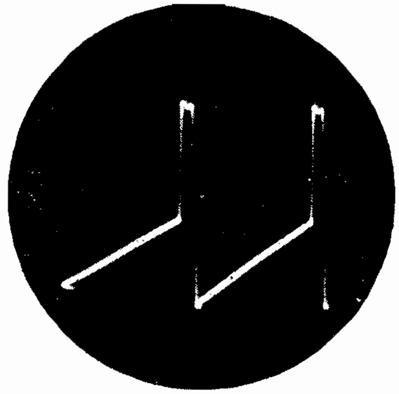

Figure A-5. Waveform which is present at the ends of the oscillator-transformer discriminator winding when a TV signal is being received.

whether or not the noise-immunity network is coupling the error voltage to the grid of the reactance tube by connecting a VTVM between the grid of the reactance tube and ground, and varying the horizontal-oscillator frequency control. As the oscillator frequency is varied above and below 15,750 cps, the control grid voltage should vary from approximately +1 to approximately —4 volts. If the error voltage is not correct, the components in the noise-immunity network should be checked.

The network should also be checked to determine whether or not it is properly filtering the error voltage. This may be accomplished by connecting an oscillograph between the grid of the reactance tube and ground. The waveform observed should be similar to that shown in Figure A-7A. A typical waveform produced by a defective noise-immunity network is shown in Figure A-7B. This waveform resulted in horizontal tearing in the picture as shown in Figure A-8.

When it has been determined that the noise-immunity network is functioning properly, the reactance tube stage should be checked.

Reactance Tube Stage

The usual voltage and resistance measurements are all that is required to locate a fault in the reactance-tube circuit, with the exception of an open screen by-pass condenser. This fault will cause a slight horizontal jitter in the picture and may be checked by connecting the vertical input of an oscillograph between the screen of the reactance tube and ground. If a sine-wave signal is observed on the screen, the bypass capacitor is probably open.

Troubleshooting Procedure

The following is a review of the procedure used to isolate a-f-c circuit faults:

1. Check all tubes in the a-f-c circuit by substitution. When substituting tubes, readjust the frequency and phasing controls.
2. Connect a VTVM between the reactance-tube control grid and ground and check the variation in grid voltage as the horizontal-frequency control is rotated.

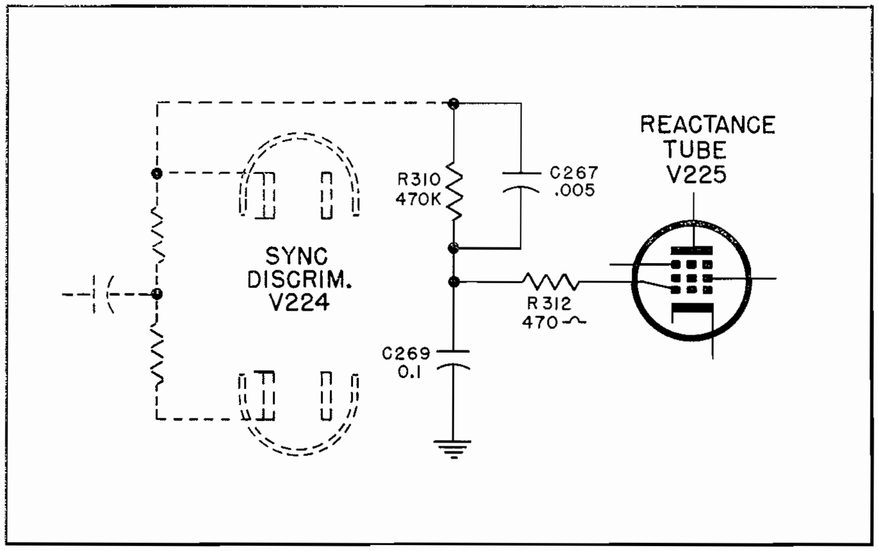

Figure A-6. Partial schematic showing the noise-immunity network components (solid lines).

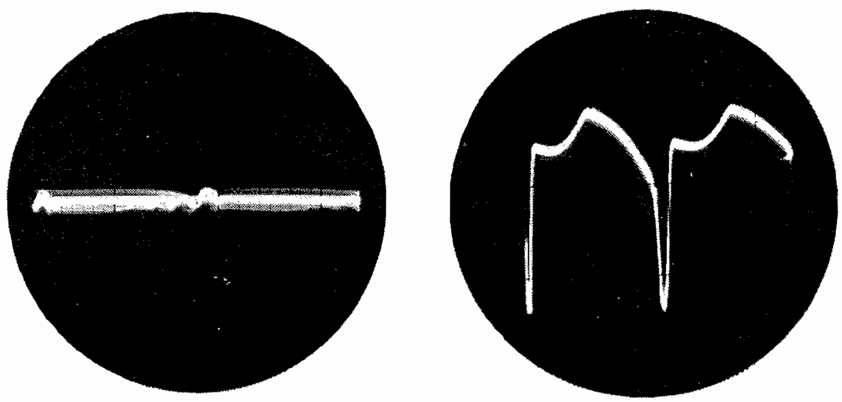

Figure A-7. A—Left, waveform at the grid of the reactance-tube when the noise immunity network is functioning properly. B—Right, waveform at same point when the network is defective.

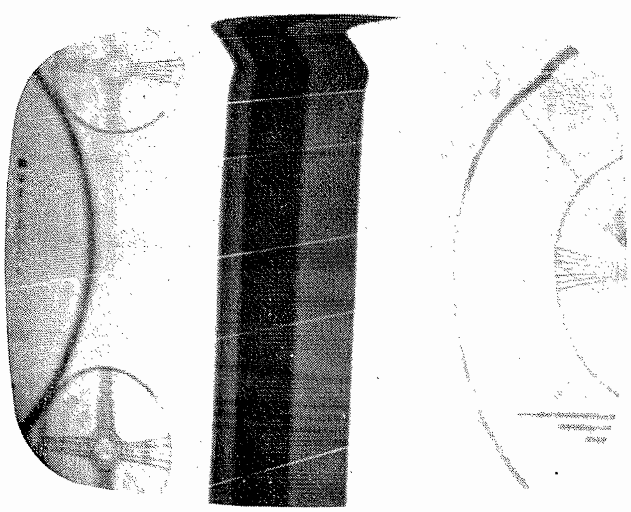

Figure A-8. Picture on CRT when the noise immunity network is not functioning properly.

3. If the grid voltage does not vary from approximately +1 to —4 volts, check the sync-discriminator and horizontal-oscillator stages using the methods previously outlined.
4. Check the waveform at the control grid of the reactance tube using an oscillograph. If the waveform is similar to that shown in Figure A-7B, check the components in the noise-immunity network.
5. If the noise-immunity network is functioning properly, measure the voltages on the reactance tube and check for an open screen grid bypass capacitor.

In the next issue of the SERVICE NEWS the methods used to troubleshoot the pulse-width a-f-c system will be discussed.

TROUBLE SHOOTING HINTS

Teleset: All Current Models

Symptom: "Snow" in picture. The snow may not become apparent until the Teleset has been operating for several minutes or more. A check of the i-f and tuner a-g-c lines indicates that the i.f. a-g-c voltage drops and the tuner a-g-c voltage increases when the snow appears in the picture.

Probable Fault: Grid-to-cathode leakage in one of the a-g-c controlled video i-f stages.

Remedy: Substitute tubes in the a-g-c controlled video i-f stages to locate the defective tube.

Teleset: RA-109A

Symptom: Audio hum

Probable Fault: Lead dress

Remedy:

(a) Shorten black lead connected to ground side of volume control by 2¼ inches.

(b) Shorten black lead connecting C224 to the tone control by 1 inch.

(c) Dress C221 (located near tone control) so that flat side is not facing chassis.

Teleset: RA-109A

Symptom: ¼ amp. fuse opens repeatedly.

Probable Fault: Leakage in C288A.

Remedy: Replace C288A.

Contributed by A. Horowitz, Quality Television Corp., Los Angeles, Calif.

Teleset: RA-109A, RA-116A and RA-119A

Symptom: Bottom of raster shrinks about three inches intermittently. As a result, it is impossible to obtain proper vertical size and linearity.

Probable Fault: C294 in vertical BTO circuit is opening intermittently.

Remedy: Replace C294.

Teleset: RA-112A, RA-113

Symptom: Pull at top of the picture.

Probable Fault: C264, 180 mmf capacitor, leaky or shorted.

Remedy: Replace C264.

Teleset: RA-112A, RA-113

Symptom: In TV position tuning eye has a dull green appearance, sound is weak, brightness is lower than normal, no horizontal or vertical sync and picture is overloaded.

Probable Fault: C233, the screen bypass condenser for the narrow-band sync amplifier V212, is shorted.

Remedy: Replace C233.

Contributed by Ray Norris, New World Distributors, Chicago, Ill.

Teleset: RA-112A, RA-113

Symptom: Several fine, bright, evenly-spaced horizontal lines appearing from top to bottom of blank synchronized raster. This condition may be accompanied by faulty d-c restoration.

Probable Fault: C232 at the cathode of the d-c restorer, V209-B, is open.

Remedy: Replace C232.

Contributed by W. Votek, Specialties Distributing Co., Detroit, Mich.

Teleset: RA-112A, 113

Symptom: High frequency whistle on all channels. Picture and sound normal.

Probable Fault: Flyback terminal board loosely mounted on flyback transformer.

Remedy: Tighten screw which mounts flyback terminal board to the flyback transformer.

Teleset: RA-112A, RA-113, RA-117A

Symptom: Insufficient brightness at the left side of the raster. (See Figure T-1) Sync adjustments are extremely critical. Brightness varies with hold control setting.

Probable Fault: C253, the 50 volt negative bias filter capacitor, is open.

Remedy: Replace C253.

Contributed by Paul Boller, Crist-Kissell Co., Springfield, Ohio.

Teleset: RA-112A, RA-113, RA-117A, RA-120A

Symptom: Heavy raster foldover on the right side of the picture. (See Figure T-2)

Probable Fault: C249, the 270 mmf

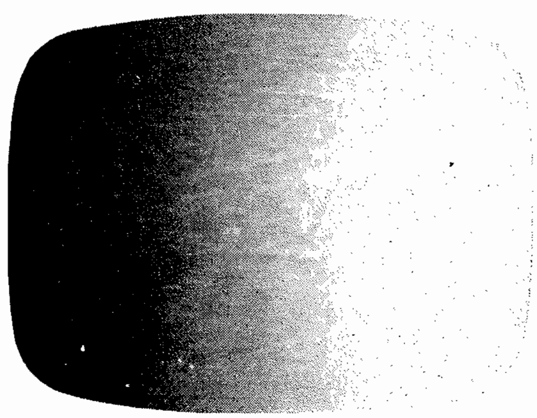

Figure T-1. Picture of a RA-112A CRT raster showing the effect of an open negative bias filter capacitor.

coupling capacitor to the grid of V215 is leaky.

Remedy: Replace C249.

Teleset: RA-112A, RA-113, RA-117A, RA-120A

Symptom: The picture overloads on strong signal stations and is very unstable. The AGC control has little effect.

Probable Fault: C237 the .05 mf capacitor in the AGC voltage divider circuit is leaky.

Remedy: Replace C237.

Teleset: RA-112A, RA-113, RA-117A

Symptom: Crackling sound heard within cabinet when set is turned off.

Probable Fault: External Aquadag coating peeling from CRT.

Remedy: Remove all loose peelings and spray remaining CRT coating with KRYLON acrylic spray. This spray is available in a self-dispensing container at your local supply house.

Contributed by Mr. Lindsay, House of Television, Houston, Texas.

Teleset: RA-117A

Symptom: Horizontal pull and ringing noticeable in picture. Critical vertical hold adjustment.

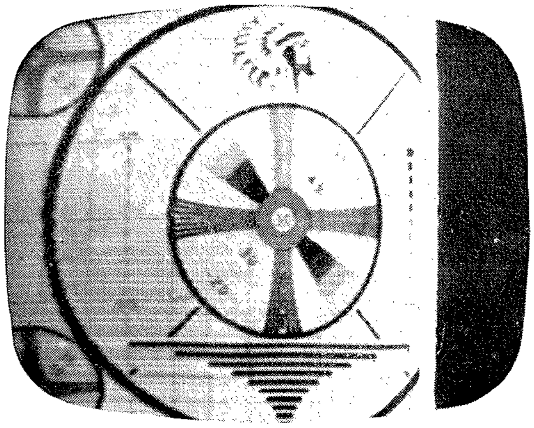

Figure T-2. Picture of a CRT showing heavy foldover at the right side of the screen. The steaking lines in the picture indicate that the horizontal sweep amplifier tube is defective and requires replacement.

Probable Fault: Adjustable core of 27.75 mc adjacent channel sound trap, T102, located on top side of tuner, has worked loose in shipment.

Remedy: Readjust trap, moving core out (counterclockwise) until symptoms disappear.

Contributed by L. Moede, Nash-Kelvinator Sales Corp., Seattle, Wash.

Teleset: RA-119A's converted for 300 ohm input

Symptom: Vertical lines about 10 inches from right-hand side of picture.

Probable Fault: Barkhausen oscillation in the high-voltage rectifier circuit.

Remedy: Interchange the IB3 rectifiers. If this does not eliminate the oscillation, try substituting one or two new tubes.

Teleset: RA-119A

Symptom: Alternate white and dark horizontal bars in picture. The bars are approximately 1/4″ wide.

Probable Fault: Microphonic 6AU5, vertical deflection amplifier tube.

Remedy: Replace the defective tube.

THE RA-130A AND RA-147A TELESETS

Included in present production are two new Telesets, the RA-130A and the RA-147A. The RA-130A is an improved version of the RA-109A FAS chassis, while the RA-147A is an improved version of the RA-117A.

RA-130A

The RA-130A is identical to the RA-109A FAS with the exceptions listed below. The RA-130A features a larger picture tube, greater sensitivity, and increased noise immunity.

1. Linearity resistors, R360 through R364, are added in parallel with the horizontal-deflection coil, as shown in Figure B-1.
2. An additional decoupling capacitor is added at the B+ terminal of the 3rd video i-f stage, as shown in Figure B-2.
3. A channel-5 beat trap and a noise-immunity switch are added at the

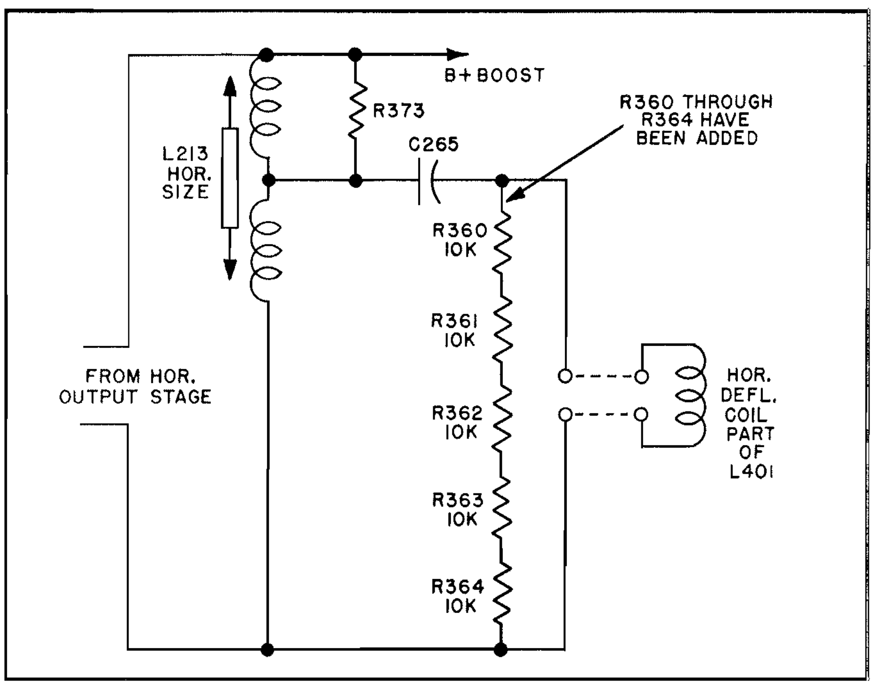

Figure B-1. Partial schematic showing the location of the linearity resistors across the horizontal deflection coil winding. These resistors were incorporated in RA-130A Telesets to facilitate horizontal linearity adjustments.

sync-detector output as shown in Figure B-3.

4. A channel-5 beat trap is added at the video-detector output as shown in Figure B-4.
5. Two correction magnets are added to eliminate pincushioning at the top and bottom of the picture.
6. The values of C306 and R275 are changed to increase sync stability. Both components are included in the sync-detector output as shown in Figure B-3.
7. The 21EP4A, a 21-inch, rectangular-type CRT, replaces the 19AP4A.
8. A new horizontal deflection coil is used to provide 70° deflection for the larger CRT.

The RA-109A FAS parts list may be used for the RA-130A with the following changes:

PARTS LIST CHANGES

Delete:

C306	03 018 690	Cap CE 33 mmf 20% 500V
L401	87 000 031	Deflection Yoke Assy.
R275	02 031 940	Res F C 18K 10% ½W
V215	25 002 640	Tube CRT 19AP4A

Add:

C306	03 015 790	Cap CE 20 mmf 10% 500V
C333	03 015 610	Cap CE 5000 mmf 450V
C341	03 055 500	Cap M 5 mmf 10% 500V
C342	03 055 500	Cap M 5 mmf 10% 500V
L209	21 007 132	Coil 78.75 mc trap
L210	21 007 134	Coil 78.75 mc trap
L401	21 008 871	Deflection yoke
R275	02 031 940	Res F C 27K 10% ½W
R360	02 037 890	Res F C 10K 10% 2W
R361	02 037 890	Res F C 10K 10% 2W
R362	02 037 890	Res F C 10K 10% 2W
R363	02 037 890	Res F C 10K 10% 2W
R364	02 037 890	Res F C 10K 10% 2W
S203	05 004 200	Switch DPST
V215	25 006 860	Tube CRT 21EP4A

RA-147A

The RA-147A is identical to the RA-117A with the exception of the following changes which result in im-

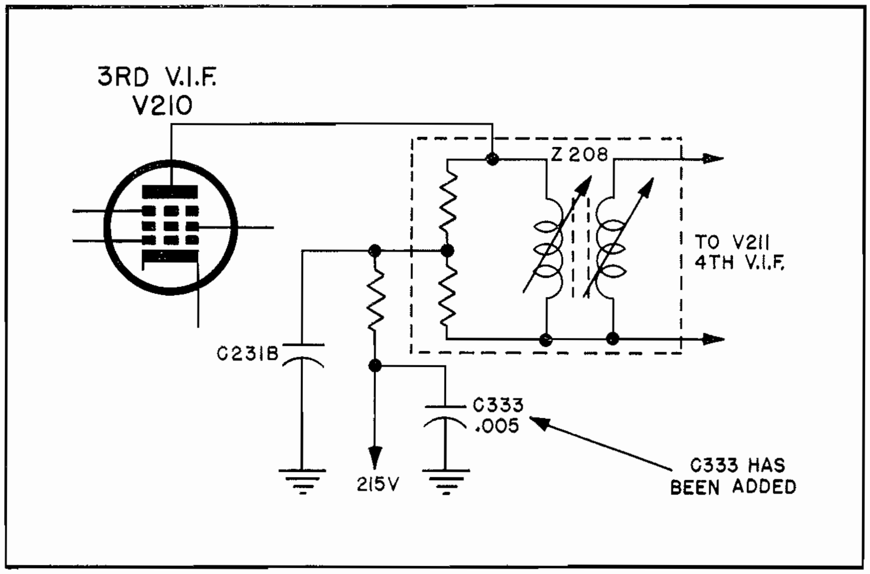

Figure B-2. Partial schematic showing the location of the decoupling capacitor in the 3rd video i-f stage. This capacitor was incorporated in the RA-130A Telesets to prevent sound regeneration.

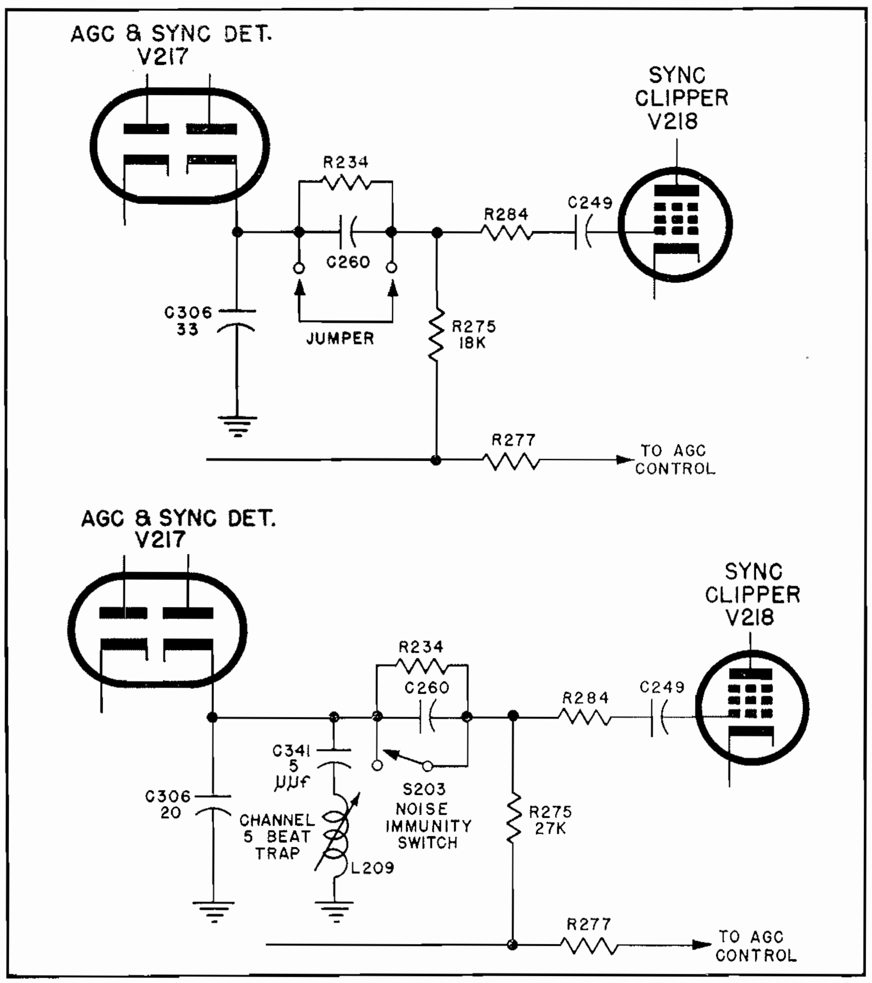

Figure B-3. Upper: Partial schematic of the RA-109A FAS sync-detector output stage. Lower: Partial schematic of the RA-130A sync-detector output stage showing the location of the Channel 5 beat trap and the noise-immunity switch.

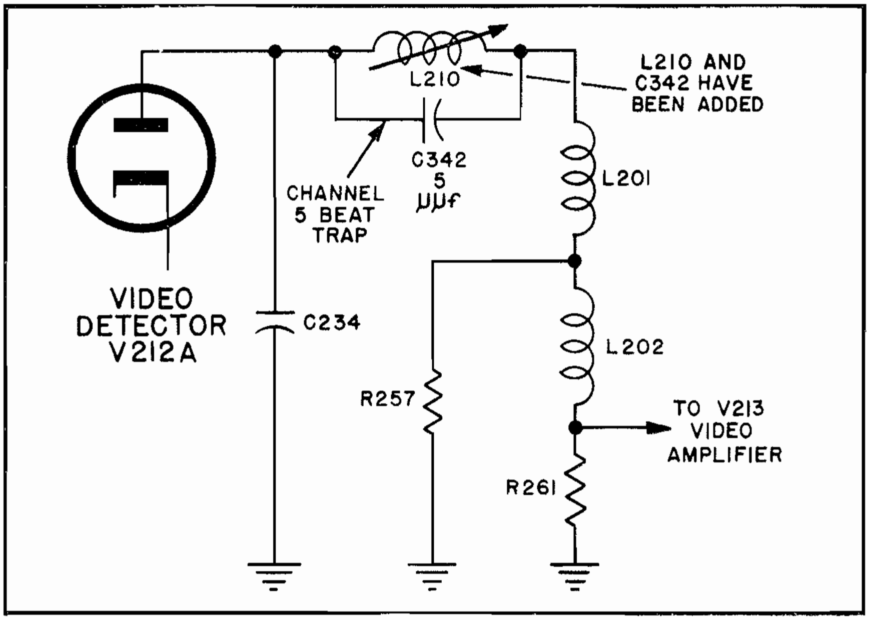

Figure B-4. Partial schematic of the RA-130A video detector output stage showing the location of the 2nd Channel 5 beat trap, which was incorporated in the above circuit.

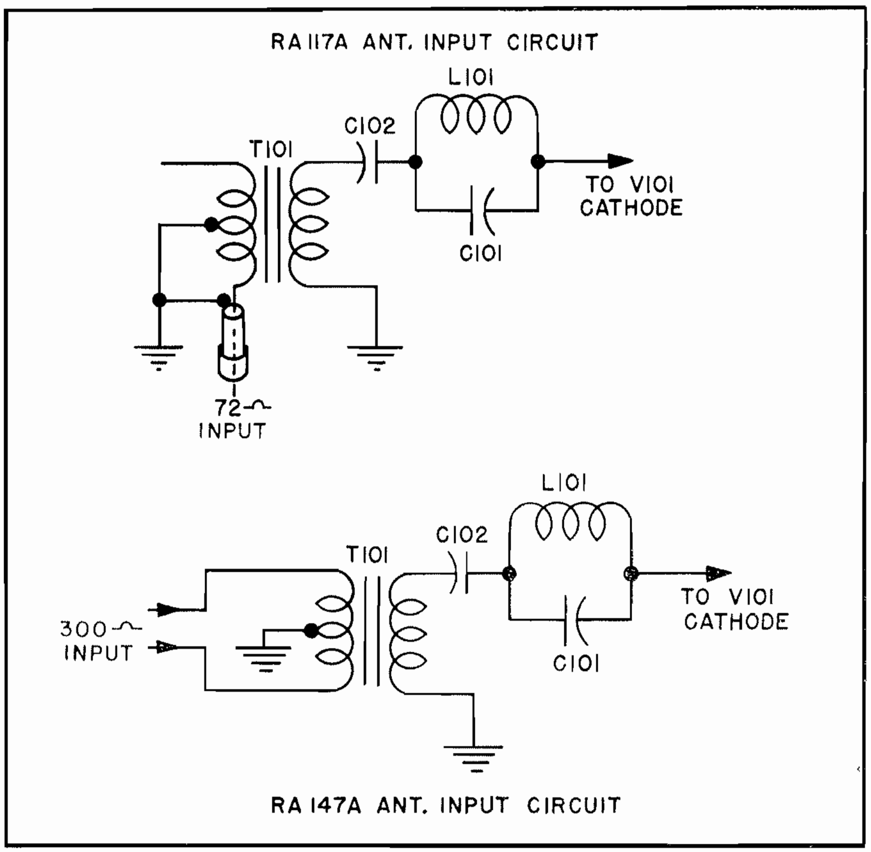

Figure B-5. Upper: Partial schematic of the RA-117A input circuit for use with a 72-ohm coaxial cable. Lower: Partial schematic of the RA-147 input circuit showing the change made to permit the use of 300-ohm transmission line.

proved sound performance and greater sensitivity.

1. An improved second sound i-f transformer, Z202.
2. A new Inputuner assembly incorporating 300-ohm input and FM coverage. The 300-ohm antenna input is shown in Figure B-5.

The RA-117A parts list may be used for the RA-147A with the following changes:

PARTS LIST CHANGES

Delete:

Z202	20 005 581	Trans sound i-f
Inputuner	89 002 941	

Add:

Z202	20 004 511	Trans sound i-f
Inputuner	89 002 991	

RECORD CHANGER PARTS

Replacement parts are now available through your local distributor for repair of record changers used in the following model Telesets:

Teleset Model		Changer Part No.
Bradford	2 Speed	19 034 521
Wellington	3 Speed	19 034 541
Tarrytown	3 Speed	19 034 591
		19 034 593
		19 034 661
Sherbrooke	3 Speed	19 034 581
		19 034 582
		19 034 611
		19 034 691

DIRECTOR'S CORNER (Cont'd)

real explanation of how a horizontal output circuit works. Follow the logical troubleshooting presentation.

We think you will agree that this manual is the finest ever to be issued by a manufacturer. And so soon after initial production of a receiver!

Finally, to round out our plan of helping servicemen, we are preparing a series of lectures which will provide you with down-to-earth practical hints in handling the day-to-day problems that confront you.

Your Du Mont distributor will schedule a service meeting conducted by factory personnel in the near future. We know you will find this meeting profitable. We hope you can come and meet us. We would certainly like to meet you.

OVERHEATING OF COUPLING RESISTORS IN RA-119 POWER SUPPLY

Some time ago a change was made in the RA-119A Teleset to reduce the possibility of resistor failure in the high-voltage power supply. Details of the change were published in the June 1951 issue of the SERVICE NEWS (RA-119A, Change 6). This modification changed the values of R333, 334, 336, 337 and 338 which form part of a bleeder string in the high voltage supply rectifier circuit.

No mention was made of R335 because this resistor remains part of the bleeder string and is not affected by the change. In making the change in the field a number of technicians have left out R335 and as a result the remaining resistors have overheated. R335 should remain in the circuit. In addition it is recommended that "Allen Bradley" resistors be used as replacements.

To minimize the possibility of resistor failure the regulation of the power supply should be correct and the high voltage should not exceed 22 kv. The proper method for adjusting the supply will be found in the service information on the set.

SHORT CUT FRINGE-AREA ALIGNMENT

The fringe-area performance of a Teleset can usually be improved by raising the position of the video carrier on the receiver's i-f response curve. A discussion of the reasons why this procedure improves performance will be found in the July 1951 issue of the SERVICE NEWS

While the best way to reposition the video carrier is to realign the set, shifting the sound i-f 400 KC lower in frequency, considerable time can be saved by making the adjustment in the customer's home. This can be accomplished without instruments using the following procedure.

1. Tune the set for strongest picture. If the station is very weak, the strongest picture will not be received at the same point as the best sound.
2. Turn the top slug of the discriminator transformer ½ turn clockwise.
3. Turn the bottom slug of the discriminator transformer ½ turn counter-clockwise.
4. Turn the top slug of Z203 ½ turn clockwise.
5. Turn the bottom slug of Z203 one turn clockwise. Note: The transformer symbol numbers given here are for the RA-109. With this exception, the same procedure may be used for RA-112, RA-113 and RA-117 Telesets.
6. Turn the top slug of Z202 ½ turn clockwise.
7. Turn the bottom slug of Z202 one turn clockwise.

The points at which the best picture and sound are received should now correspond. Some slight readjustment of the sound i-f and discriminator transformers may be required. This should be done with great care. Readjustment of the narrow band sync transformer may also be necessary. A procedure for making this adjustment without instruments will be found on page 18 of the March 1951 issue of the SERVICE NEWS.

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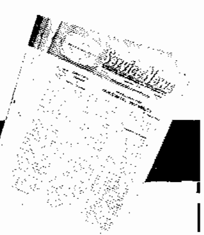

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